enfinium

Our journey to

CARBON REMOVALS

Net Zero Transition Plan 2024

About this Report

This is our Net Zero Transition Plan. It lays out our vision to deliver carbon removals and outlines how we will decarbonise our own business, while helping communities and other industries decarbonise too.

The report is organised under the framework recommended by the Task Force on Climate related Financial Disclosures (TCFD). It describes our strategy and climate-related policy positions, advocacy, and engagement. In the Appendices you'll find modelling assumptions, our independent verification, and a glossary.

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If you have any feedback, just let us know at communications@enfinium.co.uk

For more information about enfinium and our ESG commitments visit enfinium.co.uk

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Chief Executive Officer's Foreword

We all have a responsibility to take action to avoid catastrophic climate change and help the UK achieve net zero carbon emissions by 2050 or earlier.

The UK generates around 220 million tonnes of waste each year. Of this, around 27 million tonnes is residual household, commercial and industrial waste that cannot be recycled today. It's important we reduce this figure to as close to zero as possible. But even when we meet the UK Government's target of reducing residual waste by 50% by 2042, there will still be around 17 million tonnes of unrecyclable waste produced by British households and businesses every year.

So what do we do with it?

We can't bury that waste in the ground. We shouldn't export it either. It is our responsibility to carefully and responsibly dispose of it here and now. And we believe we can harness this waste to help decarbonise our country.

This is why, today, enfinium is already helping reduce the UK's emissions through our existing energy from waste facilities across the country. All powered by unrecyclable waste.

But we can do much more. And this Net Zero Transition Plan sets out our ambition.

First, our current operations support decarbonisation of the UK waste sector by generating low carbon energy and avoiding carbon emissions that would have otherwise been generated by landfilling or exporting unrecyclable waste. Second, we're aiming to achieve net zero from our own operations by 2033. Third, we plan to deliver the net removal of carbon dioxide (CO_2) from the atmosphere, increasing to up to 1.2 million tonnes per year by 2039.

This bold ambition, which will inform every operational and investment decision at enfinium, is part of our plan to power the UK's decarbonisation with homegrown reliable waste. And we will keep you updated on our progress with regular reports.

The plan has been reviewed and verified by a leading engineering firm, Arup and requires us to lead an investment programme worth over £1.7bn over the project lifecycles across our fleet of facilities, creating green jobs and growth across the country. But we can't deliver this investment on our own. To realise the potential unrecyclable waste has to power decarbonisation, we need to work in partnership with the UK Government in three key areas:

1. Driving the right climate outcomes for unrecyclable waste in the short-term, through ending by 2028 the practice of combustible waste being sent to climate damaging landfill or exporting our waste abroad.

2. Scaling up the UK's onshore and offshore carbon capture and storage infrastructure, including non-pipeline solutions such as rail and shipping.

3. Creating a marketplace for high-quality carbon removal credits in the UK through the inclusion of carbon removals in the UK ETS no later than 2031.

We do not underestimate the scale of the challenge ahead. But the urgency of the climate crisis means we have to move quickly. In this report you'll find the ambition and potential of our plan which, with the right conditions, we are ready to deploy at pace.

"We plan to deliver the net removal of carbon dioxide from the atmosphere, increasing to up to 1.2 million tonnes per year by 2039."

Mike Maudsley
Chief Executive Officer

Executive summary

The energy from waste sector in the UK has already halved greenhouse gas (GHG) emissions over the last 30 years and enfinium is committed to reaching net zero from waste and to go beyond with carbon removals.

The UK has one of the most ambitious 2030 emission targets of the G-20 countries and has a legally binding net zero goal for 2050. Meeting net zero will first and foremost require rapid and deep emissions reductions. The EfW sector has an important role to play in this decarbonisation journey. enfinium is committed to reaching net zero from waste and to go beyond with carbon removals.

The recycling and waste management sector has already halved GHG emissions from its activities over the last 30 years, primarily by increasing recycling and phasing out landfill. Despite this significant effort to reduce emissions, the waste sector still accounts for around 8% of the UK's total GHG emissions (35.8 $MtCO_2e$ in 2021) when accounting for all services provided by the recycling and waste management sector. This compares with total UK emissions of 450 $MtCO_2e$[1].

This report outlines the steps we need to take as a business to meet net zero goals and go beyond with carbon removals. To achieve them, enfinium and the EfW industry will need support from government, supply chain partners and customers to help deliver the Net Zero Transition Plan we outline within this report.

We have a plan to deliver Net Zero

Our Net Zero Transition Plan is built around our desire to move from energy from waste operations today to a carbon removals business tomorrow. It is our ambition to achieve net zero by 2033 across all our operations and deliver up to 1.2 million tonnes of net removals per year by 2039. The technical roadmap to net zero within the report has been independently verified by Arup with modelling against three potential policy, technology, and commercial readiness scenarios.

The Plan will be achieved by:

1. Advocating for and supporting measures that support recycling and reduce unrecyclable waste.

One of the key levers to lower GHG emissions from EfW is to reduce the fossil content and increase the biogenic content of waste received. Driving a higher proportion of biogenic content in the waste we process depends on the successful implementation of government waste policy as well as wider behavioural change in society's attitude towards waste and recycling.

2. Developing carbon capture, permanently storing fossil and biogenic CO_2 from our facilities, achieving net carbon removals in the process.

Our CCUS project timeline assumes a development stage of two years, FEED of one year, and a construction period of three years, with operation thereafter. During the past year, we completed carbon capture pre-feasibility work for each of our operational EfW facilities. These confirm viable technology exists, and carbon capture is technically feasible at all our facilities.

3. Explore options to displace diesel use in mobile plant vehicles and reduce emissions associated with the use of auxiliary fuels.

Mobile plant vehicles use diesel for a variety of on-site purposes including moving Incinerator Bottom Ash (IBA) and Air Pollution Control residues (APCr) offsite for recycling and metals recovery. The use of electric or hydrogen powered vehicles or using hydrotreated vegetable oil (HVO) fuel provide an opportunity to lower emissions further. Auxiliary fuels are used during start up and shut down to maintain combustion temperatures in line with Environmental Permits. Modifications to reduce downtime, lower diesel oil consumption and plant efficiencies will also reduce emissions.

4. Procure renewable imported electricity.

Typically, EfWs utilise their own electricity generated as part of operations on-site, however when boilers or turbines are not operating, imported electricity is required to operate cranes, pumps, compressors, air conditioning and fans. In June 2023, we signed a deal to move to a 100% renewable, REGO backed tariff[2] for all imported electricity to support operations during scheduled and unscheduled downtime.

5. Evolve our facilities to become Decarbonisation Hubs

By combining our existing EfW infrastructure with carbon capture technology, we have the potential to remove millions of tonnes of CO_2 from the atmosphere by generating low carbon heat, electrolytic hydrogen, and reliable homegrown power. Our Decarbonisation Hubs will remove CO_2 by capturing it from the processing of biogenic waste, helping hard-to-abate sectors to decarbonise; provide homegrown energy to the grid; supply new heat networks and produce electrolytic hydrogen to replace fossil fuels.

We are committed to developing the skills and workforce of the future

Our Net Zero Transition Plan will also provide exciting opportunities for our workforce. We anticipate new skills being required as we transition from an energy from waste to a carbon removals business. To ensure a Just Transition, we plan to provide learning, development, and internal job promotion, alongside apprenticeship and work experience opportunities to develop the next generation.

1 Environmental Services Association (ESA) 2021, A net zero greenhouse gas emissions strategy for the UK recycling and waste sector. ESA-Net-Zero-Full-Report.pdf (esauk.org)

2 REGO means Renewable Energy Guarantees of Origin, a scheme providing certificates which demonstrate that electricity has been generated from renewable sources operated by Ofgem, the UK's gas and electricity markets regulator.

Net Zero Transition Plan on a Page

The graphic below shows enfinium's short, medium, and long-term carbon targets, alongside key actions it will take to achieve them.

S1

Scope 1

Direct emissions from owned or controlled sources.

S2

Scope 2

Indirect emissions from the generation of purchased electricity, steam, heating, and cooling that we use in our activities.

S3

Scope 3

All other indirect emissions that occur in our value chain.

AE

Avoided Emissions

Emissions avoided by diverting the unrecyclable waste from landfill, by the electricity we produce, from exporting the heat/steam we generate (where possible), and by recovering usable resources from our incinerator bottom ash (IBA) and air pollution control residues (APCr).

Our Net Zero Transition Plan

By 2033 we plan to achieve net zero across all our operations, and by 2039 we aim to deliver up to 1.2 million tonnes of net carbon removals per year.

Our Net Zero definition

As defined by the United Nations (UN) Intergovernmental Panel on Climate Change (IPCC), the term "net zero" means balancing anthropogenic greenhouse gas (GHG) emissions to the atmosphere with GHGs permanently taken out of the atmosphere.

At enfinium, net zero means we facilitate the reduction, capture, removal and storage of at least the same quantity of GHGs that are emitted. This includes emissions generated by our operations (Scope 1), by others to create the power we purchase (Scope 2), and by customers and consumers using the services we provide (Scope 3). It is important to note that Scope 3 emissions are a very small part of our emissions profile. We are taking steps today to implement the net zero future called for by the IPCC and world leaders, to meet the goals of the Paris Agreement.

TARGET

SHORT TERM (to 2025) | **MEDIUM TERM** (2025-2035) | **LONG TERM** (2035-2050)

2025 | 2035 | 2050

SHORT TERM

- **S1** Continue investment in feasibility and design development for CCS projects at all operational EfW facilities
- **S1** Mobilise an operational CCS pilot plant at our facilities
- **S3** Engage with 50% of suppliers by spend to lower emissions by 2025

MEDIUM TERM

- **S1** Carbon capture projects delivered at all current operational facilities from 2029 - 2033
- **AE** Heat offtake and private wire advanced at all six plants by 2035
- **S1 S2** Net zero for enfinium's Scope 1 and 2 emissions by 2033
- **AE** Electrolytic hydrogen production by 2035

LONG TERM

- **S1** Carbon capture fully operational at current construction projects by 2039
- **S3** Net zero for enfinium's remaining Scope 3 emissions by 2050

SUMMARY ACTIONS

SCOPE 1

- Develop carbon capture: we will capture and permanently store fossil and biogenic carbon from our facilities, achieving net carbon removals in the process.
- Advocate for and support measures that support recycling and reduce unrecyclable waste.
- Reduce use of fossil-based fuels in mobile plant and vehicles.

SCOPE 2

- Procure renewable imported electricity.
- Deliver a net zero property estate.

SCOPE 3

- Support supply chain to lower emissions.
- Advance heat networks across the fleet.
- Build Scope 3 reporting into all future construction projects.

AVOIDED EMISSIONS

- Heat offtake installed at all six plants by 2035.
- Private wire advanced across fleet.
- Electrolytic hydrogen production by 2035.
- 100% recycling of IBA and APCr into new products with no residues going to landfill.

CROSS-CUTTING ACTIONS

Just transition actions

Publish annually within our annual ESG report, progress on our aims for a Just Transition.

Climate adaptation and resilience

Continuous review of adaptation plans at plants, whilst participating fully in national adaptation frameworks.

CHAPTER 1:
The waste sector and climate

Tackling climate change is one of the biggest challenges we face today.

