



Energy from Waste with CCUS – supporting a Thames net zero transition

Westminster Energy Forum

18 May 2022



AGENDA

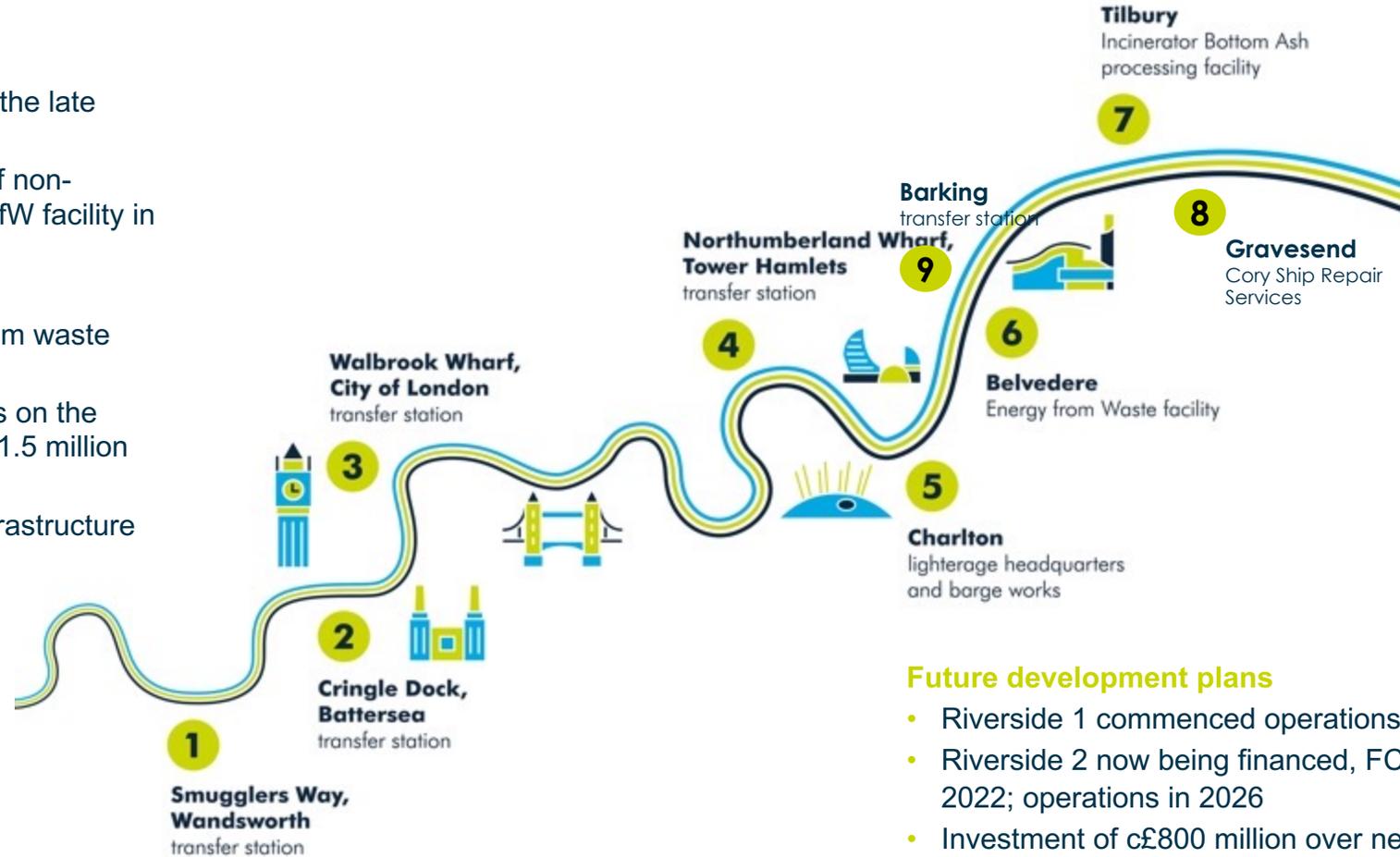
1. Introduction to Cory
2. Cory's decarbonisation plans and the impact of abating EfW CO₂e emissions
3. Cory's CCUS project
4. Riverside Heat Network*



