7. Climate Change and Greenhouse Gases

7.1 Introduction

7.1.1 MVV Environment Limited (the Applicant) has submitted a full planning application for a Carbon Capture Retrofit Ready (CCRR) Energy from Waste Combined Heat and Power (EfW CHP) Facility at Canford Resource Park (CRP), off Magna Road, in the northern part of Poole. Together with the associated CHP Connection, Distribution Network Connection (DNC) and Temporary Construction Compounds (TCCs), these works are the Proposed Development.

7.1.2 The primary purpose of the Proposed Development is to treat Local Authority Collected Household (LACH) residual waste and similar residual Commercial and Industrial (C&I) waste from Bournemouth, Christchurch, Poole and surrounding areas, that cannot be recycled, reused or composted and that would otherwise be landfilled or exported to alternative EfW facilities further afield, either in the UK or Europe.

7.1.3 The Proposed Development would recover useful energy in the form of electricity and hot water from up to 260,000 tonnes of LACH residual waste and similar residual C&I waste each year. The Proposed Development has a generating capacity of approximately 31 megawatts (MW), exporting around 28.5 MW of electricity to the grid. Subject to commercial contracts, the Proposed Development will have the capability to export heat (hot water) and electricity to occupiers of the Magna Business Park and lays the foundations for a future CHP network to connect to customers off Magna Road.

7.1.4 The location and the extent of the Proposed Development is identified by the Red Line Boundary shown on **Figure 1.1**. In total, the Proposed Development covers an area of 10.1 hectares (ha).

7.1.5 A full description of the Proposed Development is provided in **ES Chapter 3: Description of the Proposed Development**. A list of terms and abbreviations can be found in **ES Appendix 1.1**.

7.1.6 This chapter assesses the likely significant effect on climate change resulting from the Proposed Development as a consequence of the impact of greenhouse gas (GHG) emissions. It is supported by **ES Appendix 7.1** containing details of the GHG emissions calculations.

7.1.7 This chapter was written in June 2023. References to policies and published information sources are to the editions current at that time.

7.1.8 Climate change in the context of Environmental Impact Assessment (EIA) can be considered broadly in two domains: the impact of GHGs caused directly or indirectly by the Proposed Development, which contribute to climate change; and the potential impact of changes in climate to the Proposed Development, which could affect it directly or could modify its other environmental impacts.

7.1.9 This chapter focuses on the effect of GHG emissions. As agreed through the EIA scoping process (discussed further below), potential climatic risks and project resilience or adaptation measures are assessed through other ES topic chapters, primarily **ES Chapter 11: Hydrology** and **ES Chapter 8: Ecology and Nature Conservation.**

7.1.10 There are other potential inter-relationships between climate change and environmental topic areas reported in other chapters of this ES. These are summarised in the Implications of Climate Change section at the end of this chapter, with the details of such effects being found in the corresponding section within topic chapters.

7.2 Assessment Criteria & Methodology

Legislation and Policy

7.2.1 There is much legislation and policy concerning climate change, energy and waste in general, which is not exhaustively listed; this summary focuses on aspects of legislation or policy where these three matters intersect.

7.2.2 The Climate Change Act 2008 (amended in 2019)[1] commits the UK government to reducing GHG emissions by at least 100% of 1990 levels by 2050: a net zero target. The Act requires the UK government to set interim carbon budgets[2] for the UK. The Climate Change Act 2008 also established the Climate Change Committee (CCC) to give advice on carbon budgets and report on progress. Its advice, while not adopted policy, is relevant to consider. The CCC works alongside[3] the Office for Environmental Protection (OEP), established under the Environment Act 2021[4], which has a monitoring and enforcement role for public authorities' plans and actions under environmental legislation.

7.2.3 At present, the Fourth, Fifth and Sixth Carbon Budgets, set through The Carbon Budget Orders 2011, 2016 and 2021, are 1,950 $MtCO_2$ for 2023 to 2027, 1,725 $MtCO_2$ for 2028 to 2032 and 965 $MtCO_2$ for 2033 to 2037. The Sixth Carbon Budget is the first that is consistent with the UK's net zero target, requiring a 78% reduction in GHG emissions by 2035 from 1990 levels.

7.2.4 The UK's updated Nationally Determined Contribution (NDC)[5] under the Paris Agreement to the United Nations Framework Convention on Climate Change (UNFCCC), revised in September 2022 in light of the Glasgow Climate Pact, commits the UK to reducing economy-wide GHG emissions by at least 68% by 2030 compared to 1990 levels.

7.2.5 The UK Emissions Trading Scheme (UK ETS) replaced the UK's participation in the EU ETS following Brexit. The UK ETS does not currently apply to waste combustion installations, but the Department for Business, Energy and Industrial Strategy (BEIS) has consulted on a potential plan to change that in the mid-late 2020s[6].

7.2.6 The Net Zero Strategy[7], revised in 2022, sets out the UK's plans to achieve net zero emissions by 2050. Alongside this target is the ambition to fully decarbonise the UK's power system by 2035 and achieve a substantial increase in low carbon heating uptake by that time, with further detail set out in the UK's Heat and Buildings Strategy[8]. The Net Zero Strategy refers to the near-elimination of landfilling for biodegradable waste by 2028,

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[1] Climate Change Act 2008 (c. 27) as amended by The Climate Change Act 2008 (2050 Target Amendment) Order 2019. [Online] Available at: https://www.legislation.gov.uk/ukpga/2008/27/contents. Accessed 12/12/22
[2] A carbon budget places restrictions on the total amount of GHGs that can be emitted. The budget balances the input of CO2 to the atmosphere by emissions from human activities, by the storage of carbon (i.e. in carbon reservoirs on land or in the ocean).
3 CCC and OEP (2022): Memorandum of Understanding between the CCC and the OEP. [Online] Available at: https://www.theccc.org.uk/wp-content/uploads/2022/08/CCC_OEP_MoU-_.pdf accessed 16/12/22
[4] The Environment Act 2021. [Online] Available at: https://www.legislation.gov.uk/ukpga/2021/30/contents/enacted. Accessed 12/12/22
[5] HM Government (2022): United Kingdom of Great Britain and Northern Ireland's Nationally Determined Contribution. [Online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1109429/uk-nationally-determined-contribution.pdf (accessed: 12/12/22).
[6] BEIS (2022). Developing the UK Emissions Trading Scheme. [Online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1067125/developing-the-uk-ets-english.pdf. Accessed 12/12/22
[7] BEIS (2021, updated 2022). Net Zero Strategy: Build Back Greener [Online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1033990/net-zero-strategy-beis.pdf. Accessed 13/12/2022
[8] BEIS (2021): Heat and Buildings Strategy. [Online] Available: https://www.gov.uk/government/publications/heat-and-buildings-strategy, accessed 07/12/22

funding for source-separated food waste collection, and achievement of the 25 Year Environment Plan goals to implement a circular economy and eliminate avoidable waste. The strategy foresees that by 2035, unabated energy from waste (EfW without carbon capture, use or storage – CCUS) could come to constitute a significant fraction of residual power sector emissions, which has led to the consideration of including EfW in the UK ETS and within the Industrial CCUS Business Model for the UK. The Strategy indicates a key role for CCUS in UK decarbonisation, including potentially an increasing role for GHG removals from CCUS applied to bioenergy.

7.2.7 The Carbon Plan 2011[9] laid out a strategy for preventing waste arising, reducing methane emissions from landfill and efficient energy recovery from residual waste. Our Waste, Our Resources: A Strategy for England[10] encourages greater efficiency of EfW plants through the use of heat which they produce. This is supported by a BEIS capital fund for the Heat Networks Investment Project. The Waste Management Plan for England[11] outlined Defra's aim of moving waste up the hierarchy and how efficient energy recovery from waste can aid in this goal.

7.2.8 The Clean Growth Strategy 2017[12] and National Infrastructure Assessment 2018[13] with 2022 baseline update[14] discussed progress and the ongoing need to divert waste from landfill. Annex E (Waste) of the update noted that "*Greenhouse gas emissions from waste have reduced substantially since their highest point in 1996, as biological waste has been diverted from landfill, reducing methane emissions. However, since around 2015, emissions have begun to increase as energy from waste emissions has grown. Further progress on greenhouse gas reduction will be needed to meet net zero emissions by 2050*." It discusses the challenges of raising recycling rates and potential for more stringent rules on waste exports.

7.2.9 Although the Proposed Development is not a nationally-significant infrastructure project (NSIP) subject to the National Policy Statements for Energy and Renewable Energy Infrastructure, these policy documents remain useful in providing context for the GHG assessment. NPS EN-3[15] notes the role that EfW plays in waste management and meeting energy needs, supports CHP, and describes the benefit of CCS for biomass fuel including that within waste. For projects at an NSIP scale, and which may affect waste management from more than one local authority, EN-3 would set a requirement for conformity with the waste hierarchy to be assessed, with consideration to the waste hierarchy, effect on recycling targets and extent of residual waste treatment capacity.