The World Economic Forum's latest Global Risks Perception Survey identified a failure to mitigate climate change as the most severe global risk likely to impact over the next 10 years[3].

The waste sector makes up around 8% of the UK's total GHG emissions (35.8 $MtCO_2e$ in 2021[4]) when accounting for all services provided by the recycling and waste management sector.

The main sources of GHG emissions in the sector are from:

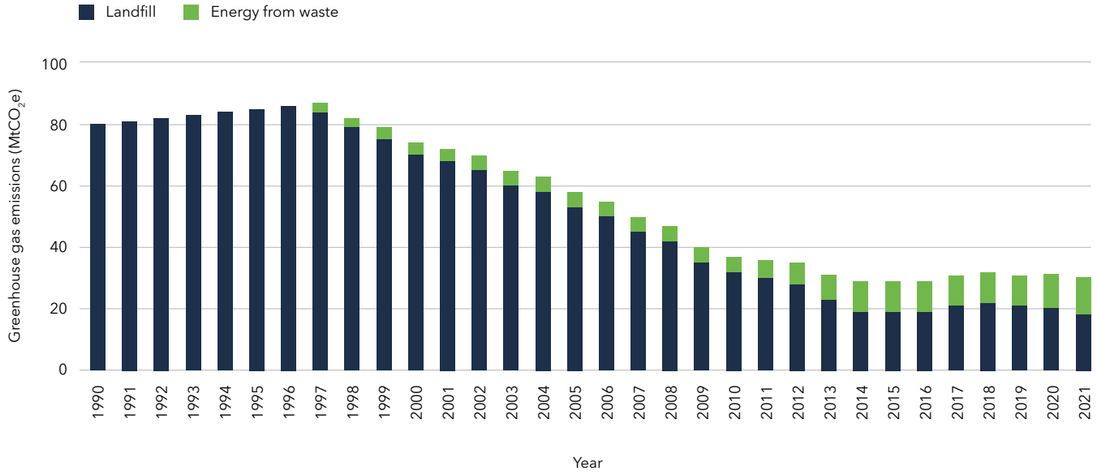
- Energy needed to operate recycling and sorting facilities
- Landfill methane emissions produced from the decomposition of biodegradable waste
- Emissions from transporting waste
- Emissions from EfW facilities.

The recycling and waste management sector has already more than halved GHG emissions from its activities over the last 30 years, primarily by increasing recycling and phasing out landfill[5].

EfW plays a central role in this by diverting waste away from landfill and transforming it into reliable homegrown energy. Around half of the waste we receive is biogenic, the other half is fossil.

enfinium operates the most modern, energy efficient EfW fleet in the UK. Our existing facilities ensure we play an important role in the UK's environmental infrastructure, providing local and sustainable waste management solutions.

Figure 1. Greenhouse gas emissions from EfW and landfill sectors[6]



3 weforum.org/reports/global-risks-report-2023

4 Environmental Services Association (ESA) 2021, A net zero greenhouse gas emissions strategy for the UK recycling and waste sector. ESA-Net-Zero-Full-Report.pdf (esauk.org)

5 Environmental Services Association (ESA) 2021, A net zero greenhouse gas emissions strategy for the UK recycling and waste sector. ESA-Net-Zero-Full-Report.pdf (esauk.org) (page 4)

6 DESNZ (2023), Provisional UK greenhouse gas emissions national statistics 2022; BEIS (2023), Final UK greenhouse gas emissions national statistics: 1990 to 2021

Waste sector and climate

Our operations contribute direct emissions of CO_2 to the atmosphere. Our vision for the future is to harness technology and solutions that help us avoid 90% or more of these emissions. In this way we will be able to deliver EfW solutions that are fully integrated in the future energy infrastructure required for a net zero economy.

Today, we calculate our overall emissions impact by assessing our carbon 'balance sheet'. This sets out the direct and indirect emissions from our activities, compared to the emissions avoided by diverting the unrecyclable waste from landfill, by the electricity we produce, from exporting the heat/steam we generate (where possible), and by recovering usable resources from the residues of the EfW process, which include incinerator bottom ash (IBA) and air pollution control residues (APCr).

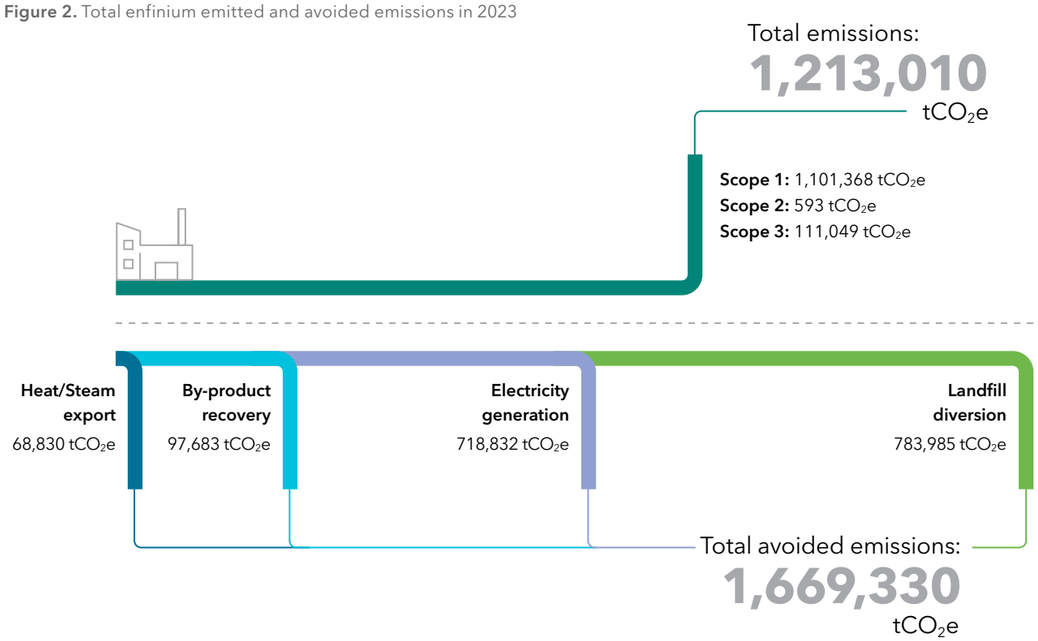
In 2023, our facilities delivered a net carbon benefit to the UK by delivering a desired end to end outcome of dealing with unrecyclable waste in an effective way, and through our approach and process, avoiding a total of 456,320 tCO_2e of emissions entering the atmosphere (equivalent to a reduction of around 3% of the waste sector's emissions).

To calculate total emissions, we look at Scope 1, 2 and 3 emissions. Scope 1 covers direct emissions and we capture data using industry best practice Continuous Emissions Monitoring Systems (CEMS) to directly measure CO_2, N_2O and gas flow rates. These CEMS use a sample probe within the flue to continuously collect samples which are analysed in real-time to determine the quantity of CO_2 and N_2O present. The direct measurement approach allows the emissions profile of our operations to be more accurately quantified. Scope 2 covers indirect emissions from the generation of purchased electricity, steam, heating, and cooling that we use in our activities. Scope 3 includes construction-related purchased goods and services, fuel and energy related activities, as well as business travel.

Our Net Zero Transition Plan does not currently cover our Scope 3 emissions. See Scope 3 emissions explanation, page 16.

We are committed to open and transparent reporting in relation to emissions from our business activities and the figures used in this report have been verified by Arup, an independent engineering consultant. See Verification Statement, page 43.

Figure 2. Total enfinium emitted and avoided emissions in 2023



In 2023, our facilities delivered a net carbon benefit to the UK by avoiding a total of

456,320 tCO_2e

of emissions entering the atmosphere.

CHAPTER 2: enfinium's Net Zero Transition Plan

enfinium has the ambition and potential to achieve net zero by 2033 across all our operations, and deliver up to 1.2 million tonnes of net carbon removals per year by 2039.

Our plan to achieve net zero by 2033 and then begin to deliver net carbon removals, covers our Scope 1 and 2 greenhouse gas emissions. It includes all our facilities, both operational and under construction.

We will achieve this by:

- **Advocating for and supporting measures that support recycling and reduce unrecyclable waste.** We will continue to encourage measures and policies that address the volume of non-biogenic unrecyclable waste produced, and drive higher biogenic content in the waste we process in our facilities.
- **Developing carbon capture.** We will capture and permanently store fossil and biogenic CO_2 from our facilities, achieving net carbon removals in the process. We will also explore options to utilise captured CO_2.
- **Reduce the use of fossil-based fuels in mobile plant and vehicles.**
- **Procure renewable imported electricity.** We moved to a 100% renewable Renewable Energy Guarantees of Origin (REGO) certification backed tariff in 2023 to eliminate emissions associated with imported electricity.
- **Evolve our facilities to become Decarbonisation Hubs.** Integrating carbon capture and storage, maximising heat networks, developing private wire opportunities and producing electrolytic hydrogen at our facilities.

Our vision for the future

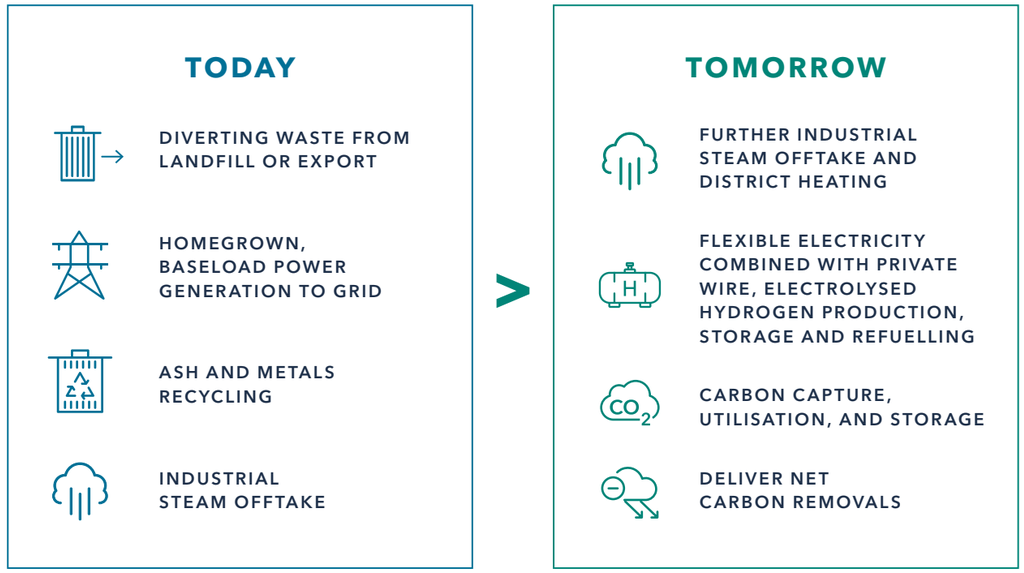
Our vision is to transform enfinium into a carbon removals business powered by unrecyclable waste.

By combining our existing EfW infrastructure with carbon capture technology, we have the potential to remove millions of tonnes of CO_2 from the atmosphere. This would form the backbone of new 'Decarbonisation Hubs' located around the UK, which could also generate low carbon heat, electrolytic hydrogen, and reliable homegrown carbon negative power for the electricity system.

By focusing on decarbonising our operations and using our existing assets to deliver decarbonisation benefits for the wider economy, we can play a unique role in the UK's net zero journey.