CORY – SUPPORTING LONDON AND THE SOUTHEAST VIA THE THAMES

Current operations

- Operating on the river Thames since the late 1700s (incorporated 126 years ago)
- Currently process c785,000 tonnes of non-recyclable waste at the Riverside 1 EfW facility in Belvedere
- Process 71,000 tonnes of recyclates
- Generate c.532 GWh of electricity from waste process (2021)
- Currently ship around 800,000 tonnes on the river (including ash) – this will rise to 1.5 million tonnes following build of Riverside 2
- Owned by experienced long term infrastructure investors



Future development plans

- Riverside 1 commenced operations in 2011
- Riverside 2 now being financed, FC expected July 2022; operations in 2026
- Investment of c£800 million over next 5 years on new facility, river infrastructure, heat network, CCUS



Cory's decarbonisation plans

And the impact of abating EfW CO₂e emissions



CORY'S DECARBONISATION PLANS

Investing in the net zero transition

Riverside 2 EfW facility

- Will process c. 650kt tonnes of non-recyclable waste (805kt permit)
- Does not increase amount of waste in the UK and actually reduces CO₂ UK footprint as displaces waste from landfill/RDF export, which have higher CO_{2e}
- Will generate c.500 GWh, enough electricity to power 140,000 homes each year.
- One of top performing UK EfWs in terms of emissions performance

- **DCO obtained: April 2020**
- **Financial Close: by Q3 2022**
- **Construction start: Q4 2022**
- **Operational start: Q2 2026**

Riverside Heat Network

- Provide up to 58MW of spare heat from Riverside 1 and Riverside 2 waste processing operations for up to 21,000 homes in the London Borough of Bexley and Royal Borough of Greenwich via the proposed heat network.
- Working with Vattenfall and the London Borough of Bexley

- **Awarded funding under BEIS Heat Network Investment 2021**
- **Progressing commercialisation**
- **Construction start: 2022 H2**

Carbon capture and storage

- Capture up 1.3-1.5 million tonnes per year of CO₂ from Riverside 1 and Riverside 2 waste processing operations (c53% biogenic therefore c690,000 tonnes net POSITIVE)
- CO₂ captured and liquefied on Cory's site at Belvedere
- Cory river logistics expertise to export CO₂ via ship to offshore underground

- **Pre-FEED / EIA scoping: 2022**
- **DCO application: Q3 2023**
- **CCUS ready: 2026**
- **Fully operational: 2030**