7.2.10 The overriding advice of the CCC has been that there remain important policy gaps for carbon reduction, that more must be done in all economic sectors including waste management to meet the national carbon budgets[16]. In particular, the CCC's most recent

[9] HM Government, December 2011. The Carbon Plan: Delivering our low carbon future. [Online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47613/3702-the-carbon-plan-delivering-our-low-carbon-future.pdf. Accessed 13/12/22
[10] HM Government, December 2018. Our Waste, Our Resources: A Strategy for England. [Online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/765914/resources-waste-strategy-dec-2018.pdf. Accessed 12/12/2
[11] Defra, January 2021. Waste Management Plan for England. [Online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/955897/waste-management-plan-for-england-2021.pdf. Accessed 12/12/22.
[12] BEIS (2017): The Clean Growth Strategy: Leading the way to a low carbon future.. [Online] Available at: https://www.legislation.gov.uk/uksi/2011/988/contents/made. Accessed 12/12022.
[13] NIC (2018): National Infrastructure Assessment [online] https://www.nic.org.uk/wp-content/uploads/CCS001_CCS0618917350-001_NIC-NIA_Accessible.pdf, accessed 22/11/18.
[14] NIC (2022): Second National Infrastructure Assessment: Baseline Report. [Online] Available at: https://nic.org.uk/studies-reports/national-infrastructure-assessment/baseline-report/. Accessed 12/12/22.
[15] DESNZ (2023). National Policy Statement for Renewable Energy Infrastructure (EN-3) [Online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1147382/NPS_EN-3.pdf, accessed 19/06/23
[16] CCC (2022): 2022 Progress Report to Parliament. [Online] Available: https://www.theccc.org.uk/wp-content/uploads/2022/06/Progress-in-reducing-emissions-2022-Report-to-Parliament.pdf, accessed 16/12/22

progress report highlights increasing emissions from EfW, declining recycling rates in England, and a need in the CCC's view to limit growth in incineration in favour of greater recycling while delivering the Net Zero Strategy's waste management reforms – which is a broad issue:

"Progress in reducing emissions from landfill has recently been undermined by increased incineration. Tackling these dual challenges requires a step change in waste reduction and recycling, as part of a holistic plan to decarbonise the sector."

7.2.11 The CCC's Sixth Carbon Budget report[17] made the following policy recommendations, with regard to low carbon and renewable energy deployment:

- reducing demand and improving efficiency: require changes that will reduce carbon-intensive activities and the improvement of efficiency in the use of energy and resources;
- take-up of low carbon solutions: phase out fossil fuel generation by 2035;
- expansion of low carbon energy supplies: increasing renewables to 80% of generation by 2050; and
- electricity generation: will require a significant expansion of low carbon generation; this includes low cost renewables, with more flexible demand and storage.

7.2.12 Its Balanced Pathway would involve 80% capture of landfill methane by 2050, CCUS for EfW plants by 2040 and a reduction in overall waste arisings by 2037. Increasing the renewables penetration in the UK electricity mix to 80% by 2050 will largely be met with intermittent, non-dispatchable[18] generation types (the CCC suggests that up to 140 gigawatts (GW) of offshore wind should be deployed by 2050). In order to facilitate such a high penetration of intermittent energy sources, the CCC emphasises the requirement for a flexible energy network, including the use of battery energy storage systems.

7.2.13 The revised National Planning Policy Framework (NPFF) 2021[19] states with regard to climate change that the core planning principle of the NPPF is that the planning system should:

"…support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change. It should help to: shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure." (paragraph 152).

7.2.14 Under paragraph 158, applicants for energy development are not required to demonstrate the overall need for low-carbon energy. 'Low-carbon' technologies are defined in the NPFF at page 71 as *"…those that can help reduce emissions (compared to conventional use of fossil fuels)."*

7.2.15 The 2019 Waste Plan for Bournemouth, Christchurch, Poole and Dorset[20] provides policy framework for planning applications for waste management facilities up to 2033. The plan acknowledges the benefits which come from waste facilities, including *"the production of*

[17] CCC (2020) The Sixth Carbon Budget: The UK's path to Net Zero. [Online] Available: https://www.theccc.org.uk/wp-content/uploads/2020/12/The-Sixth-Carbon-Budget-The-UKs-path-to-Net-Zero.pdf, accessed 30/04/21
[18] Non-dispatchable sources of electricity generate electrical energy but cannot be turned on or off in order to meet fluctuating demand. The two main types of non-dispatchable sources are solar power and wind power.
[19] MHCLG, July 2021. National Planning Policy Framework. [Online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1005759/NPPF_July_2021.pdf. Accessed 13/12/2022
[20] Dorset Council and BCP Council, 2019 Waste Plan. [Online] Available at: https://www.dorsetcouncil.gov.uk/planning-buildings-land/planning-policy/dorset-county-council/waste-planning-policy/2019-waste-plan. Accessed 12/12/2022.

renewable energy". The Plan supports co-location of EfW facilities with heat customers to increase useful energy recovery.

7.2.16 BCP Council declared a climate and ecological emergency on 16th July 2019; following this the council has committed to being carbon neutral in its own operations by 2030 and to support achieving this for the region by 2050[21].

Guidance

7.2.17 The main guidance used for the assessment of GHG emissions in EIA is the Institute of Environmental Management and Assessment (IEMA) guide 'Assessing Greenhouse Gas Emissions and Evaluating their Significance'[22].

7.2.18 Additional guidance used for the quantification of GHG emissions includes:

- the Greenhouse Gas Protocol suite of documents (WRI and WBCSD, 2004)[23];
- Valuation of Energy Use and Greenhouse Gas: Supplementary guidance to the HM Treasury Green Book (BEIS, 2021)[24]; and
- UK Government GHG Conversion Factors for Company Reporting (BEIS and Defra, 2022)[25].

7.2.19 The principles of PAS2080 Section 7 (BSI, 2016)[26] are also relevant, but as this is an assessment of GHG emissions for EIA, the other elements of whole-life carbon management for infrastructure in the standard are not addressed here.

GHG Emissions Calculation Overview

7.2.20 In overview, GHG emissions have been estimated by applying published emissions factors and/or operational data from similar facilities to activities in the baseline and those required for the Proposed Development, as applicable. The emissions factors relate to a given level of activity, a physical or chemical process, or amount of fuel, energy or materials used to the mass of GHGs released as a consequence.

7.2.21 The assessment has considered (a) the GHG emissions arising from the Proposed Development, (b) any GHG emissions that it displaces or avoids, compared to the current or future baseline, and hence (c) the net impact on climate change due to these changes in GHG emissions overall.

7.2.22 Further detail of the approach, data inputs, assumptions and boundaries of the calculations are given in **ES Appendix 7.1**.

7.2.23 The GHGs considered in this assessment are those in the 'Kyoto basket'[27] of global warming gases expressed as their CO_2-equivalent global warming potential (GWP). This is denoted by CO_2e units in emissions factors and calculation results. GWPs used are typically

[21] BCP (undated): Climate and ecological emergency. https://www.bcpcouncil.gov.uk/News/News-Features/Climate-and-Ecological-Emergency/Climate-and-ecological-emergency.aspx, accessed 16/12/22
[22] IEMA (2022): Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance. *2nd Edition*. [Online] Available at: https://www.iema.net/resources/blog/2022/02/28/launch-of-the-updated-eia-guidance-on-assessing-ghg-emissions, accessed: 06/04/22
[23] WRI and WBCSD (2004): The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard. Revised edition, Washington and Geneva: WRI and WBCSD.
[24] BEIS (2023): Valuation of Energy Use and Greenhouse Gas: Supplementary guidance to the HM Treasury Green Book. [Online] Available at: https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal, accessed 19/06/23
[25] BEIS and Defra (2022): UK Government GHG Conversion Factors for Company Reporting, v2.0. [Online] Available at: https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2022, accessed: 05/12/22
[26] British Standards Institution (BSI) (2016) PAS2080:2016 Carbon Management in Infrastructure. BSI, London.
[27] The 'Kyoto Basket' encompasses the following greenhouse gases: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride (SF_6).

the 100-year factors in the Intergovernmental Panel on Climate Change Sixth Assessment Report[28] or as otherwise defined for national reporting under the United Nations Framework Convention on Climate Change (UNFCCC).

7.2.24 The main emissions sources within the boundary of the assessment comprise:

- direct combustion emissions;
- other process inputs (consumables, parasitic load);
- nitrous oxide emissions from ammonia slip[29] in the air pollution control system;
- electricity generation displaced by that from the Proposed Development;
- heat generation displaced by that from the Proposed Development;
- management of process outputs (disposal to landfill, re-use or recycling as applicable for Incinerator Bottom Ash (IBA), Air Pollution Control residues (APCr) and metals); and
- transport of waste and outputs.