Our Decarbonisation Hubs will:

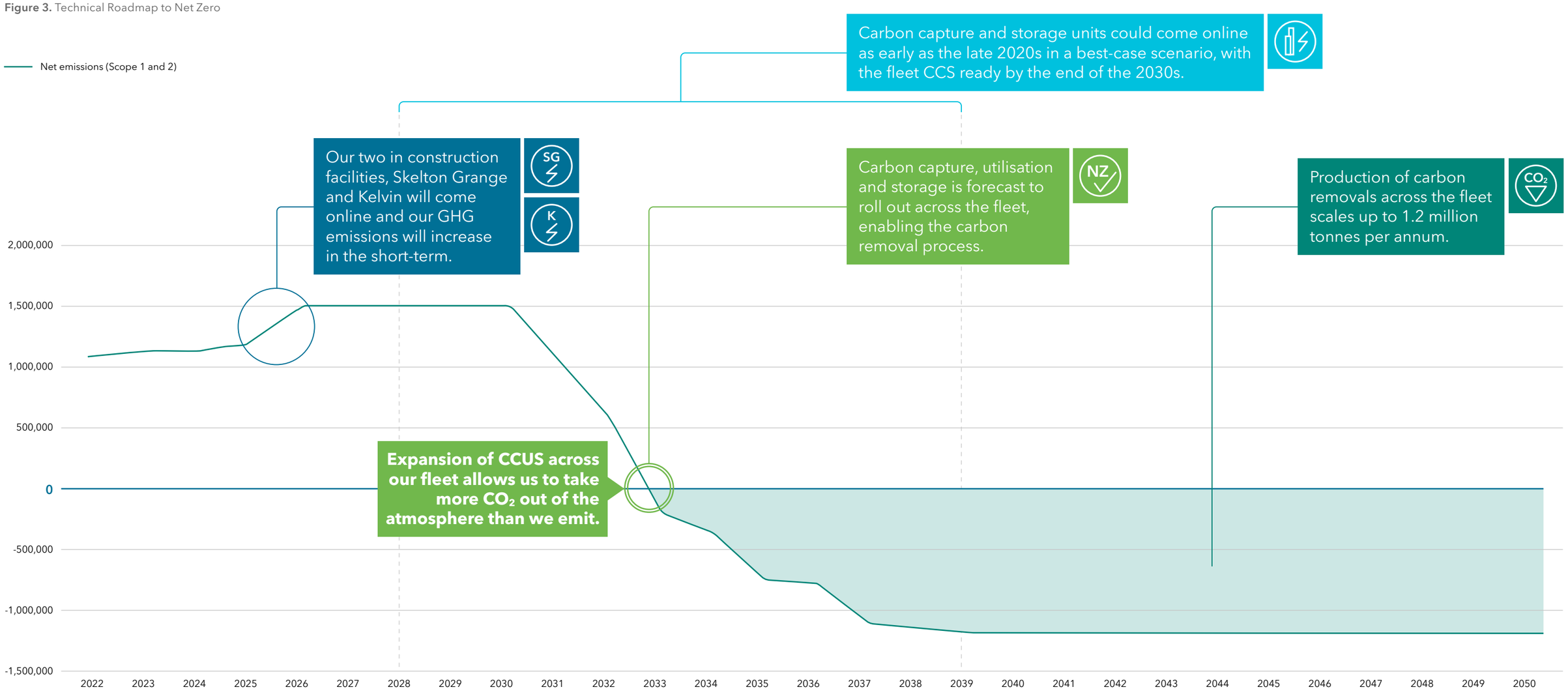
- **Remove carbon** by capturing it from the processing of biogenic waste, helping hard-to-abate sectors decarbonise.
- **Provide homegrown reliable energy to the grid** to support the UK's move to a net zero electricity system by 2035 or earlier.
- **Supply new heat networks** to decarbonise homes and businesses and use steam to power the future of UK industry. We will also explore the possibility of developing private wire networks across the fleet, which could provide customers with local, reliable, verified carbon-negative electricity.
- **Produce low carbon electrolytic hydrogen** when electricity we produce is not needed by the grid. This could help balance the grid, replace fossil fuels, such as diesel and natural gas, and speed up industry and transport decarbonisation.



Our approach: modelling our Net Zero pathway

To ensure our plan is robust and deliverable, we adopted a modelling approach that lets us review and scrutinise potential routes to net zero. This model forms the basis of our plan.

Figure 3. Technical Roadmap to Net Zero



Note: line shown is net emissions, defined as net greenhouse gas emissions includes Scope 1 direct emissions (fossil only), Scope 2 emissions and carbon captured from CCUS. Scope 1 and 2 emissions in line with GHG Protocol Reporting Standards for waste.

We built our decarbonisation activities into a Net Zero Transition Plan model covering calculations for Scope 1 and 2 emissions, from 2022 to 2050. The model also provides calculations for the carbon benefit from avoided emissions and functionality for modelling different CCUS, heat export and hydrogen production scenarios.

Independent verification

Arup, an independent engineering consultant, carried out a review of the model. They focused on challenging the underlying modelling assumptions, inputs, and calculation methodology, and aligning with best practice reporting. Arup also provided a review of site-by-site emissions scenarios, including carbon reduction interventions, carbon capture, hydrogen, and heat networks. See Verification Statement, page 43.

Use of scenarios

Our plan to achieve net zero involves dependencies outside our direct control, such as changing market conditions, future policy uncertainty and technology commercial readiness.

Our net zero model has three scenarios:

- **Optimistic scenario.** Assumes faster development in the UK and Europe of CCUS infrastructure and the technologies laid out in this report.
- **Base case scenario.** Represents our base case assumption and applies the recommendations and assumptions identified by Arup in their independent review.
- **Pessimistic scenario.** Assumes slower CCUS development, driven by policy changes, slower market rollout of key technologies, and lower commercial readiness.

We use the base case scenario in this report, unless otherwise indicated.

Scope 3 emissions

Scope 3 covers indirect emissions that occur in our value chain, both upstream and downstream of our activities. Our Net Zero Transition Plan does not currently cover our Scope 3 emissions. We recognise this typically represents an important part of an organisation's wider carbon footprint and future plans will include more detail on our Scope 3 emissions profile and emissions reduction plans.

We are expanding our Scope 3 measurement and reporting to improve our understanding of our Scope 3 emissions footprint. In 2023, we expanded our reporting to include the following categories:

- Waste haulage to and from all operational plants
- Construction and major bulk materials
- Upstream emissions of purchased fuels
- Business travel

We will look to include Scope 3 formally in the Net Zero Transition Plan model in the next revision. Scope 3 is a very small part of our emissions profile, so will not change the key dates laid out within the plan. We are always improving how we measure Scope 3 emissions and increasing our coverage of Scope 3 categories annually. As we build a better understanding of our baseline, we will develop and publish plans to decarbonise our value chain emissions. Annual updates on progress will be communicated through our ESG Report and a full plan review will be conducted every 3 years.

Read more in our ESG Report.

CHAPTER 3: Key activities to deliver our plan

Unrecyclable waste composition

S1 Advocate for and support measures that promote recycling and reduce unrecyclable waste. We will continue to encourage measures and policies that address the volume of non-biogenic unrecyclable waste produced and drive higher biogenic content in the waste we process in our facilities.

One of the key levers to lower GHG emissions from EfW is to reduce the fossil content and increase the biogenic content of waste received. This is because the biogenic waste material processed at EfW facilities results in net neutral carbon emissions and enables us to produce reliable homegrown power.

EfW operators have limited control over the unrecyclable waste content they receive. Addressing unrecyclable waste and driving a higher proportion of biogenic content in the waste we process, depends on the successful implementation of government waste policy as well as wider behavioural change in society's attitude towards waste and recycling.

Further pre-sorting alongside our waste suppliers, with the removal of plastics and better recycling of materials can have a significant impact on the fossil fraction entering EfW facilities at the front-end and thereby reduce our emissions.

Develop carbon capture

S1 We will capture and permanently store fossil and biogenic CO_2 at our facilities, achieving net carbon removals in the process.

Carbon Capture, Utilisation and Storage (CCUS) refers to a collection of technologies that capture carbon dioxide from large point sources, such as power generation facilities (using fossil or biogenic fuels), or from heavy industries, such as steel, cement, and chemicals. The captured CO_2 can be compressed and transported – by pipeline, rail, road, ship, or barge – for use or permanent storage.

Captured CO_2 can be used in many sectors, including producing CO_2 - based chemicals and construction aggregates, and food and beverage processing. Captured CO_2 can also be stored by injecting it deep underground, including into depleted oil and gas reservoirs or natural salt caverns known as saline aquifers, which traps and removes the CO_2 permanently from the atmosphere.

Carbon capture technologies are also the foundation of scaling up carbon removals. The UK's Climate Change Committee (CCC), an independent, statutory body established under the Climate Change Act 2008 forecasts that around 60 million tonnes of engineered carbon removals will be needed per year by 2050, to mitigate residual emissions in hard-to-abate sectors of the UK economy to meet the UK's net zero commitment.

Carbon removal is when the CO_2 comes from bio-based processes or directly from the atmosphere. Our EfW facilities have the potential to capture and remove carbon from both the fossil and the biogenic content of the waste we process. Since the biogenic CO_2 is considered carbon neutral (see below), this means we would be generating net carbon removals from the atmosphere, and allow us to produce high-quality carbon removal credits.

Biogenic carbon

Biogenic carbon is released when organic material is combusted or decomposes. The IPCC considers the combustion of organic material to be carbon neutral. This is because it's part of the natural carbon cycle – growing plants absorb carbon from the atmosphere, which is then released again during combustion.

Biogenic carbon emissions are therefore treated separately in carbon accounting, according to the GHG Protocol carbon accounting standard.

Our carbon capture development journey

The carbon capture value chain can be broken into three areas:

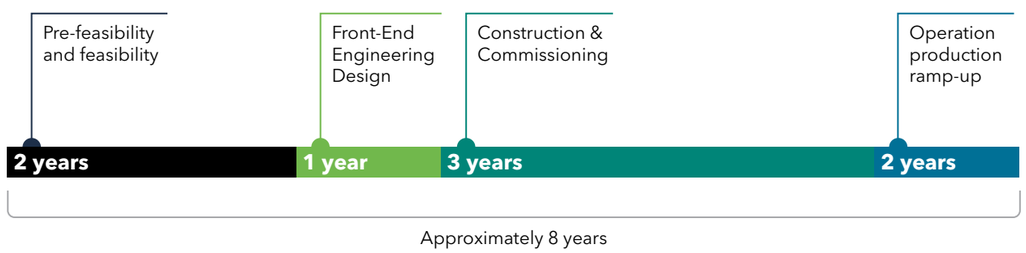
- **Upstream** – CO_2 capture at emission source.
- **Midstream** – compressing, dehydrating, transporting CO_2 from point of capture to location of storage and utilisation.
- **Sequestration** – CO_2 is either sequestered in a geological formation or utilised.