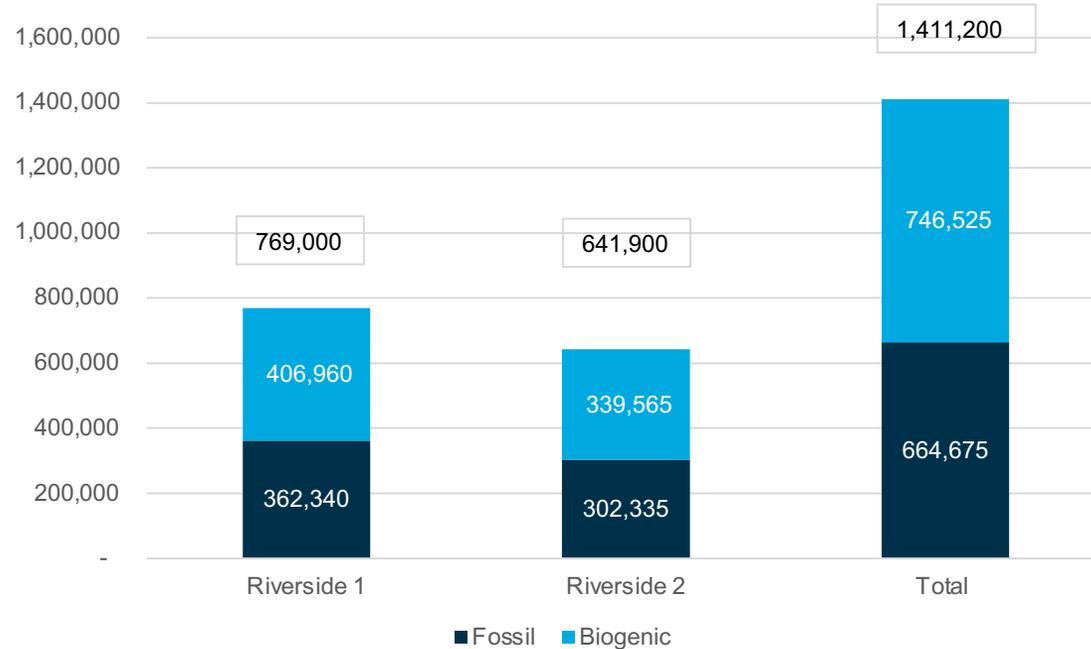
Main focus for today

Additional plans towards net zero carbon by 2040 include:

- R&D in net zero river transport
- All operational emission net zero by 2035

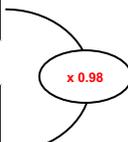
OUR CHALLENGE: TOTAL CO2 EMISSIONS OF 1.4 MT BY 2026

Annual CO2 emissions from Cory EfW processes by 2026



Source*	Tonnes Waste
Riv 1 Waste	785
Riv 2 Waste	655
Total Waste	1,440

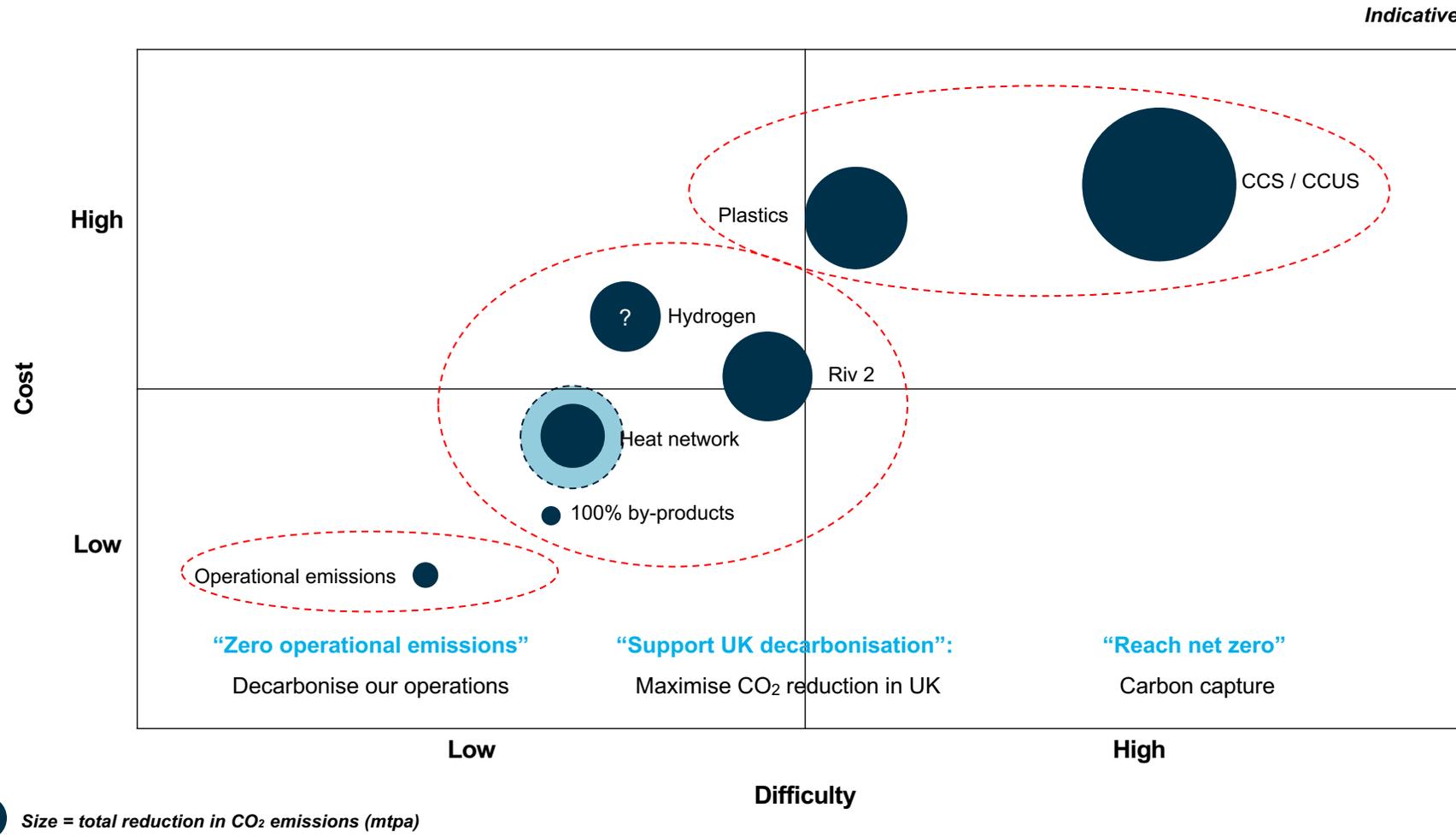
Source	Tonnes CO ₂ e
Biogenic	747
Fossil	665
Total CO₂e	1,411