7.2.25 Mixed waste typically contains both 'biogenic' and 'fossil' carbon, both of which are released as CO_2 when the waste is incinerated. Biogenic carbon is that in plant-derived material, such as food waste, whereas fossil carbon is that in material derived from fossil fuels, such as plastics. Only fossil carbon is regarded as causing a net increase in atmospheric CO_2 concentration, having been released from long-term geological storage. Biogenic carbon was drawn down from the atmosphere by the plants during growth prior to being released again by combustion, so over this short cycle does not change the net atmospheric concentration, provided that the carbon content is released as CO_2 and not as methane (CH_4, such as from a decomposition process) with a higher GWP.

7.2.26 GHG emissions have been calculated for each operating year using a factor for the carbon intensity of marginal electricity and heat generation that is displaced in that year. The benefits of recovering recyclable metals from IBA (at third party facilities) have also been considered, because these would otherwise likely not be recovered from the residual (non-recyclable) waste treated by the EfW CHP Facility.

7.2.27 To allow for potential variation in the waste and to consider the sensitivity of assessment outcomes to the total carbon content and ratio of biogenic to fossil carbon in the waste (which depends on its composition), several scenarios have been assessed. Ranges in other factors such as ammonia slip and metals recycling benefits have also been considered. **ES Appendix 7.1** sets out the range of GHG emissions predicted from these sensitivity tests. Results from a central scenario are presented in this chapter.

Baseline Data Collection

7.2.28 No site survey has been required for the assessment. Baseline information is established from published data sources, which are referenced in the assessment and detailed in **ES Appendix 7.1**.

[28] Table 7.15 in IPCC (2021): Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 2391 pp.

[29] Formation of N2O in the stack exhaust due to excess NH3 from the reagent used in the air pollution control system to reduce NOx formation

Predicting Effects

Impact Magnitude

7.2.29 As GHG emissions can be quantified directly and expressed based on their GWP, the magnitude of impact is reported numerically as tCO_2e rather than requiring a descriptive scale.

Receptor Sensitivity

7.2.30 GHG emissions have a global effect rather than directly affecting any specific local receptor to which a level of sensitivity can be assigned. The global atmospheric mass of the relevant GHGs and consequent warming potential, expressed in tCO_2e, has therefore been treated as a single receptor of **high** sensitivity. It is considered to be of high sensitivity given the importance of the global climate as a receptor, the limited and decreasing capacity to absorb further GHG emissions without severe climate change resulting, and the cumulative contribution of GHG emission sources.

Effect Significance

7.2.31 Assessment guidance for GHG emissions[22] describes five levels of significance for emissions resulting from a development, each based on whether the GHG emission impact of the development will support or undermine a science-based 1.5°C compatible trajectory towards net zero. To aid in considering whether effects are significant, the guidance recommends that GHG emissions should be contextualised against pre-determined carbon budgets, or applicable existing and emerging policy and performance standards where a budget is not available or not meaningfully applicable at the scale of development assessed. It is a matter of professional judgement to integrate these sources of evidence and evaluate them in the context of significance.

7.2.32 Taking the guidance into account, the following have been considered in contextualising the Project's GHG emissions:

- the magnitude of gross and net GHG emissions as a percentage of national and local carbon budgets (where feasible);
- the GHG emissions intensity of the Proposed Development against future baseline emissions intensity for waste treatment and energy generation, and projections or policy goals for future changes in that baseline; and,
- whether the Proposed Development contributes to, and is in line with, the applicable UK policy for GHG emissions reductions, where this policy is consistent with science-based commitments to limit global climate change to an internationally agreed level (as determined by the UK's current NDC to the Paris Agreement).

7.2.33 Effects from GHG emissions are described in this chapter as adverse, negligible or beneficial based on the following definitions, which closely follow the examples in Box 3 of the IEMA guidance.

- **Major Adverse:** the Proposed Development's GHG impacts would not be compatible with the UK's net zero trajectory. Its GHG impacts would not be mitigated, or would be compliant only with do-minimum standards set through regulation. The Proposed Development would not provide further emissions reductions required by existing local and national policy for projects of this type. A project with major adverse effects is locking in emissions and does not make a meaningful contribution to the UK's trajectory towards net zero.

- **Moderate Adverse:** the Proposed Development's GHG impacts would not be fully compatible with the UK's net zero trajectory. Its GHG impacts would be partially mitigated and may partially meet the applicable existing and emerging policy requirements, but it would not fully contribute to decarbonisation in line with local and national policy goals for projects of this type. A project with moderate adverse effects falls short of fully contributing to the UK's trajectory towards net zero.
- **Minor Adverse:** the Proposed Development's GHG impacts would be compatible with the UK's 1.5°C trajectory and would be fully consistent with up-to-date policy and good practice emissions reduction measures. A project with minor adverse effects is fully in line with measures necessary to achieve the UK's trajectory towards net zero.
- **Negligible:** the Proposed Development would achieve emissions mitigation that goes well beyond existing and emerging policy compatible with the 1.5°C trajectory, such that radical decarbonisation or net zero is achieved well before 2050. A project with negligible effects provides GHG performance that is well 'ahead of the curve' for the trajectory towards net zero and has minimal residual emissions.
- **Beneficial:** the Proposed Development would result in emissions reductions from the atmosphere, whether directly or indirectly, compared to the without-project baseline. As such, the net GHG emissions would be below zero. A project with beneficial effects substantially exceeds net zero requirements with a positive climate impact.

7.2.34 Major and moderate adverse effects and beneficial effects are considered to be **significant**.

7.2.35 Minor adverse and negligible effects are considered to be **not significant**.

Geographical Scope

7.2.36 The scope of GHG emission sources and processes assessed has been defined in **paragraph 7.2.24**, above.

7.2.37 GHG emissions have a global effect rather than directly affecting any specific local receptor. The impact of GHG emissions occurring due to the Proposed Development on the global atmospheric concentration of the relevant GHGs, expressed in CO_2e, is therefore considered within this assessment. As GHG impacts are global and cumulative with all other sources, no specific geographical study area is defined for the identification of receptors or assessment of effects.

7.2.38 However, GHG emissions caused by an activity are often categorised into 'scope 1', 'scope 2' or 'scope 3' emissions, following the guidance of the WRI and the WBCSD Greenhouse Gas Protocol suite of guidance documents[23].

- Scope 1 emissions: released directly by the entity being assessed, e.g., from combustion of fuel at an installation;
- Scope 2 emissions: caused indirectly by consumption of imported energy, e.g., from generating electricity supplied through the national grid to an installation; and
- Scope 3 emissions: caused indirectly in the wider supply chain, e.g., in the upstream extraction, processing and transport of materials consumed or the downstream disposal of waste products from an installation.

7.2.39 This assessment has sought to include emissions from all three scopes, where this is material and reasonably possible from the information and emissions factors available, to capture the impacts attributable to the Proposed Development.

7.2.40 The majority of GHG emissions are likely to occur within the territorial boundary of the UK and hence within the scope of the UK's national carbon budgets. However, in recognition of the climate change effect of GHG emissions (wherever occurring) and the need, as identified in national policy, to avoid 'carbon leakage' overseas when reducing UK emissions, potential scope 3 GHG emissions that may physically occur outside the UK have been considered where relevant.

Temporal Scope

7.2.41 GHG emissions from construction and from operation over the expected operating lifetime of the Proposed Development have been assessed. Quantitative assessment of decommissioning-stage effects has been scoped out through the EIA scoping process with BCP, as discussed further below.

7.2.42 The varying atmospheric residence time of GHGs once emitted, and their differing climate impact, has been considered through the use of 100-year GWPs to express these in a common CO_2e metric, as discussed above.

Consultation

7.2.43 An EIA Scoping Report setting out the proposed scope and approach to the assessment was submitted to Bournemouth, Christchurch and Poole Council (BCP Council) in April 2022. A Scoping Opinion (ref. PREA/22/00049) was received in response on 14 October 2022.

7.2.44 The relevant comments from the Scoping Opinion and how these have been addressed in this chapter are set out in **Table 7-1**.

Table 7-1: Scoping Response

Scoping Opinion Comment	How Addressed
Carbon and Greenhouse Gases (GHG) Officers accept your conclusions in relation to carbon emissions and GHG – this should be scoped into the Environmental Statement. The methodology is accepted in principle, but should factor in vehicle movements and should provide the various potential outcomes in relation to other EfW plants within the plan area and the plant running at expected and maximum capacity. The ES should also consider the impact on the natural environment's ability to store and sequester greenhouse gases. While the application would not be required to provide a whole life-cycle carbon emissions assessment, officers welcome the approach to reduce embodied carbon and encourage the decommissioning of the plant to be considered.	GHG emissions have been scoped into the assessment. This has included vehicle movements. Regarding the impact on operation of other EfW plants in the plan area, their operation is market-driven (dependant on waste contracts). It is discussed qualitatively in the assessment of effects and cumulative effects sections. As the EfW CHP Facility Site is brownfield land, there is no direct effect on the (local) natural environment's ability to store and sequester greenhouse gases. More broadly, the global capacity of various earth systems to absorb GHG emissions forms part of the defined GWPs used in the assessment. Opportunities to reduce embodied carbon and, potentially, decommissioning-stage carbon have been discussed qualitatively.