The upstream journey of carbon capture development follows a well-defined process, from pre-feasibility through to operation. The main stages in the process are:

- **Pre-feasibility and Pre-FEED** – preliminary exploration of the proposed project to determine its viability. This early-stage analysis collects broad ranging data, including technology options, basic designs, process descriptions, financial considerations, and key risks and challenges.
- **Front-End Engineering Design (FEED)** – FEED covers the basic design work needed to produce process and engineering documentation to define the project requirements for detailed engineering, procurement, and construction. This stage is typically used to support the investment decision.
- **Construction** – Project construction typically begins after a Final Investment Decision.
- **Operation** – From the start of operations, our model base case assumes carbon capture rates will ramp up to 90% by year three, at which point the capture rate is modelled as steady. We assume a 95% CO_2 capture rate in the optimistic case and 85% under the pessimistic case.

Our CCUS project timeline assumes a development stage of two years (pre-feasibility and pre-FEED), FEED of one year, and a construction period of three years, with operation thereafter. Planning and consenting for the projects will be carried out in parallel with the feasibility and FEED stages of the project.

Figure 4. Engineering and Construction Lifecycle (approx. years per project stage)



Our progress on carbon capture

Carbon capture pre-feasibility studies

During the past 18 months, we began carbon capture pre-feasibility work for each of our operational EfW facilities. These confirm viable technology exists, and carbon capture is technically feasible at all our facilities on our existing land.

We are partnering with Hitachi Zosen Innova (HZI) to pilot EfW with CCUS on-site at Ferrybridge 1 to learn more about the technology, solvent testing, and scalability.

Evaluating transport and storage network options

Here we look at the proximity of our facilities to transport and storage hubs, and viable transport options from each of our site locations, such as pipeline, barge, rail, or road.

For our Parc Adfer facility, pre-feasibility work included completing a concept study on a CO_2 pipeline connection to HyNet – an industrial decarbonisation project that will provide infrastructure for low carbon hydrogen and CO_2 across the Northwest and North Wales. The study showed there are two feasible pipeline routes that can be taken forward for more engineering design, development, and consenting assessment.

For our Ferrybridge site, we are looking at two potential transport options – pipeline and rail. In 2023, we signed a Memorandum of Understanding with Navigator Terminals, a bulk liquid storage provider in the UK and began assessing a joint project to transport captured CO_2 for storage in the North Sea. This 'Train to Zero' rail link would transport captured CO_2 from our Ferrybridge EfW facilities in West Yorkshire to Navigator's storage facilities in Teesside. The CO_2 would then be transported safely offshore for permanent storage. This is an exciting UK-first project and would open new possibilities for our country's decarbonisation aims. Bechtel was selected to support the feasibility work underpinning the concept.

We have separately conducted a pre-feasibility study to identify the engineering necessary to lay a CO_2 pipeline from Ferrybridge to either the Humber or Teesside for CO_2 storage offshore.

In 2022, we joined the Bacton Thames Net Zero Cooperation Agreement (BTNZ), an initiative that aims to decarbonise power generation and waste disposal sectors in the South-East of England, home to our Kemsley EfW facility. The Thames Estuary is well-positioned for CO_2 transport and storage in the North Sea. The Bacton Thames project will initially capture, transport, and store six million tonnes of CO_2 annually, eventually rising to 10 million.

The National Infrastructure Commission (NIC) in its Second National Infrastructure Assessment highlighted the importance of carbon capture and storage core networks to carbon capture and storage commercial deployment, including networks in Humberside, Merseyside, and Medway.

Figure 5. National Infrastructure Commission carbon capture and storage core networks in the UK[7]

7 National Infrastructure Commission's proposed 'core network' for CO_2 and hydrogen pipelines and storage.

Economy wide benefits of carbon removal

Removing carbon emissions from the atmosphere should not be at the expense of emissions reduction efforts. As recognised by the Climate Change Committee, UNFCCC and other credible expert organisations, accelerating both reduction and removals is essential to mitigate the worst impacts of climate change.

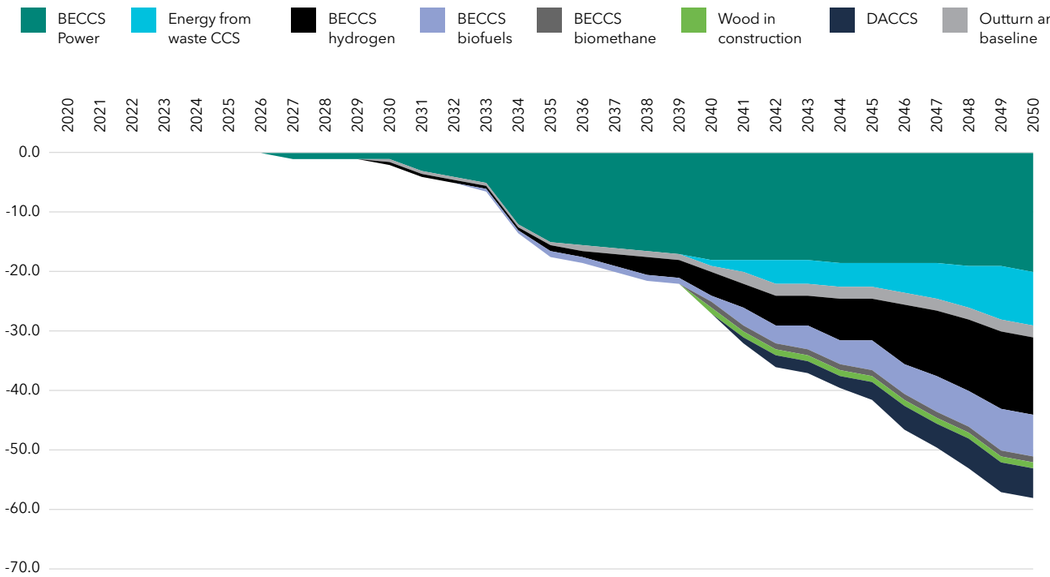
By transforming our Decarbonisation Hubs into carbon removal hubs in the 2030s, enfinium would be able to support the UK's transition to Net Zero economy in a number of ways.

Plugging the UK's carbon removals 'gap'

The Climate Change Committee estimates that by 2050, the UK could need as much as 60 million tonnes of carbon dioxide removed from the atmosphere every year to achieve a Net Zero economy. This would mitigate emissions in hard-to-decarbonise sectors like agriculture and aviation. This would be achieved through a range of technologies using CCUS, such as energy from waste facilities, biomass power plants and Direct Air Capture units.

To achieve this long-term goal, the UK Government has set a target of 23 million tonnes of carbon removals produced annually from 2035. This will require a rapid scale up of an industry that is in its infancy in the UK. Installing CCUS across the UK's energy from waste plants could make a significant contribution to the UK realising this ambition.

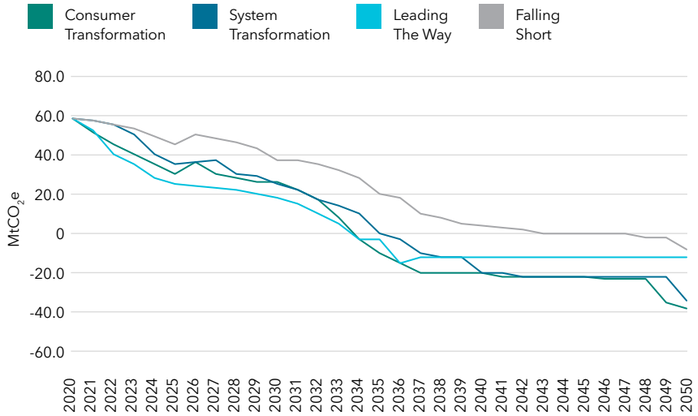
Figure 6. Carbon removal deployment in Climate Change Committee's Balanced Net Zero Pathway scenario[8]



Note: BECCS refers to Bioenergy Carbon Capture and Storage. DACCS refers to Direct Air Carbon Capture and Storage

8 theccc.org.uk/wp-content/uploads/2020/12/The-Sixth-Carbon-Budget-The-UKs-path-to-Net-Zero.pdf (page 198)

Figure 7. Future CO_2 intensity of electricity generation (gCO_2/kWh) under the National Grid's Future Energy Scenarios[9]



Decarbonising the power sector with carbon negative electricity

enfinium's portfolio of operational and development facilities have a combined electricity generation capacity of more than 300 MW – homegrown power that supports the UK's energy security. Given the fossil fuel content of the waste we use, the power we generate has a carbon intensity higher than renewables such as wind and solar, when related to emissions at source. There are carbon avoidance benefits when taken relative to the landfill counterfactual. However, when combined with CCUS our power can go one step further and become carbon negative.

The UK Government has a target to decarbonise the electricity system by 2035. EfW plants with CCUS can support this ambition by producing carbon negative electricity that can mitigate any residual fossil fuel emissions on the power system, such as peaking gas plants. The latest National Grid Future Energy Scenarios illustrate (summarised in Figure 7), the important role carbon negative power producers will play over the coming decades.

Helping the communities where we operate achieve their Net Zero targets

Our facilities are located in forward-looking communities who are dedicated to fighting the climate crisis and decarbonising their local economy. From West Yorkshire to the West Midlands, each area has its own ambition to achieving Net Zero in advance of the UK's legally binding 2050 target.

Our carbon removal hubs can help the communities we support to accelerate their decarbonisation plans and achieve their goals faster. For example, when combined with CCUS technology our Ferrybridge and Skelton Grange facilities could capture over 800,000 tonnes of carbon per annum which could be used to mitigate hard-to-abate sectors across West Yorkshire's economy and enable it to achieve a Net Zero economy earlier than its 2038 target.

Creating a world leading market for high-quality carbon removal credits

The UK has one of the most progressive emissions trading schemes in the world, where polluters pay a price for the emissions they release into the atmosphere. The UK Government has recently confirmed it intends to include carbon removal technologies in the UK Emissions Trading Scheme at some point in the future, which would allow carbon removal technologies to be rewarded for taking carbon out of the atmosphere.

enfinium's carbon removal hubs can support the development of the UK ETS as a world-leading compliance market for carbon removals. Our energy from waste facilities will be powered by homegrown biogenic waste, supported by robust monitoring, reporting and verification processes. Once captured, the CO_2 will be used or permanently stored in the North Sea. As a result, the carbon removal credits we will generate will be high quality and help build trust in the UK's carbon removal sector as it scales up from the 2030s.

9 nationalgrideso.com/document/283101/download (page 43)

Fuel use

S1 Reduce the use of fossil-based fuels in mobile plant and vehicles.

Mobile plant vehicles

Mobile plant vehicles use diesel for a variety of on-site purposes including moving Incinerator Bottom Ash (IBA) from Ferrybridge to the Blue Phoenix IBA processing facility. Diesel trucks are also used to move the Air Pollution Control residues (APCr), another by-product of EfW facilities.

Smaller electric vans now operate at Ferrybridge, Kemsley and Parc Adfer, reducing our emissions. We are investigating using hydrotreated vegetable oil (HVO) instead of diesel for on-site trucks and potentially using electrolytic hydrogen trucks in the future to lower emissions further.

Auxiliary fuels

Our facilities use auxiliary fuels, fuel oil and diesel, in burners used during start up and shut down to maintain combustion temperatures in line with regulations. An emergency diesel generator is also available on site.

We will explore options to replace auxiliary fuels with lower carbon alternatives. We will also explore system modifications that reduce downtime, lower diesel oil consumption, and improve plant efficiencies.

Imported electricity

S2 Procure renewable imported electricity. We moved to a 100% renewable REGO backed tariff in 2023 to eliminate emissions associated with imported electricity.

We signed a deal to move to a 100% renewable, REGO backed tariff for all imported electricity to support operations during scheduled and unscheduled downtime beginning in June 2023.