- Biogenic and fossil based on Riv 1 2020 composition analysis (53.09% biogenic, 46.91% fossil), and modelled using same proportion of gas oil in auxiliary burners and emergency diesel generator as RRRL in 2020
- Composition is expected to remain c.50/50 for the fossil/biogenic components through to 2035 (Greenhouse Gas and Air Quality Impacts of Incineration and Landfill, Eunomia, 2020)
- Fossil and biogenic emissions split as only fossil carbon considered to be contributing to anthropogenic climate change by the IPCC.
- By capturing all emissions (biogenic + fossil) EfW facilities can become:
 - Net zero: Not adding any new fossil carbon emissions to the atmosphere, and selling negative emissions as offsets for hard to abate sectors
 - Carbon negative: Not adding any new fossil carbon emissions and capturing biogenic component → removing historic anthropogenic emissions



PRIORITISING DECARBONISATION STRATEGIES



Notes:

- Cost: High-level qualitative estimate of the cost to deliver the decarbonisation opportunity. Subject to further detailed analysis.
- Difficulty: The technical and operational difficulty, e.g. complexity, tech maturity, proven similar projects, etc.



Carbon capture project

Supporting a Thames net zero transition



CORY CARBON CAPTURE PROJECT – HIGHLIGHTS



- Combined, Cory's two modern, collocated 'R1' rated EfWs will:
 - Sustainably and hygienically dispose of up to **1.655 million tonnes of residual waste p/a**
 - Generate and export over **127.8 MWe of low carbon baseload electricity** to the grid
 - Generate **58 MWt of exportable heat** for use in the Riverside District Heat Network (with Vattenfall) (BEIS HNIP supported)
 - Produce over **350 ktpa of ash (IBA) for secondary aggregate** production
 - Recover approximately **35 ktpa of valuable ferrous and non-ferrous metals**
 - Have the **highest performing flu gas abatement systems** (NO_x etc).
- However, once Riverside 2 is operating, we believe the Belvedere site will be the **single largest CO₂ emitting EfW operation in Europe, emitting c.1.4m tonnes CO₂e pa**
- Carbon capture the only viable carbon abatement solution available to Cory to reach net zero
- At a 95% capture rate, an EfW CCUS system with this volume of waste throughput **could capture at lease 1.3m tCO₂/yr by 2030**
- Cory is not constrained by need to commit to a specific 'cluster', and will use shipping to transport carbon to North Sea storage locations