7.2.45 The Scoping Report stated that the main climate change risks and inter-related effects were with hydrology and ecology, which would be assessed in the applicable ES topic chapters (**ES Chapter 11: Hydrology** and **ES Chapter 8: Ecology and Nature Conservation**). No specific comment was made regarding this in the Scoping Opinion.

7.2.46 The Scoping Report proposed to scope out decommissioning-stage effects on the basis of likely non-significance, with discussion of why that was the case. The Scoping Opinion 'encourages' consideration of plant decommissioning. This has been discussed qualitatively, but is not considered likely to give rise to significant effects or a magnitude of impact that can be quantified effectively at the time of assessment.

Assumption and Limitations

7.2.47 The main limitations of the assessment are uncertainty and variability in (a) data concerning the waste that would be treated by the EfW CHP Facility and (b) the future baseline for alternative waste management during the EfW CHP Facility's operating lifetime.

7.2.48 The GHG emissions (and hence magnitude of impact and significance of effect) predicted for the EfW CHP Facility itself and for the comparison with the future baseline are strongly sensitive to combinations of values for the following parameters:

- the future baseline carbon intensity of electricity and heat generation;
- the composition of residual waste managed by the EfW CHP Facility, affecting the proportion of biogenic and fossil carbon in the waste and its calorific value (CV);
- the proportion of ferrous and non-ferrous metals, potential recovery rate from IBA, and carbon intensity of primary metals production in the future;
- the likely scenario for management of the residual waste absent the EfW CHP Facility; and
- in a future baseline scenario where waste is sent to alternative UK EfW facilities for treatment, the operation of such facilities including their efficiency of energy recovery.

7.2.49 There is both natural variability in the composition of residual waste arisings and uncertainty in trends for how this may change over the EfW CHP Facility's operating lifetime. Waste composition affects the energy content available to be recovered by the Proposed Development (and hence amount required as fuel to generate the target amount of electricity and heat) and the amount of biogenic and fossil carbon in the waste. These factors are linked.

7.2.50 Within the commercial market for residual waste management, there are various potential scenarios for the treatment or disposal of the waste absent the EfW CHP Facility. Waste market modelling is not within the scope of the EIA, as is discussed further below.

7.2.51 These limitations have been addressed overall by considering:

- a range in waste carbon content values derived from literature sources and samples of waste at a number of similar facilities around the UK;
- three scenarios for the ratio of biogenic to fossil carbon in the waste, allowing the sensitivity of assessment results to this to be explored;
- projections for the future baseline of decarbonising electricity and heat generation; and
- a qualitative comparison of the EfW CHP Facility to what is considered to be the most likely future baseline, as evidenced in the Planning Statement.

7.2.52 While uncertainty cannot be eliminated using available information, this approach allows a judgement to be made concerning whether net impacts are likely to be adverse or beneficial and whether they are likely to be significant. It is intended to be conservative.

7.2.53 A further limitation of the assessment is that it is typically difficult to established detailed information about construction material quantities and engineered products required for a development at an early pre-consent stage of design. The assessment of construction impacts has therefore used a screening approach and published information to consider whether these impacts are likely to be significant to the total effects of the Proposed Development.

7.3 Baseline Conditions

Current Baseline

7.3.1 The physical baseline conditions of the area surrounding the Proposed Development with regard to GHG emissions are its use primarily for an existing waste management operation as the Canford Resource Park, but also smaller areas of amenity grassland, scrub and woodland around the edges of the site, as detailed in **ES Chapter 8: Ecology and Nature Conservation.**

7.3.2 Depending on the composition, woodland and soil carbon can be important stocks that may be lost through disturbance. However, the relatively sparse vegetation and the nature of made ground and soils in the Proposed Development Boundary that would be disturbed by the project mean that existing carbon stocks and fluxes are considered to be a *de minimis* part of the baseline and not significant to the assessment.

7.3.3 The EfW CHP Facility Site will occupy the land that an implemented, but not operational, low carbon gasification and pyrolysis energy from waste facility currently occupies. As this gasification and pyrolysis facility is not operational, there are no baseline GHG emissions from it.

7.3.4 Demolition of this facility may offer opportunities for material re-use and recycling, to reduce the construction-stage impacts of the Proposed Development.

Future Baseline

7.3.5 The future baseline in a no-development scenario would be the processes that need to operate to provide electricity and heat generation and waste treatment capacity absent that from the Proposed Development. Greater primary metals production would also be required without the recyclable materials recovered by the EfW CHP Facility.

7.3.6 The future baseline for electricity generation would be the carbon intensity of electricity supplied from the national grid, whether this is being displaced by the Proposed Development exporting electricity to business park users by private wire or exporting further electricity to other users via the grid. The future baseline grid-average and marginal generator carbon intensity is projected to reduce over time, in line with the UK's net zero policies. A projection published by BEIS as part of the Treasury Green Book guidance, as updated in 2023, has been used[24].

7.3.7 Although the Proposed Development operating lifetime is stated as up to 40-years, i.e., to 2066, the future baseline has been considered for its first 25 operating years out to 2050. By that point the UK is obliged to have reached net zero national emissions and there is little or no further change in the projected future baseline beyond that point.

7.3.8 The future baseline for heating among business park users proposed to be supplied by the EfW CHP Facility are assumed initially to typically be provided by gas boilers, but with an increasing likelihood of retrofit with air source heat pumps (ASHPs) for space heating or other low-carbon heating technologies (such as adaptation to hydrogen supply) over time, as set out in the UK's Heat and Buildings Strategy[8]. For the purpose of this assessment, an efficient condensing natural gas boiler has been assumed as the initial marginal future baseline source displaced by heat from the Proposed Development, with a subsequent transition to ASHP as a marginal source between the opening year and 2035 to broadly represent decarbonisation of the future heating baseline.

7.3.9 The baseline carbon intensity of primary metals production has been established from published lifecycle assessment (LCA) sources. However, this is also likely to be reduced over time in the future baseline to meet the UK and European carbon reduction targets. A trend for this has been considered based on the expected tightening of the EU Emissions Trading Scheme (EU ETS) emissions cap over time, as the LCAs for primary metals production are for the whole European region rather than UK-specific.

7.3.10 As set out in the **Planning Statement** and in **ES Chapter 3: Description of the Proposed Development**, the residual waste treatment capacity to be provided by the Proposed Development would likely be met principally by existing UK or European EfW facilities.

7.3.11 This is likely to have a broadly similar scale of GHG emissions as the EfW CHP Facility, albeit with the specifics depending on operational efficiency, any heat offtake, recycling and any future carbon capture. There would also be a difference in GHG emissions from transporting the waste over a greater distance. A qualitative comparison of the EfW CHP Facility with the future baseline of alternative UK or European EfW treatment of the waste has been made, together with a quantitative assessment of transport emissions to determine whether this latter is likely to be material to the significance net effects.

7.3.12 The boundary of the future baseline scenario, for this assessment, has been drawn at the operation of the alternative EfW facilities, these being taken as the marginal source of waste treatment capacity during the EfW CHP Facility's operating lifetime. The indirect consequences for such facilities at the margin due to the increase in total waste treatment available capacity with the Proposed Development would require economic analysis that is beyond the scope of this ES chapter and thus has been excluded from the assessment boundary. Speaking generally, there are several possibilities: that the marginal facilities would close; that they would have a reduced operation; that they would source replacement waste fuel otherwise managed within the UK (e.g., by diverting it from landfill disposal); or that they may treat waste that is otherwise exported from the UK to European EfW facilities.

7.4 Inherent Design Mitigation

7.4.1 A Construction Environmental Management Plan (CEMP) would be followed during construction of the Proposed Development. A CEMP would typically include requirements to use well-maintained construction plant compliant with current emission standards, to minimise plant idling which would reduce construction-stage GHG emissions, and to minimise materials wastage. The Outline CEMP (**ES Appendix 3.2**) accompanies the planning application.

7.4.2 In operation, the key inherent mitigation is the recovery of energy from the waste combusted through CHP operation, which would displace GHG emissions from alternative energy generation in the future baseline.

7.4.3 For a project of this scale, a high efficiency steam turbine would be procured, and the facility is expected to have a net efficiency for electricity generation (after subtracting parasitic load) of approximately 28%. Operating in CHP mode by exporting waste heat in the form of hot water from the project further increases the combined efficiency and provides GHG emission reductions through displacing fossil-fuelled heat generation in the baseline, reducing the carbon intensity of the project per unit of useful energy generated. CHP is strongly supported by local and national climate change policy.

7.4.4 In addition, it is expected that IBA from the EfW CHP Facility will be sent to a processor that provides recycling of the ash, including metals recovery, which would reduce GHG emissions from primary material production in the future baseline.