During normal operations, the electricity generated by the EfW process supplies our operational load for operating cranes, pumps, compressors, air conditioning, and fans. However imported electricity is needed when boilers or turbine-generators are not operating.

Heat networks and private wire

S3 Advance heat networks and private wire across the fleet.

Decarbonising homes and industry

Waste heat and steam is generated through the EfW process. The heat and steam can be exported to serve as a carbon-neutral, local, lower-cost, and reliable source of heat and steam for nearby industry and district heating networks.

We already provide steam offtake to the DS Smith paper mill at Kemsley. We are actively pursuing options to supply new heat networks to decarbonise homes and businesses, as well as using steam to power the future of UK industry. EfW heat export technology is mature and already has high potential for further deployment across the UK.

As part of our plan to transform our EfW facilities into Decarbonisation Hubs, we are developing our heat export capacity. This includes options for heat offtake at each of our facilities, as we look to supply new heat networks and export steam to industrial customers.

We have undertaken heat export pre-feasibility work for each of our EfW facilities. These confirmed few barriers to supplying heat from our sites, and all are located close to potential end users. The benefit of exporting heat improves the energy efficiency of our facilities. All of our facilities are Combined Heat and Power (CHP) ready and able to export heat with minimal modifications needed.

We have been engaging with third parties around our sites, including Local Authorities, network operators and industry, to understand their heat offtake requirements and explore opportunities.

In 2023, we joined the UK District Energy Association, an organisation that promotes District Energy to achieve significant carbon savings and establish a direct link between government and industry. We aim to collaborate within this forum and others, to develop more heat export opportunities.

Exploring alternative sources of heat

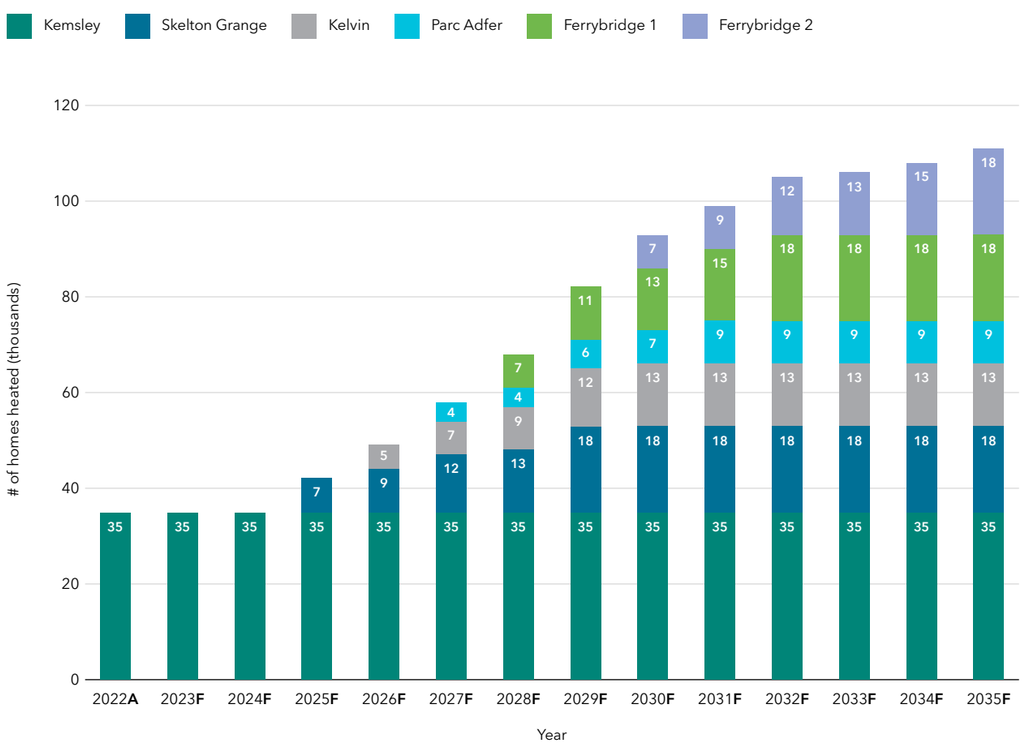
For EfW plants, the bleed on the turbine is the conventional point to take heat from. This however reduces the turbine's gross output. That's why we are looking at using other points of heat recovery on our facilities to supply district heating networks.

For example, there is a large amount of lower grade heat rejected into the atmosphere through air cooled condensers. The temperature of this heat ranges from 40 to 55°C, which is attractive to a heat network developer running water source heat pumps.

Existing district heating projects are exploring recovering heat from data centres, and sewage treatment plants, however these sources are at lower temperatures and often lower volumes than what is available from the cooling system on an EfW plant. Effectively, the heat network could provide cooling services to the EfW facility and dramatically increase the overall system efficiency of the energy recovery process.

Private wire enables us to provide local, baseload and reliable power to nearby industry and businesses without the need for expensive grid connections. Private wire can also be better than the carbon impact of grid connected power when fossil-fuel generators are being utilised.

Figure 8. Our heat network expansion could decarbonise the equivalent of over 110,000 homes[10]



As shown in the graph above, our studies have found that the equivalent of over 110,000 homes could have their heating decarbonised through expansion of heat networks around enfinium facilities. Estimated operation dates were determined on a site-by-site basis and considered factors including our current expectations of the regulatory landscape, such as Heat Zoning legislation and carbon pricing (Emission Trading Scheme or ETS), and the status of heat offtake opportunities being explored with third parties. We have assumed a conservative five-year ramp up period to reach full capacity.

We determined heat export capacity (MWth) based on turbine bleed and anticipate there is scope to expand supply capacity in the future. Key dependencies or risks to realising our timeline include delays due to multiple stakeholder engagement and development hurdles.

10 Note: The number of equivalent homes heated is based on DESNZ natural gas carbon conversion factor of 0.18 kgCO_2/kWh, Ofgem average domestic gas consumption of 12,000 kWh per dwelling and BEAMA gas consumption for heating of 77%. Heat offset natural gas boiler efficiency assumed at 80%. Seasonal adjustment for peak load factor of 75%.

DESNZ, Greenhouse gas reporting: conversion factors 2022 – gov.uk

Ofgem, ofgem.gov.uk/information-consumers/energy-advice-households/average-gas-and-electricity-use-explained

BEAMA, beama.org.uk/static/1a84100d-8fae-4208-9f9fa3e07dee1f1a/UK-homes-Analysis-of-kWH-gas-consumption-for-heating.pdf

Electrolytic hydrogen

Electrolytic hydrogen: a versatile fuel

Hydrogen is a highly versatile fuel that can be produced from a range of energy sources. When used as a fuel, its only by-product is water, so it can help reduce carbon emissions from transportation and industry.

There are several technology options for producing hydrogen at scale. The UK Low Carbon Hydrogen Standard states that a maximum of 2.4 tonnes of CO_2 emissions per tonne of hydrogen produced will count as 'low carbon'. We see opportunity to use EfW electricity to drive the production of low carbon hydrogen.

The Environmental Services Association (ESA) highlights hydrogen fuel production as a potential pathway for decarbonising the waste sector.

We are exploring electrolytic hydrogen production using EfW-generated electricity. A proportion of this is linked to the biogenic fraction of waste we process and therefore eligible for REGO certification, at accredited facilities.

For our EfW facilities, being able to alternate between power export and hydrogen production in the future would provide opportunities to maximise the value of the reliable homegrown power we generate, as well as facilitating carbon savings for wider industry and transport. During periods of high renewable output our flexible, dispatchable sites would be able to switch between power export to the grid and hydrogen production.

The low carbon hydrogen we will produce at our facilities has two main potential end uses: transport and industry.

Transport

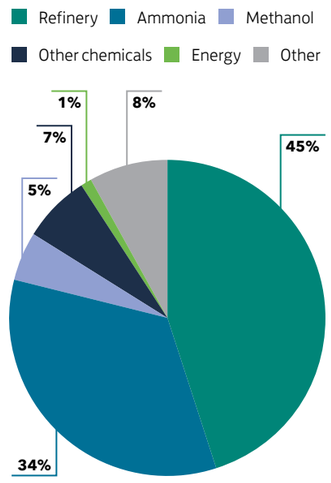
We can supply hydrogen to refuelling stations to displace diesel for the approximately 150,000 articulated heavy goods vehicles (HGVs) that bring waste to our plants annually. This would achieve a significant reduction in our Scope 3 carbon emissions and in the Scope 1 emissions of our waste suppliers.

Similarly, we can supply hydrogen to local fleets, rail freight and shipping that switch to hydrogen-based fuels in the future. For fleet owners, hydrogen offers another way to move away from diesel and petrol to meet UK government deadlines, such as a ban on the sale of new diesel and petrol cars and vans from 2035, as well as all lighter HGVs sold to be zero emission from 2035. All new HGVs will be zero emission by 2040. We expect these pledges will accelerate hydrogen's role in a decarbonised transport system.

Industry

We can supply hydrogen directly to replace natural gas and other fossil fuels used to produce glass, plasterboard, ammonia, refining, steel fabrication or other industrial processes. Hydrogen production can interlink our plants with the planned regional and national hydrogen infrastructure to help develop a hydrogen economy, as most of our plants are located in large industrial areas.

Figure 9. Split of hydrogen demand by application in Europe



Source: Hydrogen Europe.

Our progress on hydrogen

We have undertaken hydrogen pre-feasibility work for each of our EfW facilities, including the best available technology for hydrogen production, the best location for siting and the production scale required to generate necessary returns.

We confirmed that electrolytic hydrogen production is technically feasible at all our facilities on existing land and water sources.

For production at scale, we may need extra land in some circumstances, though this will vary depending on the end use, such as transport or industry.

Our work also shows that EfW-derived electrolytic hydrogen has the potential to be commercially competitive with green and blue hydrogen[11]. Hydrogen from EfW would complement these hydrogen sources, with green hydrogen dependent on weather and blue hydrogen dependent on natural gas pricing.

We are working with potential hydrogen customers and connections local to our sites, including registered fleets and large industrial emitters planning to decarbonise. Looking ahead we want to install a single electrolyser stack alongside all the necessary sub-systems to produce high-purity, self-pressurised hydrogen gas. A pilot project like this could provide enough hydrogen to quickly refuel HGV trucks that could each drive up to 700 km on a single tank.

11 Green hydrogen is defined as hydrogen produced by splitting water into hydrogen and oxygen using renewable electricity. Blue hydrogen is produced from methane, split with steam into CO_2 and hydrogen, with the additional technologies necessary to capture the CO_2 produced when hydrogen is split from methane (or from coal) and store it for long term.