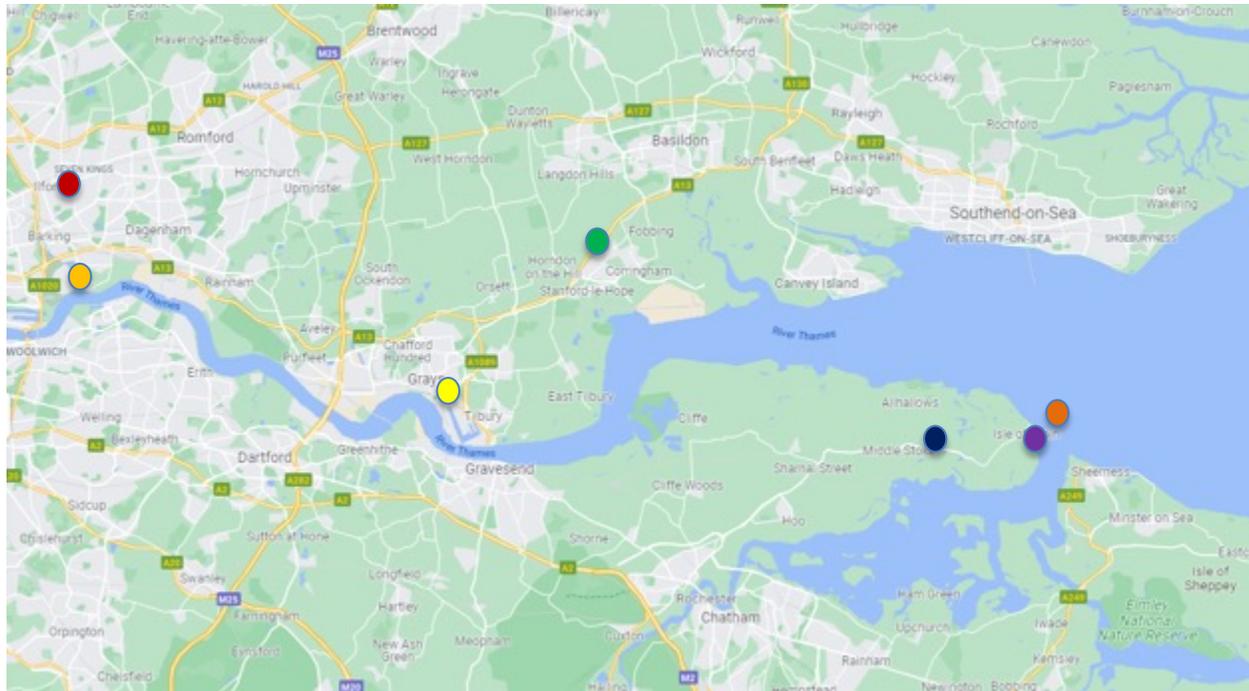
TRANSPORTATION AND STORAGE OF CO2

- Number of important stakeholders support the principle of bulk transportation of CO2 on the river Thames (eg Port of London Authority and Thames Estuary Growth Board)
- Currently evaluating shipping models. Similar to LNG, which is already done at scale. Storage providers willing to offer transportation as a service
- Cory agnostic to storage (advancing discussions with HyNet, Humber Zero, Acorn, Storegga, Uniper etc) and funding models (including hybrid/merchant models). Cory cares about deliverability and price
- Cory has MOU with Northern Lights, the most advanced storage provider (ready for carbon by 2024). Deal supported by Norwegian Government
- Cory speaking to other high CO2 emitters in the Thames region, including others with marine export infrastructure (e.g Tate & Lyle Sugars), and others currently 'landlocked' (e.g North London Waste Authority)