7.4.5 Local treatment of waste will reduce transport and logistics GHG emissions, including HGV miles, loading and unloading waste, and baling and de-baling as required for transport to destinations outside the UK. There would be a further indirect effect as fewer HGVs would need to be manufactured and maintained and there would be less highway maintenance required.

7.5 Potential Environmental Impact and Effects

Construction phase

7.5.1 Indirect GHG emissions would be caused in the supply chain for materials (such as concrete and steel) and engineered products (such as the boiler, steam turbine and generator) to construct the Proposed Development. Construction plant on site will also cause direct GHG emissions from fuel combustion, and there would be small indirect emissions from electricity and water use.

7.5.2 As set out in EIA scoping, the construction stage impacts are likely to be only a small component of its long-term effect on climate change and are unlikely to affect the judgement of significance of the full life-cycle effects of the Proposed Development.

7.5.3 The Proposed Development's net total GHG emissions would be dominated by its operational phase, as a facility that is combusting waste and providing energy over an operating lifetime of approximately 40-years. The ongoing emissions of such a facility year on year will typically substantially outweigh the one-off 'embodied carbon'[30] cost of producing building materials and constructing the Proposed Development. However, this is difficult to quantify in detail at an early stage of design where full bills of quantities and materials specifications for construction are not yet available.

7.5.4 The IEMA guidance indicates that emissions sources individually comprising less than 1% of total emissions, and collectively up to 5%, can be excluded from an assessment. This can be necessary in order to provide a proportionately-scoped assessment and where some details are not available, for example at an early stage of design.

7.5.5 A screening approach has therefore been taken to consider whether construction-stage GHG emissions could be material to the total impact of the project and the significance of effects. Materiality is a term used in greenhouse gas accounting to distinguish minor and major emission sources for a proportionate assessment, with non-material or *de minimis* sources being those that are unlikely to appreciably affect the total or are likely to be within its uncertainty range.

7.5.6 Based on the embodied carbon of construction materials estimated in Waste and Resources Assessment Tool for the Environment (WRATE) analyses[31] of two similar energy-from-waste facilities, scaled to the waste throughput capacity of the Proposed Development, construction-stage embodied carbon would be around 850tCO_2e, far less than 1% operational emissions. If this estimate were doubled or tripled to allow for fuel consumption of construction plant and delivery of materials to site, it would still clearly remain *de minimis* for the assessment. A life-cycle assessment of five Scandinavian EfW

[30] the GHG emissions associated with extracting raw materials, manufacturing into products and transportation that are 'embodied' in construction materials used
[31] SLR, pers. comm. (2018) Carbon Assessment Report for the Kemsley K3 and Kemsley North WTE facilities.

facilities indicated that construction-stage GHG emissions amounted to 2–3% of GHG emissions from waste combustion[32].

7.5.7 The operational stage impact of the EfW CHP Facility, discussed in the following section, would be in the order of 6-9MtCO_2e over its lifetime. One percent of this, around 60,000-90,000tCO_2e, would be equivalent to around 19-30,000 tonnes of steel or 400,000-600,000 tonnes of concrete[33]; much greater amounts than are realistic for construction of the Proposed Development.

7.5.8 Taking into account these screening approaches, and due to the limited data about materials quantities available at the early stage of project design, further quantitative assessment of construction-stage embodied carbon has not been undertaken.

7.5.9 This embodied carbon impact would make a small additional contribution to the significant **moderate adverse** lifetime effect of the Proposed Development in operation as discussed in the following section. Although construction-stage effects would make only a small contribution to the overall significant adverse effect, it is good practice to seek mitigation opportunities for emissions reduction across all lifecycle stages. Further mitigation has therefore been recommended in **Section 7.6**.

7.5.10 Construction methods and materials also affect the likely decommissioning-stage impacts of the Proposed Development, which would be influenced by the ease of deconstruction and the potential for re-use or recycling of materials. It is not considered possible to make a robust quantitative prediction of GHG impacts from decommissioning in 25- or 40-years' time, but qualitatively this is likely to be much less than those from construction in the present-day. Consideration of the decommissioning stage has been included in the recommended further mitigation measures in **Section 7.6**.

Operational phase

Proposed Development operation

7.5.11 In operation the Proposed Development would combust up to 260,000 tonnes per annum (tpa) of waste and would use the energy released to generate 30.9MW gross of electricity. Net of 2.4MW of parasitic load, 28.5MW of electricity would be exported to the national grid, which at the expected 7,830 annual operating hours would be 222,998MWh. A further 5MW of heat would be exported, which would be 39,150MWh/annum. This would be from low-pressure waste steam extracted from the steam turbine without significantly reducing the electrical generation capacity.

7.5.12 Around 806m^3 per annum of gas oil support fuel to raise and maintain the required minimum combustion temperature is estimated to be required. The selective non-catalytic reduction system may lead to N_2O slip of up to 35mg/Nm^3 of stack efflux, depending on the reagent used and performance of the system.

7.5.13 After combustion, approximately 68,900tpa of IBA and 13,260tpa of APCr would remain. The IBA and APCr would be transported to treatment facilities for processing. The IBA would contain ferrous and non-ferrous metals present in the input waste, a proportion of which can be extracted and recycled. The remaining IBA would be suitable for re-use in construction aggregates following processing and drying/weathering, during which a small absorption of atmospheric CO_2 is possible. There are also opportunities for carbonation and re-use of

[32] Brogaard, L., Riber, C. and Højlund, T. (2013): Quantifying Capital Goods for Waste Incineration. Waste Management, 33(6) pp. 1390-1396.
[33] using typical embodied carbon factors published in Jones, C. and Hammond, G (2019): Inventory of Carbon and Energy, Version 3.0. [Online] Available at: https://circularecology.com/embodied-carbon-footprint-database.html, accessed 14/09/20

APCr, discussed in the further mitigation. APCr which cannot be re-used would require disposal at a suitably licensed hazardous landfill.

7.5.14 Gross GHG emissions from waste combustion by the Proposed Development would be approximately 122,620 to 190,789 tCO_2e/annum[34] with the central assumption of 50:50 biogenic to fossil carbon ratio. Sensitivity tests with other ratios of fossil:biogenic carbon, total carbon content and N_2O slip are shown in **ES Appendix 7.1**. GHG emissions from transporting the waste and other process inputs and outputs would be approximately 3,795 tCO_2e/annum.

7.5.15 The GHG emissions avoided due to the electricity exported by the Proposed Development would be 39,388 tCO_2e/annum in year one of operation, reducing to 8,159 tCO_2e/annum in year 10 and 509 tCO_2e/annum by year 25 as the carbon intensity of marginal generation sources displaced is projected to reduce over time. The GHG emissions avoided due to the heat exported by the Proposed Development would be 9,316 tCO_2e/annum in year one of operation, reducing to 258 tCO_2e/annum in year 10 and 32 tCO_2e/annum by year 25.

7.5.16 The GHG emissions that would be avoided by recovering metals for recycling would be 6,736 to 15,614 tCO_2e/annum in year one of operation, depending on the rate of recovery and the carbon intensity of primary materials production that is displaced. Projections for future years are set out in **ES Appendix 7.1**.

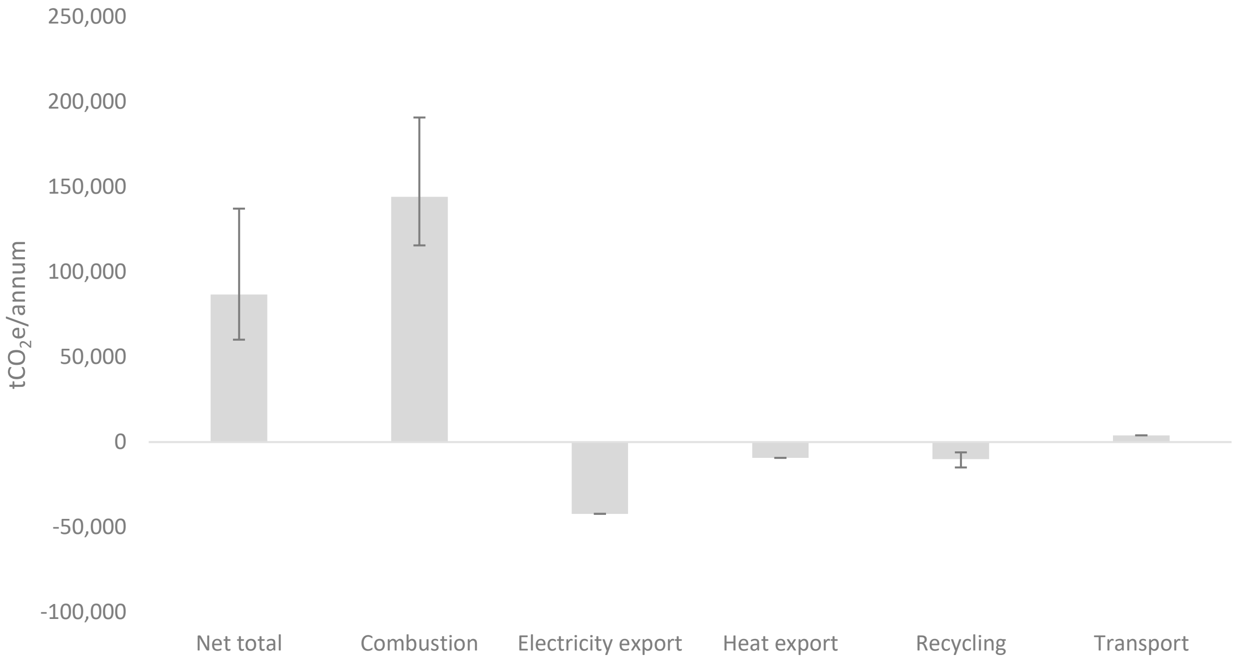
7.5.17 Net GHG emissions from the project and its outputs are predicted to be between 62,097 and 139,144 tCO_2e/annum in year one, which is the balance of the above-described emissions. The central estimate is 88,495 tCO_2e/annum. In year 10 this would be 107,285 to 181,545 tCO_2e/annum and in year 25, 125,874 to 194,042 tCO_2e/annum. The net emissions and contributions are illustrated in **Graph 7-1** and **Graph 7-2** shows the net GHG impact over time as the carbon intensity of various future baseline emissions that are displaced or avoided decreases.