CHAPTER 4:
Asset level detail

Our CCUS project timeline

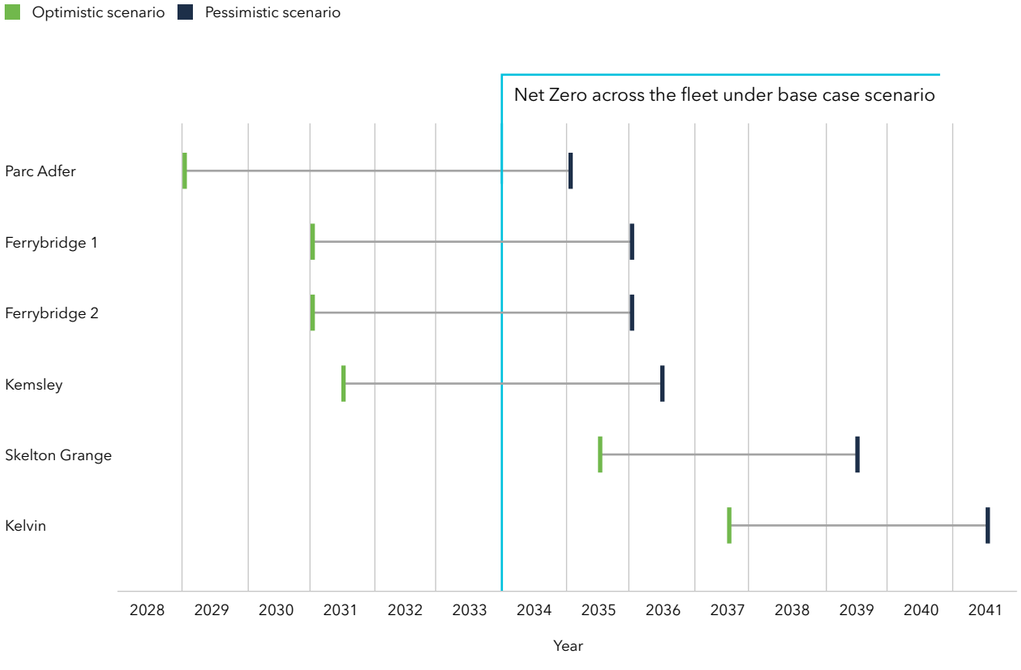
To develop our Net Zero Transition Plan, we modelled a series of assumptions to explore what will be required for us to achieve net zero by 2033. The timetable below sets out the target delivery windows during which commercial operations will begin at each of our facilities. This represents the optimistic and pessimistic ends of the scenarios modelled, which bookend our base case assumptions for carbon capture development and operation.

The estimated commercial operation dates were determined on a site-by-site basis. Operational carbon capture at Parc Adfer is estimated to begin first, with Ferrybridge 1 and 2 next. Construction is expected to be staggered. Ferrybridge is the largest EfW site in the UK, offering the biggest potential for carbon capture and net carbon removals.

Operational carbon capture at Kemsley, Skelton Grange and Kelvin would begin thereafter.

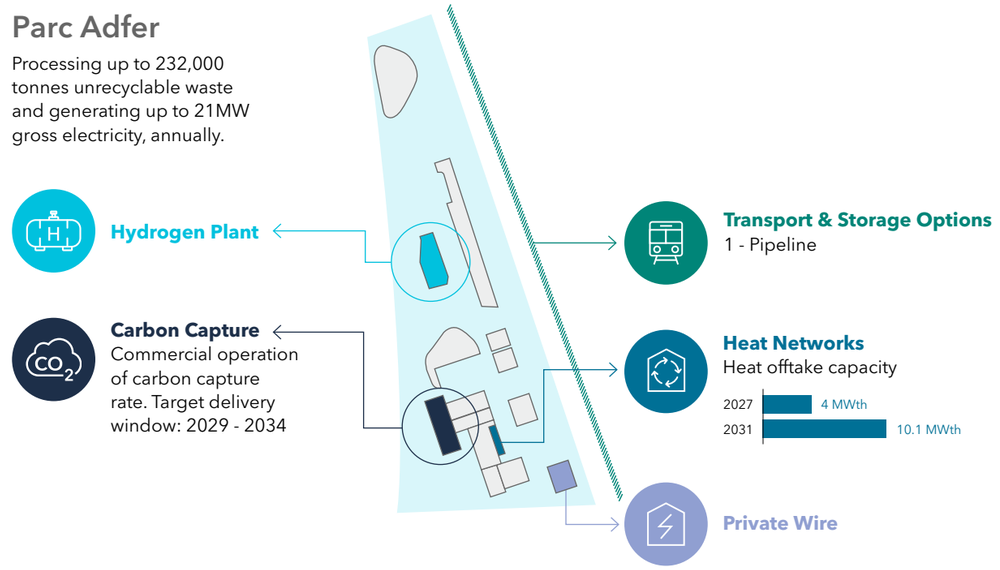
We are making good progress to develop carbon capture and storage proposals, at the same time we recognise that timescales remain subject to substantial development, commercial and supply chain uncertainty and continued Government progress in developing CCUS transport and storage infrastructure.

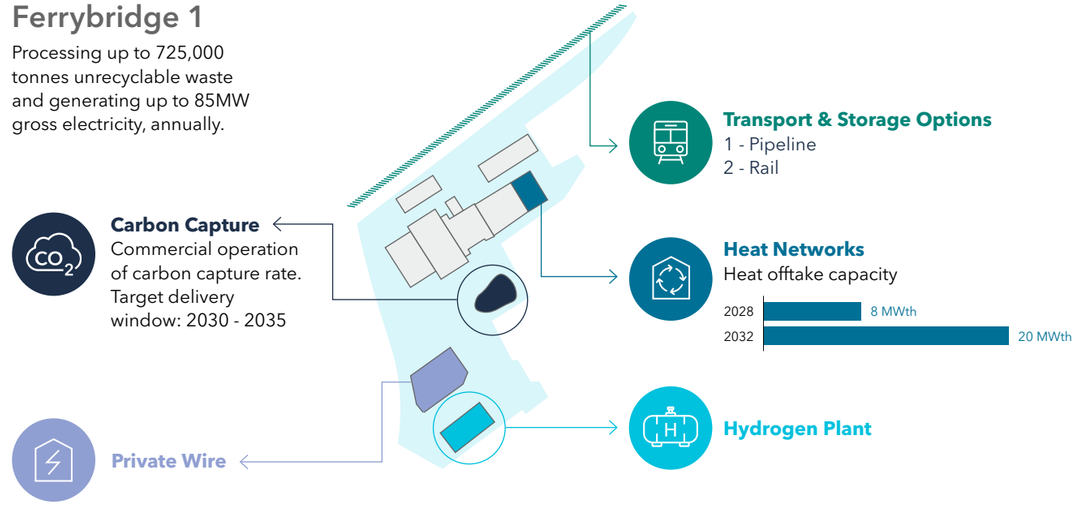
Figure 10. CCUS timeline: target delivery windows for start of CCUS operations at each enfinium facility



The diagrams below show how, where and when we estimate each element of our decarbonisation plans could be installed at each of our EfW facilities. They show:

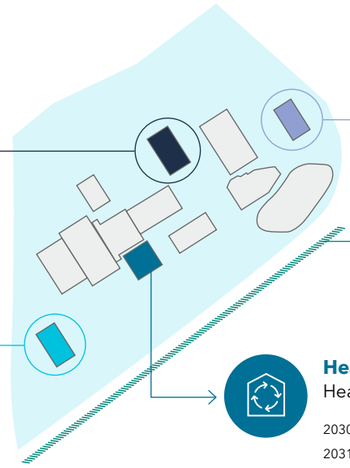
1. Target dates for commercial operation of carbon capture technology. The dates ranges provided represent the optimistic and pessimistic ends of the scenarios we modelled.
2. Heat offtake capacity and target dates represent our base case scenario.
3. Locations and options for private wire networks, electrolytic hydrogen production plants, and transport and storage of the captured CO_2.





Ferrybridge 2

Processing up to 725,000 tonnes unrecyclable waste and generating up to 85MW gross electricity, annually



Carbon Capture
Commercial operation of carbon capture rate. Target delivery window: 2030 - 2035

Hydrogen Plant

Private Wire

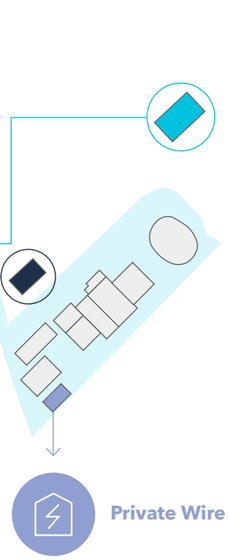
Transport & Storage Options
1 - Pipeline
2 - Rail

Heat Networks
Heat offtake capacity

2030	8 MWth
2031	20 MWth

Kemsley

Processing up to 657,000 tonnes unrecyclable waste and generating up to 74MW gross electricity, annually.



Hydrogen Plant

Carbon Capture
Commercial operation of carbon capture rate. Target delivery window: 2031 - 2036

Private Wire

Transport & Storage Options
1 - Pipeline
2 - Marine

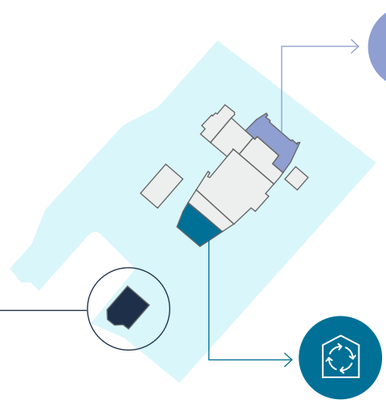
We have joined the Bacton Thames Net Zero Cooperation Agreement.

Heat Networks
Current capacity of 40 MWth. Our Kemsley facility currently supplies 33 MW of heat to DS Smith paper mill.

Skelton Grange

Under construction: Will process up to 410,000 tonnes unrecyclable waste and generate up to 49MW gross electricity, annually. 2025 - commercial operation of EfW facility begins.

2025 - commercial operation of EfW facility begins.



Carbon Capture
Commercial operation of carbon capture rate. Target delivery window: 2035 - 2039

Private Wire

Transport & Storage Options
1 - Pipeline
2 - Rail
3 - Barge

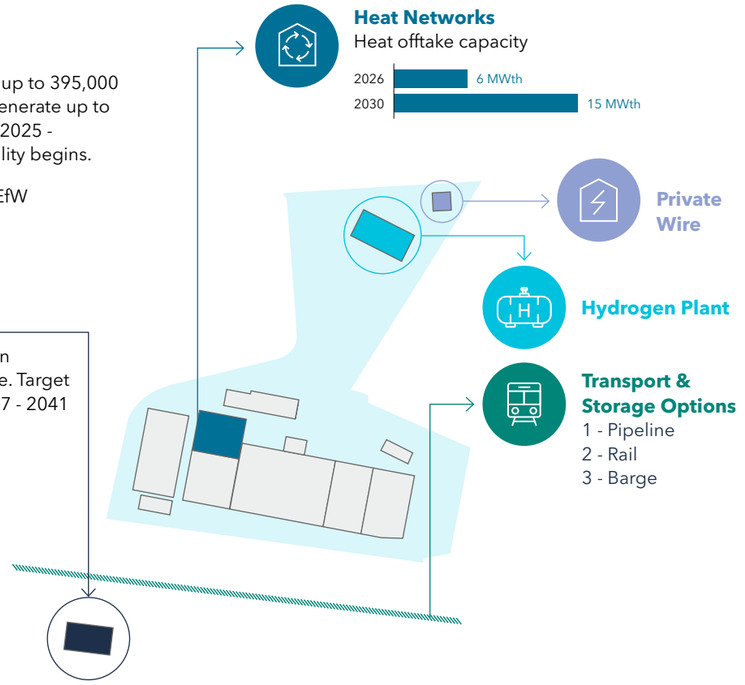
Heat Networks
Heat offtake capacity

2025	8 MWth
2029	20 MWth

Kelvin

Under construction: Will process up to 395,000 tonnes unrecyclable waste and generate up to 44MW gross electricity, annually. 2025 - commercial operation of EfW facility begins.