THE THAMES AS A CLUSTER

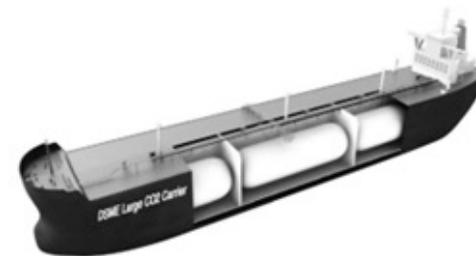
Cory's marine-supported CCS facility could catalyse a marine CO₂ logistics aggregation service on the Thames Estuary, serving other high industrial emitters and encouraging the deployment of consented CCUS-ready energy facilities. Inland emitters nearby could pipe to Thames storage/pickup hubs



- Barking Power Station
- Cory EfW facilities
- Tilbury Green Power (Greenvolt and Equitix)
- Gateway Energy Centre (Intergen)
- North Grain CCGT (Uniper)
- Medway Power (SSE Thermal)
- Damhead Creek (Vitol)

Combined potential carbon emissions = ~14.5 Mtpa

SMALL DESIGN BASED ON SEMI REFRIGERATED,
LOW PRESSURE LPG VESSELS (C.10,000M³)



PROGRAMME

2022

- Commercialisation workstreams continue (including capture, shipping, storage)
- Commencing Pre-FEED Stage 2
- Commencing DCO Programme (Pre-Application Phase – including optioneering)
- Commence Socio-economic research programme
- Riverside 2 (EfW) Financial Close & Construction Commence
- Commence CCUS FEED (Q3/4)

2023- 2026

- DCO application submission Q2/3 2023
- DCO approved / JR period lapsed / pre-commencement conditions discharged (Target Q1 2026)
- **Cory CCUS Readiness achieved (2026)**

2028

- Q3 CCUS Phase 1 Commissioned/operational
- **Cory will be capturing at least 683,200 tCO₂ /yr (c-50,333 tCO₂/yr Carbon Negative)**

2030

- - Q3 CCUS Phase 2 Commissioned/operational
- - **Cory will be capturing at least 1.3m tCO₂ /yr (c-533,000 tCO₂/yr Carbon Negative)**



CHALLENGES



- Ensuring the waste industry speaks with a collective voice to shape policy outcomes that will maintain a level playing field across the sector
- Establishing a government funding model that will support the development of CCUS until a self-sustaining market exists
- Bringing dispersed sites into the funding model – not just the businesses situated in established industrial clusters
- Coordinating businesses with shared challenges and interests to develop new clusters, e.g. Thames cluster
- Considering multiple options until clarity achieved in a nascent sector, e.g. technology, transportation, storage
- Planning / DCO process