7.5.18 It should be noted that the comparison with marginal displaced energy generation is based upon a projected rapid decarbonisation of baseline power and heat generation. Such decarbonisation is required to achieve national carbon reduction targets and expected to include a growing proportion of intermittent renewable generation, requiring also therefore transitional sources of power generation to supplement wind and other renewables.

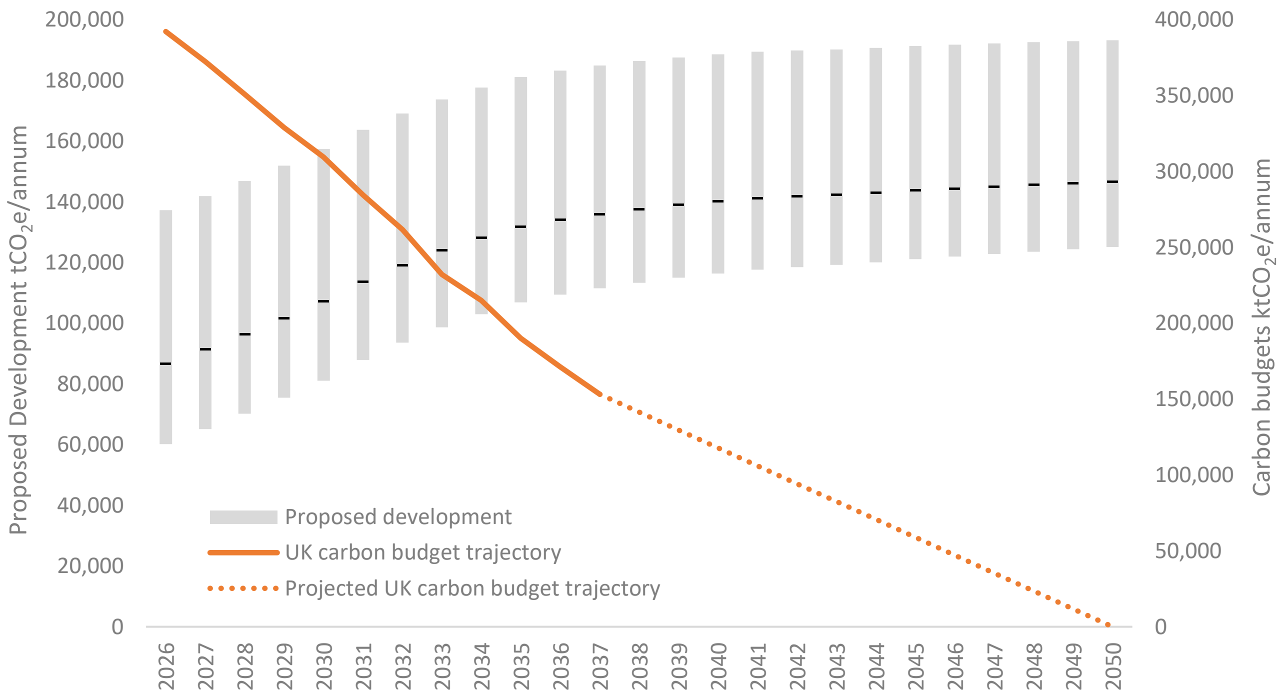
7.5.19 The net GHG emissions stated above for the project may also change over time as the proportion of fossil and biogenic carbon in the waste it treats changes. If the biogenic content were to increase and the fossil carbon content to decrease, for the same throughput and CV of waste, e.g., as a result of biogenic origin packaging replacing fossil origin, net GHG emissions would be reduced. Conversely, if there was more fossil plastic in the residual waste mix then net GHG emissions per tonne of waste combusted would be higher; however, this may also increase the CV of the waste and energy recovery per tonne. The possible changes with a 5% increase in biogenic carbon and 5% decrease in fossil carbon or vice versa are considered further as a sensitivity test in **ES Appendix 7.1**.

[34] excluding biogenic CO2, which would be 119,143 to 163,374 tCO2e/annum

Graph 7-1: Year one GHG emissions breakdown at 50:50 biogenic: fossil carbon ratio



Graph 7-2: Annual net GHG emissions at 50:50 biogenic: fossil carbon ratio (central estimate)



7.5.20 **Paragraph 7.2.33** defined three ways in which GHG impacts could be contextualised to aid in determining significance of effects: as a percentage of national and local carbon budgets; by comparison to baseline emissions intensity; and with reference to whether the impact is in line with national net zero- and Paris Agreement-compatible policy goals for carbon reduction.

7.5.21 The net GHG emissions arising from operating the Proposed Development would be equivalent to 0.02% to 0.04% of the applicable annual national carbon budget in year one of operation. This would rise over time as subsequent carbon budgets are tightened and the net GHG emissions of the project change. This is a small contribution on a national scale. However, as set out in the assessment guidance, GHG emission sources at all scales contribute cumulatively to climate change effects and significance is judged based on contribution to the trajectory towards the UK's net zero goal. The Proposed Development's net GHG emissions are likely to increase over time and its gross GHG emissions, prior to further mitigation, are unlikely to reduce significantly.

7.5.22 Additionally, the Tyndall Centre for Climate Change Research[35] has recommended local authority-specific carbon budgets up to 2100 that, in its research, are considered to be an equitable distribution and compatible with a 1.5°C-aligned trajectory for the UK. The Tyndall Centre carbon budgets are more stringent than the UK national budgets (as advised by the Committee on Climate Change): the carbon budget for BCP would result in achieving zero or near zero carbon by 2043 at a carbon reduction rate of -12.6% per year from a 2020 baseline[36]. The Proposed Development's GHG emissions would be equivalent to 15% of the recommended BCP carbon budget in the 2026 opening year, rising to 83% by year 10 (2035).

7.5.23 The carbon intensity per unit of electricity generated by the Proposed Development would be substantially higher than in the current or future baseline, and also substantially higher than the projected marginal generator carbon intensity. The recovery of waste heat reduces the combined carbon intensity per MWh of useful energy exported, but this is still higher than in the baseline of non-EfW energy generation. However, carbon intensity of energy generation should not be considered in isolation as the Proposed Development primarily has a waste management function. Potential change in emissions compared to the alternative waste management baseline is discussed in the following section.

7.5.24 The Proposed Development's operation would be consistent with national climate change policy to divert waste from landfill (particularly biodegradable waste) and to recover energy from waste, including via provision of CHP. EfW also creates the opportunity to recover additional metals from the ash of residual (unrecyclable) waste, which is in line with circular economy policy that supports climate change goals. However, the Proposed Development is not consistent with climate change policy to introduce CCUS for point-source emitters that cannot be decarbonised via other means such as process or fuel changes. The heat expected to be exported is also quite limited compared to the potential capacity of the Proposed Development, due to limited firm demand.

7.5.25 Taking the above factors into consideration, the long-term impact of GHG emissions from operating the Proposed Development without CCUS, which is the balance of direct and indirect impacts of combustion, transport, use and disposal of its outputs, is judged to cause a **moderate adverse** effect that is **significant**, using the definition in **paragraph 7.2.33**.

7.5.26 However, in the absence of the Proposed Development, up to 260,000tpa of residual waste would require alternative treatment and, for some proportion, disposal. Whether significant adverse effects would also be likely in the future baseline scenario should therefore also be considered, which is set out in the following section.