2025 - commercial operation of EfW facility begins.



Carbon Capture
Commercial operation of carbon capture rate. Target delivery window: 2037 - 2041

Heat Networks
Heat offtake capacity

2026	6 MWth
2030	15 MWth

Private Wire

Hydrogen Plant

Transport & Storage Options
1 - Pipeline
2 - Rail
3 - Barge

Chapter 5:
Delivery and governance of our Plan

Governance of our Plan

Our Plan is underpinned by a commitment to transparent governance and disclosure.

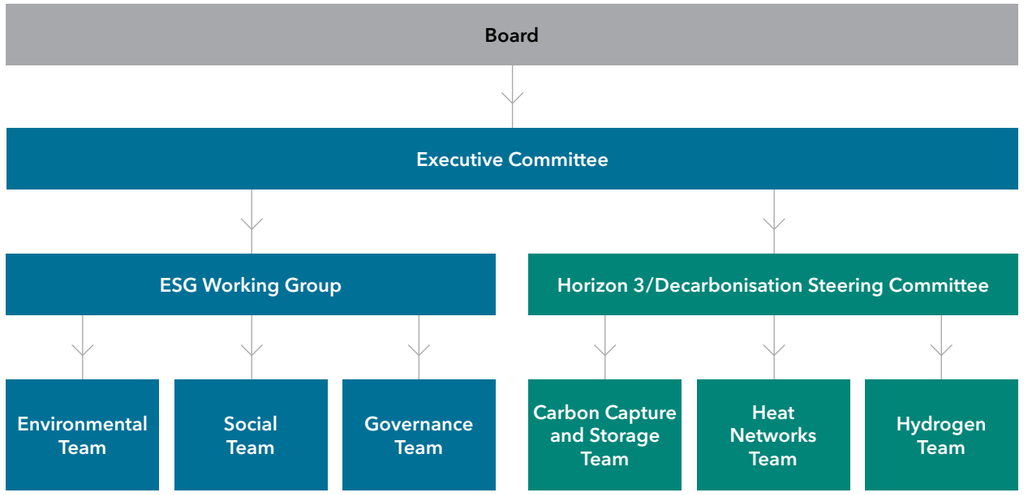
Governance structure and accountability

Our Group Board meet at least quarterly and are responsible for defining our strategy and overseeing business performance. They review and approve our Net Zero Transition Plan and subsequent iterations of the plan, which will be published every three years.

Our Executive Committee are responsible for overseeing implementation of the Net Zero Transition Plan and our ESG strategy. They receive updates on performance and review progress against the Net Zero Transition Plan annually, providing updates to the Board.

At management level, we have our ESG working group and within that there are focused teams for environmental, social and governance projects. Our Horizon 3 (Decarbonisation) Steering Committee are responsible for our Net Zero Transition Plan, and this team consists of three focused teams for CCUS, heat networks & hydrogen projects. Each team are responsible for regularly communicating progress and reporting annually on activities to the executive committee.

Figure 11. Governance chart



Reporting our progress

We will publish an updated Net Zero Transition Plan report every three years. Our ESG report will provide annual updates on progress against our Net Zero Transition Plan. Our annual ESG report will continue to disclose Scope 1, 2 and 3 greenhouse gas emissions performance, alongside total avoided emissions. This data is independently verified.

Metrics and targets:

- Total GHG emissions for Scope 1, 2 and 3 (including biogenic and non-biogenic emissions)
- R1 efficiency calculations
- Total avoided emissions for electricity generation, by-product recovery, heat/steam export, as well as landfill diversion
- Emissions performance compared to ELV and BREF limits
- Water resource usage
- Safety
- Safety observations
- RIDDOR and LTIFR
- Employees

Additional metrics that will be added to our reporting as the Net Zero Transition Plan unfolds includes tCO_2e captured, number of verified carbon removals and generated MWth of heat offtake.

Taskforce on climate-related financial disclosures

We are committed to managing and disclosing climate-related risks and opportunities, in line with the Recommendations of the Task Force on Climate-related Financial Disclosures (TCFD). Our first TCFD disclosure is published in our ESG Report 2022 and we will report our progress annually.

Culture and skills for a transition to net zero

Our Net Zero Transition Plan centres on transforming our EfW facilities into Decarbonisation Hubs by using low carbon technologies. This change will require innovation, agility, and new skillsets inside a working environment that is safe, diverse, and inclusive.

We are planning for the changing requirements of our future workforce. We anticipate new skills required for roles such as chemical engineers and new office support roles, such as customer service. This is alongside a continued focus on diversity, colleague engagement and developing skills and talent to deliver operational excellence across our existing EfW operations.

As our business evolves, we want to bring our colleagues with us and ensure they can take new opportunities and develop their careers. Our annual employee engagement survey helps us connect with and gather feedback from our colleagues. We run quarterly roadshows at all our facilities where our colleagues can learn how the business is performing and our plans for the future. They also have the chance to share their feedback. There are regular Board, Excom and employee 'listen and learn' roadshows on our net zero transition plans and progress.

Developing the future workforce

Our approach also focuses on early-stage careers to foster young and diverse talent in the sector. In March 2022, we launched our first Mechatronics Operations Engineering Technician (MOET) apprenticeship programme. This consists of one year of practical workshop and classroom study and two years of on-the-job training at our EfW facilities. In 2023, we extended our apprenticeship programme disciplines to mechanical and operation technicians to broaden the scope for new talent joining the organisation.

As we look to the future and consider the growing needs of our business, our apprenticeship programme will provide a strong base to build on. The programme will enable us to foster new skillsets in line with the development of low carbon technologies at our sites. Early career programmes will be important for plugging the green skills deficit and developing capabilities needed for a net zero future.

To prepare for this, we joined Energy and Utility Skills as members, a forum bringing companies together to create a safe, skilled and sustainable workforce in the energy and utility industries. We look forward to working closely together on important areas including developing specialist apprenticeships and qualifications.

Read more about our current apprenticeship programme in our ESG Report.

The Importance of a Just Transition

Moving the economy to net zero will create employment and opportunities, but it may also negatively impact individuals and communities where carbon-intensive industries are phased out. We are already contributing to the 'Just Transition', with a number of our employees being former coal-fired power operators.

A 'Just Transition' means moving to a more sustainable economy in a way that is fair to everyone. This is at the heart of our growth and transformation. To do this we're focusing on delivering operational excellence within our existing and developing EfW facilities, while attracting the skills and capabilities we need to add new low carbon technologies across our sites.

There will be new opportunities linked to developing low carbon technologies, and also at our facilities under construction, Kelvin and Skelton Grange. Illustrating how we are considering a Just Transition, we have engaged with businesses near both sites to explore opportunities to repurpose the skills of thermal generators within EfW, for those facing the closure of fossil-fired power plants in the coming years.

Policy and engagement

Addressing the challenges of climate change and resource use, and successfully implementing our Plan, requires collaboration and co-ordinated policies. We work with stakeholders in the public and private sectors to promote and advance market-driven policies in key areas, such as carbon pricing, resource, and waste policy.

Transition Plan Taskforce

The Transition Plan Taskforce (TPT) was launched by HM Treasury in April 2022 to develop the gold standard for private sector climate transition plans applicable to the UK. We were guided by the Disclosure Framework and Implementation Guidance documents in the preparation of our plan. The TPT Sector Summary for Waste Management has been considered in the development, including limiting GHG emissions from EfW through:

- Optimising the efficiency of EfW process
- Increasing bottom ash recovery;
- Reducing plastics/fossil waste in EfW; and
- Developing and deploying CCUS in EfW installations

Annual updates on progress will be communicated through our ESG Report, as part of TCFD aligned disclosure with the transition plan and a full plan review conducted every 3 years.

The key policies influencing our strategy are:

The Climate Change Act

In June 2019, the UK passed legislation requiring the UK to bring all greenhouse gas emissions to net zero by 2050. In 2021, the Government set two additional interim targets to achieve a net zero power system and reduce emissions by 78% by 2035. As we decarbonise our economy, our country faces combined needs to strengthen homegrown energy security and improve how we deal with waste management.

The Climate Change Committee (CCC) is an independent, statutory body that monitors the UK's progress in reducing greenhouse gas emissions. In their 2022 Progress Report to Parliament, they highlighted the need for a strategy to manage increasing emissions from EfW facilities as part of the wider emissions reduction plans for the waste sector.

Specifically, the CCC has recommended[12]:

- Developing plans to expand CCUS coverage to the UK's EfW fleet.
- Publishing a decarbonisation plan, by the Government, for the waste sector in line with the UK's Carbon Budgets and net zero.
- Confirming the requirements under National Planning Statements to ensure new EfW plants are compatible with capacity needs and the waste hierarchy.
- Preventing biodegradable waste streams from going to landfill by 2028 at the latest.
- Phasing out waste exports by 2030.

The CCC has also highlighted that, in order to achieve net zero, the UK will need to achieve carbon removals or 'negative emissions' to counterbalance residual GHG emissions from hard-to-abate sectors. This must be achieved through both nature based and engineered removals. The CCC recommends that the Government accelerates the development of policy and plans to achieve these carbon removals to achieve its targets.

The UK's Second Infrastructure Assessment

The National Infrastructure Commission (NIC), an advisory body to the UK government that reports to HM Treasury published its Second Infrastructure Assessment, a five-yearly report that strategically reviews the state of the UK's national infrastructure and priorities for investment, in November 2023.

Recommendations in the Statement included:

- All new EfW plants need to be 'carbon capture ready' to support Net Zero.
- Local authorities should seek to contract with EfW facilities that can demonstrate a credible plan to develop CCUS.
- The UK's CCUS networks should be built with the ability to take CO_2 transport by rail, shipping or road.

12 theccc.org.uk/publication/2022-progress-report-to-parliament/

CCUS Vision

In December 2023, the UK Government set out its vision to become a global leader in CCUS, create a self-sustaining CCUS sector that supports thousands of jobs and reduces emissions to ensure a better environment for future generations.

To achieve this, the document commits to developing a commercial and competitive CCUS market, where the roles of government and industry evolving over time, through three phases:

1. **Market creation:** Getting to 20 to 30 mega tonnes per annum (Mtpa) CO_2 by 2030.
2. **Market transition:** The emergence of a commercial and competitive market.
3. **A self-sustaining CCUS market:** Meeting net zero by 2050.

To deliver this ambition, the paper commits the Government to progressing a series of workstreams in 2024 focusing on the frameworks needed to support a market transition, including:

- Launching a consultation on the design of an enhanced competitive allocation process for capture contracts.
- Working with industry and wider stakeholders to consider the strategic direction for CO_2 transport networks.
- Publish a call for evidence on how government envisages non-pipeline transport to be delivered in the UK.

We believe all of these measures support the overarching ambition and plan set out by enfinium for its carbon capture and storage programme in the UK.

UK Emissions Trading Scheme (ETS)

In 2022 the UK ETS Authority discussed including carbon removal credits in the ETS, which could unlock significant investment in the UK's carbon removal sector. It would provide an integrated market where businesses can choose how to decarbonise or remove their emissions, which would increase demand for carbon removal projects. It would also provide a robust monitoring, reporting and verification (MRV) regime that would ensure all carbon removal credits are high-quality.