Riverside Heat Network

EfW supporting decarbonisation of heat in cities



RIVERSIDE HEAT NETWORK – HIGHLIGHTS

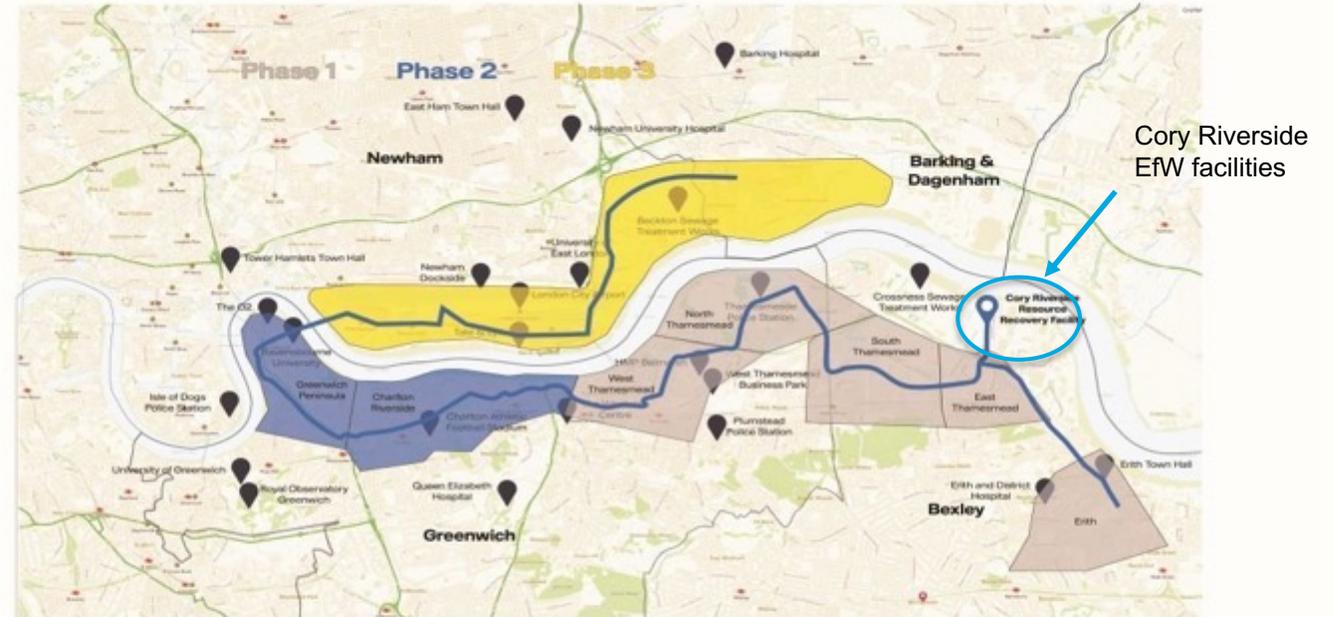


- Energy from waste process – generates heat
- Riverside 1 will provide heat for equivalent of over 10,500 homes in the London Borough of Bexley and the Royal Borough of Greenwich
- Riverside 2, when built, will provide enough heat to more than 10,500 additional homes
- Underpins Vattenfall’s plans for a larger ‘East London Heat Network’
- Working with Vattenfall, local authorities and developers such as Peabody, Lendlease, Berkely Homes
- For London and the UK, the project will deliver over 75,000 tonnes of carbon savings against existing gas boiler usage over 15 years in Phase 1 of Vattenfall’s plans, transforming the way London consumes heat
- Aim is for the Heat Network to transform how a large part of the city is supplied with heating, displacing natural gas to reduce new fossil carbon emissions, while bringing air quality improvements for residents
- It will accelerate London’s journey to net zero and will be the largest district heat project in the UK

THE VISION

- 500,000 homes, businesses and schools by 2050
- Multiple heat sources – Cory EfW, GSHP, Data centres
- Allowing access to affordable low carbon heat

London's largest heat network




Connecting half a million homes to low carbon heating


Improving local air quality


Investing more than £35m in the next decade


Creating jobs for local contractors and businesses

IMPORTANCE OF HEAT NETWORK TO ENHANCE ENVIRONMENTAL PERFORMANCE OF CCS



Scenario 1: No CCS Heat Network

- UK Gov/HNIP support for deployment
- Indicative construction commencement Q3 2022
- Cory to provide 58 MW thermal to anchor the heat network

Scenario 2: CCS Scenario Super Heat Network

- UK Gov/HNIP support for deployment
- Indicative construction commencement Q3 2022
- Wirth CCS, by 2030, Cory will be able to recover substantial quantities of otherwise wasted CCS process heat and water, increasing output to c+100 MWth plus conduit for c30-80 tph of CCS process wastewater:
 - Massive consequential increase in system resilience, range and capacity, helping to decarbonise tens of thousands more homes and businesses
 - Require introduction of more sophisticated heat storage/balancing/efficiency measures
 - Avoid direct atmospheric/environmental discharge of enormous volumes of CCS process waste heat and water