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[35] Kuriakose, J *et al* (2022): Setting Climate Commitments for Bournemouth, Christchurch and Poole: Quantifying the implications of the United Nations Paris Agreement. Tyndall Centre. [Online] Available https://carbonbudget.manchester.ac.uk/reports/combined/, accessed 12/12/22

[36] The Tyndall Centre defines zero or near zero carbon as achieving CO2 levels >96% lower than in the Paris Agreement reference year of 2015, excluding non-CO2 GHGs and aviation and shipping emissions. The carbon budgets are for energy-related CO2 emissions only.

Comparison with future waste management baseline

7.5.27 **ES Chapter 3: Description of the Proposed Development**, **Section 3.7** describes the alternative waste management that currently occurs and would be likely in the future baseline absent the treatment capacity provided by the Proposed Development. This shows that residual waste is and would continue to be sent for energy recovery at various existing UK or EU EfW facilities.

7.5.28 GHG emissions from treatment of the waste at another UK EfW facility would likely be broadly similar, overall, to the Proposed Development. Some existing UK EfW facilities are better located for CCUS clusters and/or have announced CCUS deployment plans; and some are more or less favourably located for heat networks. However, it is most likely that the future baseline residual waste treatment capacity would be provided in one or more non-CHP, non-CCUS EfW facilities, with Bridgwater or Avonmouth being typical representative examples.

7.5.29 Evaluated on the same basis as the Proposed Development, the business-as-usual future baseline would also be considered to be causing **moderate adverse** or greater effects.

7.5.30 The Proposed Development will provide 5 MW of heat offtake for CHP initially and there are considered to be prospects for district heating to be expanded in future. This may be an improvement compared to sending waste to UK EfW facilities that lack CHP or likely CHP opportunities.

7.5.31 There would be a benefit to treating waste locally and avoiding longer-distance transport emissions. Potentially avoided transport emissions are estimated to be in the order of 3,500 tCO_2e/annum using Bridgwater as the destination, as detailed in **ES Appendix 7.1**. This is not trivial but remains small relative to the Proposed Development's net total emissions and would not alter the judgement of effect significance. Avoided transport emissions in the case of a baseline scenario of RDF export to European EfW facilities, particularly at more distant locations such as Sweden, would be greater and could be material to the conclusion[37].

7.5.32 As set out in **Section 7.3**, the boundary of this assessment has been drawn at the marginal EfW facilities directly affected, i.e., those from which waste would be diverted to the Proposed Development. Depending on age and market factors, such facilities might then close during the Proposed Development's operating life, or procure alternative sources of waste to continue operation, which might entail diverting waste from landfill disposal or European export; in either of the latter cases, this might also have further indirect GHG emission effects from avoiding landfill or overseas transport. However, this lies outside the assessment boundary.

Summary of change compared to future baseline

7.5.33 On the assumption that the waste managed by the Proposed Development would have been similarly managed at another broadly comparable EfW facility in the baseline, and acknowledging that there may nevertheless be further indirect GHG emission consequences due to the change in waste treatment capacity in the market from introducing

[37] A further factor to consider is the potential for exported waste to decay during storage and transport in this future baseline scenario. Guidance on shipping RDF from British Marine (2016) indicates that RDF is a non-stable material subject to decay, and that heat generation and dangerous atmosphere developing in cargo holds are potential hazards. RDF is typically exported in plastic-wrapped bales, meaning that anaerobic decay conditions leading to methane generation could occur; and even in the case of aerobic decay (composting), while any CO2 released would be biogenic, there is potential for nitrous oxide generation. Transit time to European destinations considered here would be in the order of up to one week, but RDF may be stored for longer in port facilities at either end of the route. This would be sufficient time for the mesophilic and early parts of the thermophilic decay stages to occur, with gas generation potential. However, the compaction and plastic-wrapping of RDF is likely to slow the rate of decay and indeed this is part of the purpose, due to the issues of liquid effluent and odour release from RDF if it does decompose appreciably in transit. Specific GHG emissions would be dependent on storage/transit time, waste composition and moisture content, degree of aeration and temperature reached, among other factors, and modelling these is beyond the scope of the baseline scenario assessment.

the Proposed Development (which lie outside the scope of this assessment), then it is likely that a moderate adverse or greater effect would also occur in the future baseline scenario.

7.5.34 In this comparison, there would therefore be little or no material net change in environmental effects in the with-development scenario compared to the do-nothing future baseline scenario. Following the methodology and effect definitions set out in **paragraph 7.2.33**, this cannot be concluded to be an avoidance of significant adverse effects or indeed a beneficial effect due to the Proposed Development. However, it is important to acknowledge that the Proposed Development would not exist in isolation nor be expected to increase the amount of waste that needs to be managed in some manner (with consequential GHG emissions), so the likely significant adverse effects in the baseline scenario should be borne in mind.

7.6 Additional Mitigation

Construction

7.6.1 The following additional mitigation is recommended for the construction stage:

- carry out a pre-demolition audit to identify and act on opportunities to re-use materials in the Proposed Development design[38];
- undertake a detailed life-cycle assessment (LCA) during engineering/architectural design of the development, to identify construction carbon hotspots and guide optioneering to achieve reductions;
- use a recognised framework such as the UKGBC's framework definition for net zero buildings[39] to define a target for substantially reduced or net zero emissions from construction, including use of offsetting for residual emissions if necessary. Use a recognised methodology such as PAS2080[26] to guide the implementation and verification of the emission reduction measures to meet that target;
- use verified Environmental Performance Declarations and engage with or require the EPC contractor to engage with the key technology providers and tier one suppliers for the main materials and major engineered components to procure lower-carbon products. For bulk materials, source these locally where possible to reduce transport GHG emissions; and
- give consideration in the detailed design LCA to decommissioning, incorporating materials and fixings capable of eventual dismantling and re-use where feasible.

Operation

7.6.2 Monitoring data from other EfW facilities, discussed in **ES Appendix 7.1**, indicates that N_2O formation in the stack emissions is quite variable in practice but can be at levels well below the range given in the BREF for Waste Incineration[40]. This is possible where the selective non-catalytic reduction air pollution control system is operated at the optimum temperature (around 1,010 to 1,050°C) and where excess combustion air and hence oxygen availability is minimised. N_2O levels can be continuously monitored and reported to operating staff, as with certain other air pollutants. Good operational management to minimise N_2O formation through control of temperature and oxygen levels could reduce N_2O emissions to at or potentially below the low end of the range used in this assessment. Implementation of a

[38] The Outline CEMP includes a Site Materials Waste Management Plan that will reflect this
[39] UK Green Building Council (2019): Net Zero Carbon Buildings: A Framework Definition. [Online] Available: https://www.ukgbc.org/ukgbc-work/net-zero-carbon-buildings-a-framework-definition/, accessed 13/12/22
[40] EC Joint Research Centre (2019): Best Available Techniques Reference Document (BREF) for Waste Incineration. [Online] https://eippcb.jrc.ec.europa.eu/sites/default/files/2020-01/JRC118637_WI_Bref_2019_published_0.pdf [accessed 03/04/19]

procedure to monitor and minimise N_2O formation, with operator feedback on performance, is therefore recommended.

7.6.3 Identifying and securing the commercial delivery of further heat export opportunities would reduce net GHG emissions due to displacing additional heat generation in the baseline. However, it is recognised that this is subject to factors not fully within the Applicant's control. A balance also needs to be struck between the benefits of heat export and any reduction in electricity generation if further steam were diverted from the turbine for industrial uses. It is recommended that the Applicant undertakes and reports a CHP opportunities review at a minimum of five-yearly intervals, and commits to take up further CHP opportunities where commercially viable. The applicant has substantial experience operating one of Europe's largest district heating systems at Mannheim, which includes heat input from an EfW facility.

7.6.4 There is potential for APCr to be recycled into a manufactured limestone aggregate product, which in addition to recycling the ash and avoiding virgin aggregate production, provides carbon capture and sequestration through accelerated carbonation of the material[41]. It is recommended that the applicant directs APCr to this or an equivalent process rather than hazardous landfill, subject to available capacity of treatment facilities. Similarly, it is common for IBA to be recycled into an aggregate substitution product and with an appropriate weathering period, minor carbonation equivalent to around 1-3% of the semi-dry mass of this can be achieved[42].

7.6.5 The most important potential mitigation measure would be installation of CCUS at the EfW CHP Facility. CCUS systems have the potential to capture around 90% or more of the CO_2 in the stack exhaust. If the captured CO_2 is then sequestered in long-term storage, this would provide net negative combustion emissions for the Proposed Development due to the sequestration of short-cycle biogenic carbon in the waste stream. Installation or retrofit of CCUS is planned or under implementation for a number of EfW facilities in the UK, with various modular CCUS technologies becoming commercially available.