The UK Government's Net Zero Growth Plan has since committed to "working with the UK ETS Authority to consider options for integrating GHG removals in the UK ETS, subject to the outcomes of last year's UK ETS consultation."

enfinium fully supports the inclusion of carbon removals in the UK ETS in the late 2020s, which would accelerate the scale-up of the UK's carbon removal sector.

In July 2023, the Government confirmed its intention to include the energy from waste sector in the UK Emissions Trading Scheme from 2028. We need to decarbonise the UK economy at pace, which is why we support the Government's decision. Combined with banning landfill and minimising waste exports, this change could deliver billions of pounds of investment in decarbonising Britain's waste infrastructure.

In July 2023, the Government also confirmed its intention to include engineered Greenhouse Gas Removal technologies in the ETS. We welcome the Government's decision to include Greenhouse Gas Removal technologies in the UK ETS. This will provide a regulated compliance market that will drive investment in high-quality carbon removal technologies such as energy from waste with CCUS.

UK Policy to tackle unrecyclable waste

Defra has set a long-term target to reduce unrecyclable waste by 50% by 2042 (from 2019 levels) and mandatory interim waste targets to 2028. It has also committed to developing policies to end all biodegradable municipal waste to landfill from 2028.

Other waste management policies likely to affect waste inputs include:

- A national Deposit Return Scheme (DRS)
- Extended Producer Responsibility (EPR) for packaging
- A Plastics Packaging Tax applying a £200/tonne tax on plastics containing less than 30% recycled plastic
- Proposals for separate household food waste collections to support the move to ban biodegradable waste to landfill.

enfinium fully supports Defra's targets. We will continue to advocate and support measures that promote recycling and reduce unrecyclable waste, such as removing organics from landfill and plastics from EfW facilities.

While Defra's targets will help to drive a circular economy, the UK will still need a sustainable way of managing unrecyclable waste. Even if the unrecyclable waste target is achieved by 2042, around 17 million tonnes will need to be dealt with every year. It's critical this material is treated and disposed of in the most sustainable way possible, for example, in decarbonised EfW infrastructure that maximises the potential of this resource.

UK Heat and Buildings Strategy

Decarbonising energy used in buildings is a key part of the UK Heat and Buildings Strategy[13]. It sets out plans for how the UK will decarbonise heat energy sources and improve energy efficiency for domestic, commercial, industrial, and public sector buildings to take us closer to net zero by 2050. There are significant policies and incentives to promote heat networks, including the Green Heat Network Fund.

The UK Hydrogen Strategy

The UK Hydrogen Strategy recognises that hydrogen can play a key role in achieving net zero. It recognises its potential to help reduce emissions in industry and provide flexible energy for power, heat and transport.

The Government's current target is 5GW of low carbon hydrogen capacity by 2030[14]. The government plans to invest £500m in hydrogen, of which £240m will go towards hydrogen production facilities and the rest on hydrogen grid infrastructure.

In April 2022, in response to the Russian crisis, the government announced the UK's Energy Security Strategy has increased the hydrogen ambition to 10GW, with at least half coming from green hydrogen. To meet this goal, the government is taking a 'twin track' approach by supporting both electrolytic green and CCUS-enabled blue hydrogen. They are setting out plans to support developing a variety of production methods and facilities.

13 HM Government – Heat and Buildings Strategy (publishing.service.gov.uk)
14 UK hydrogen strategy - GOV.UK (gov.uk)

Our engagement approach

We are committed to working with policymakers, regulators and other stakeholders to develop a policy framework that delivers the investment required to transform EfW facilities into Decarbonisation Hubs. We track, engage with and contribute to policy development across three key strategic areas: waste, energy, and decarbonisation.

We participate openly and transparently in processes seeking policy outcomes that are aligned with our ESG strategy, and in the interests of our partners and communities.

Stakeholder Group	Waste	Energy	Decarbonisation
Enfinium Position Summary	We seek to speed up reforms to the UK waste sector, highlighting the critical role EfW plays in minimising landfill and waste exports.	We seek to secure long-term value for homegrown power, promoting the critical contribution EfW makes towards homegrown energy security.	We seek to pioneer new low carbon technologies, using EfW to make a critical contribution towards regional and national decarbonisation.
Examples of engagement	• Waste and resource strategy • Extended Producer Responsibility • Deposit Return Scheme	• Energy security • REMA • UK ETS	• Carbon pricing, UK ETS • Green Taxonomy
Trade bodies/forums through which we engage	• Environmental Services Association • Policy Connect • Resource Recovery UK	• Renewable Energy Association	• Carbon Capture and Storage Association • Coalition for Negative Emissions • CCS+ Initiative

Independent verification

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enfinium NZTP
Verification Supporting Letter

The Net Zero Transition Plan (NZTP) model provided by enfinium includes calculations for the Scope 1 and 2 greenhouse gas emissions for enfinium's energy from waste (EfW) portfolio. This includes three operational merchant EfW facilities and one reverting asset, with two assets currently under construction.

Arup has completed a thorough review of enfinium's current NZTP modelling approach for its facilities that are operational and under construction, focussing on challenging the underlying modelling assumptions, inputs and calculation methodology and alignment with best practice reporting.

Based on the evidence provided, it is the opinion of Arup, that the Net Zero Transition Plan Base Case scenario[1] is materially correct based on the scope presented and is a fair representation of the Scope 1 and 2 greenhouse gas emissions for enfinium's EfW portfolio.

Arup has reviewed and provided input on the approach for calculating current and potential future avoided greenhouse gas emissions and greenhouse gas reduction methodologies, and considers the assumptions used in developing these to be reasonable and in line with industry best practice.

Arup has not sought to establish the reliability of the data sources provided to us, unless otherwise stated. We have, however, reviewed the information provided and have satisfied ourselves, so far as possible, that the information presented is consistent with other information obtained during the course of work undertaken.

Ben Glover
Associate Director

[1] Refers to the Arup Base Case presented in the enfinium NZTP Model issued by Arup on 13 April 2023 titled: "230413 enfinium NZTP Model V2" with supplementary commentary and analysis in the report issued by Arup on 13 April 2023 titled: "230413 enfinium NZTP Report V2"

Appendices

TECHNICAL INFORMATION

Net Zero Transition Plan model assumptions

On the right lists the assumption parameters within our Net Zero Transition Plan model that are relevant for our Scope 1 and 2 emissions.

- Waste processing tonnages (tonnes/year)
- Commercial operations date (year) for facilities under construction, Kelvin and Skelton Grange
- Tonnes of carbon dioxide released (tonnes CO_2 /tonne waste processed)
- Tonnes of nitrous oxide released (tonnes N_2O/million tonnes waste processed)
- Biogenic proportion of waste (%)
- Auxiliary fuel use (litres/tonne waste processed)
- Imported electricity (kWh/tonne waste processed)
- Carbon capture and storage commercial operations date (year)
- Carbon capture rate (%)
- Carbon capture and storage parasitic load (%)
- Carbon capture and storage ramp up (year, %)

Glossary

APCr	Air Pollution Control Residue	**GGR**	Greenhouse Gas Removal
BECCS	Bioenergy Carbon Capture and Storage	**GHG**	Greenhouse Gas
CCC	Climate Change Committee	**HVO**	Hydrotreated Vegetable Oil
CCGT	Combined Cycle Gas Turbine	**IBA**	Incinerator Bottom Ash
CCS	Carbon Capture and Storage	**ICC**	Industrial Carbon Capture
CCSA	Carbon Capture Storage Association	**IEA**	International Energy Agency
CCUS	Carbon Capture, Utilisation and Storage	**IPCC**	Intergovernmental Panel on Climate Change
CHP	Combined Heat and Power	**LCHS**	UK Low Carbon Hydrogen Standard
DACCS	Direct Air Carbon Capture and Storage	**MOET**	Mechatronics Operations Engineering Technician
Defra	Department for Environment, Food & Rural Affairs	**MSW**	Municipal Solid Waste
DRS	Deposit Return Scheme	**NIC**	National Infrastructure Commission
EfW	Energy from Waste	**NZTP**	Model Refers to the enfinium Net Zero Transition Plan Model
EPC	Energy Performance Certificates	**PCC**	Post-combustion carbon capture
EPR	Extended Producer Responsibility	**TCFD**	Task Force on Climate-related Financial Disclosures
ESA	Environmental Services Association	**TRL**	Technology Readiness Level
ESG	Environmental, Social and Governance	**UKDEA**	UK District Energy Association
ETS	Emissions Trading Scheme	**UNFCCC**	United Nations Framework Convention on Climate Change
FEED	Front end engineering design	**VCM**	Voluntary Carbon Market

External References

Page No	References
Page 5	[1] Environmental Services Association (ESA) 2021, A net zero greenhouse gas emissions strategy for the UK recycling and waste sector. ESA-Net-Zero-Full-Report.pdf (esauk.org) [2] REGO means Renewable Energy Guarantees of Origin, a scheme providing certificates which demonstrate that electricity has been generated from renewable sources operated by Ofgem, the UK's gas and electricity markets regulator.
Page 9	[3] weforum.org/reports/global-risks-report-2023 [4] Environmental Services Association (ESA) 2021, A net zero greenhouse gas emissions strategy for the UK recycling and waste sector. ESA-Net-Zero-Full-Report.pdf (esauk.org) [5] Environmental Services Association (ESA) 2021, A net zero greenhouse gas emissions strategy for the UK recycling and waste sector. ESA-Net-Zero-Full-Report.pdf (esauk.org) (page 4) [6] DESNZ (2023), Provisional UK greenhouse gas emissions national statistics 2022; BEIS (2023), Final UK greenhouse gas emissions national statistics: 1990 to 2021
Page 22	[7] National Infrastructure Commission's proposed 'core network' for CO_2 and hydrogen pipelines and storage.
Page 23	[8] theccc.org.uk/wp-content/uploads/2020/12/The-Sixth-Carbon-Budget-The-UKs-path-to-Net-Zero.pdf (page 198)
Page 24	[9] nationalgrideso.com/document/283101/download (page 43)
Page 28	[10] Note: The number of equivalent homes heated is based on DESNZ natural gas carbon conversion factor of 0.18 kgCO_2/kWh, Ofgem average domestic gas consumption of 12,000 kWh per dwelling and BEAMA gas consumption for heating of 77%. Heat offset natural gas boiler efficiency assumed at 80%. Seasonal adjustment for peak load factor of 75%. DESNZ, Greenhouse gas reporting: conversion factors 2022 – gov.uk Ofgem, ofgem.gov.uk/information-consumers/energy-advice-households/average-gas-and-electricity-use-explained BEAMA, beama.org.uk/static/1a84100d-8fae-4208-9f9fa3e07dee1f1a/UK-homes-Analysis-of-kWH-gas-consumption-for-heating.pdf
Page 30	[11] Green hydrogen is defined as hydrogen produced by splitting water into hydrogen and oxygen using renewable electricity. Blue hydrogen is produced from methane, split with steam into CO_2 and hydrogen, with the additional technologies necessary to capture the CO_2 produced when hydrogen is split from methane (or from coal) and store it for long term.
Page 39	[12] theccc.org.uk/publication/2022-progress-report-to-parliament/
Page 41	[13] HM Government – Heat and Buildings Strategy (publishing.service.gov.uk) [14] UK hydrogen strategy - GOV.UK (gov.uk)