7.6.6 However, CCUS requires a CO_2 user or transport and sequestration solution, which are not within the Applicant's direct control. The EfW CHP Facility Site is not located in proximity to currently announced CCUS Track 1 clusters in the UK nor to a proposed CO_2 pipeline network. However, it is in reasonable proximity for potential road tanker transport of CO_2 to the Port of Southampton and the Fawley refinery and industrial complexes, which may offer CCUS cluster and export opportunities by sea in future. In line with emerging De-carbonisation Readiness regulations[43], the Applicant is:

- safeguarding space for future CCUS within the development site (area ID23[44]);
- designing the facility including its turbine for readiness to retrofit with CCUS in the future;
- keeping CCUS opportunities under active review (proposing to report on this at a minimum of five-yearly intervals); and
- intending to actively engage with any emerging government or commercial plans for future regional CCUS delivery.

[41] O.C.O Technology Ltd (2022): Manufactured LimeStone (M-LS). Environmental Product Declaration in Accordance with EN 15804+A2 & ISO 14025 / ISO 21930. EPDHUB-0193.
[42] N. Nolan, pers. comm., 2012.
[43] BEIS and DESNZ, 2021: Decarbonisation readiness: call for evidence on the expansion of the 2009 Carbon Capture Readiness requirements. [Online] https://www.gov.uk/government/consultations/decarbonisation-readiness-call-for-evidence-on-the-expansion-of-the-2009-carbon-capture-readiness-requirements, accessed 19/06/23 – referred to in the Planning Statement
[44] See Planning Statement Figure 4.1: Proposed EfW CHP Facility Site Layout

7.6.7 Installing CCUS is in line with the applicant's business strategy to be carbon neutral by 2040 and thereafter carbon negative, i.e., climate positive. Specifically, MVV Energie's strategy[45] sets out that for its business as a whole it intends to:

- reduce its direct carbon dioxide (CO_2) emissions by over 80% by 2030 compared to 2018;
- reduce its indirect CO_2 emissions by 82% compared to 2018;
- be climate neutral by 2040; and
- be climate positive from 2040 onwards.

7.6.8 Finally, BEIS consulted in June 2022 on extending the UK ETS to include EfW facilities from the mid-late 2020s[46]. If this were to occur, it would apply to the EfW CHP Facility shortly after it starts operation. Operation of the EfW CHP Facility would then be subject to the overall cap on UK emissions, whether the applicant achieved direct emissions reductions or purchased emissions allowances from other facilities that make reductions, either way providing mitigation of emissions at a UK level. The BEIS consultation also noted the potential for financial incentive to install CCUS at EfWs due to the sequestration of biogenic CO_2.

7.7 Residual Effects

Construction phase

7.7.1 With full implementation of the further mitigation, the Proposed Development's effects could be reduced to **minor adverse** and not significant.

Operational phase

7.7.2 With implementation of the further mitigation measures, excepting CCUS, the Proposed Development's residual effects have the potential to be reduced to **minor adverse** and not significant in the short term. In the longer term, considering the necessary decarbonisation trajectory for the UK to 2050, the residual effect of the Proposed Development is likely to remain **moderate adverse** and significant.

7.7.3 When compared to the Proposed Development and evaluated on the same basis, the business-as-usual future baseline would also be considered to be causing moderate adverse or greater effects. In this comparison, there would therefore be little or no material net change in environmental effects in the with-development scenario compared to the do-nothing future baseline scenario. While a non-significant or beneficial residual effect of the Proposed Development cannot be concluded under the methodology and effect definitions set out in **paragraph 7.2.33**, the likely significant adverse effects also occurring in the baseline scenario should be borne in mind.

7.7.4 With the addition of CCUS, the Proposed Development could capture and sequester both fossil and biogenic carbon and would have the potential to have a net-negative emissions balance even excluding comparison to other baseline EfW. Depending on the timing of implementation, this could lead to a **negligible** to significant **beneficial** residual effect.

[45] https://www.mvv.de/en/about-us/sustainability/transformation-of-the-energy-system/climatepositive
[46] BEIS (2022): Developing the UK Emissions Trading Scheme (UK ETS). [Online] Available: https://www.gov.uk/government/consultations/developing-the-uk-emissions-trading-scheme-uk-ets, accessed 13/12/22

7.8 Implications of Climate Change

7.8.1 The impact of climate change on the Proposed Development and adaptations to climate change have been considered within this section of each technical chapter, utilising the UKCP18 climate change projections.

7.8.2 The main areas where there is a (hypothetical) potential for inter-related effects, subject to assessment, are considered to be:

- **Chapter 12: Landscape and Visual** – consideration of climate resilience (e.g., drought tolerance) in the design and species mix of landscape planting proposed;
- **ES Chapter 8: Ecology and Nature Conservation** – potential changes in the sensitivity of habitats or species to development impacts in the future due to the stressor effects of climate change;
- **ES Chapter 11: Hydrology** – changes in rainfall frequency and intensity;
- **ES Chapter 6: Air Quality** – changes in weather patterns that affect air pollutant dispersion (annual average); possible higher odour nuisance risk in summer heatwave conditions;
- accidents and disasters – possible increase in fire risk with sustained hot and dry conditions; and
- **ES Chapter 14: Population and Health** – potential changes in sensitivity of human receptors to development impacts due to climate changes, e.g., vulnerability to air pollution during certain weather conditions.

7.9 Cumulative Effects

7.9.1 All developments that emit GHGs have the potential to impact the atmospheric mass of GHGs as a receptor, and so may have a cumulative impact on climate change. Consequently, cumulative effects due to other specific local development projects are not predicted but are taken into account when considering the impact of the Proposed Development by defining the atmospheric mass of GHGs as a high sensitivity receptor.

7.9.2 In the EIA Scoping Opinion, BCP indicated that the assessment should include "*various potential outcomes in relation to other EfW plants in the plan area*". The commercial operation and market-driven sourcing of waste in other EfW facilities is not an impact under the control of the Applicant, and lies outside the boundary of the assessment. However, qualitatively, as has been discussed in **Section 7.5**, it can be said that for a given rate of residual LACH and C&I waste requiring treatment, any reduction in waste throughput at other facilities would be likely to cause a reduction in GHG emissions that is similar to the increase from the Proposed Development.

7.10 Summary

7.10.1 A summary of the assessment is set out in **Table 7-2** overleaf.

7.11 Mitigation Commitments Summary

7.11.1 A summary of the mitigation commitments is set out in **Table 7-3** overleaf.

Table 7-2 Summary of Effects

Receptor	Sensitivity of Receptor	Nature of potential impact	Effect with inherent design mitigation	Significance	Proposed additional mitigation	Residual effect	Significance
Construction phase							
Atmospheric GHGs	High	Direct and indirect GHG emissions of Proposed Development	Contributes to **moderate adverse** whole-life effect	Significant	LCA during detailed design and carbon reduction target	Potentially reduced to **minor adverse**	Potentially not significant
Operational phase							
Atmospheric GHGs	High	Direct and indirect GHG emissions of Proposed Development	**Moderate adverse**	Significant	CCUS, additional CHP, N_2O control, APCR and IBA carbonation	Potentially **minor** to **moderate adverse** without CCUS. Potentially **negligible** to **beneficial** with CCUS.	Potentially significant
Atmospheric GHGs	High	Change compared with future baseline scenario	Moderate adverse baseline and hence **little net change**	Significant for both baseline and Proposed Development	As above for the Proposed Development	Moderate adverse baseline and hence **little net change**	Potentially significant

Table 7-3 Summary for Securing Mitigation

Identified receptor	Type and purpose of additional mitigation measure (prevent, reduce, offset, enhance)	Means by which mitigation may be secured (e.g., planning condition / legal agreement)	To be delivered by	Auditable by
Construction				
Atmospheric GHGs	Lifecycle assessment and carbon reduction plan during detailed design can identify opportunities to **prevent** and **reduce** embodied carbon, and could include **offsetting** remaining embodied carbon.	A Carbon Management Plan secured as part of the Site Materials Waste Management Plan, referred to in the Outline Construction Environmental Management Plan required (Table 7-3) by planning condition.	Applicant	BCP Council
Operation				
Atmospheric GHGs	Close monitoring and operational control of N_2O emissions can **reduce** these to the lowest end of the typical BAT range.	Requirement to apply BAT under the Environmental Permit.	Applicant	Environment Agency via the Environmental Permit
Atmospheric GHGs	Exporting additional energy via further CHP opportunities could **offset** GHG emissions from conventional heat generation in the future baseline.	Five-yearly CHP opportunities monitoring and reporting to BCP, secured by planning condition, and delivery of further CHP if commercially viable.	Applicant and third parties (heat network)	BCP Council
Atmospheric GHGs	Certain third-party reprocessing techniques for IBA and APCR can provide carbonation (**enhancing** atmospheric carbon drawdown) and provide a produce for re-use, **offsetting** emissions from primary material production in the future baseline.	Not secured – dependent on commercial market for third-party IBA and APCR reprocessor.	Applicant, contractually via third parties	n/a

Identified receptor	Type and purpose of additional mitigation measure (prevent, reduce, offset, enhance)	Means by which mitigation may be secured (e.g., planning condition / legal agreement)	To be delivered by	Auditable by
Atmospheric GHGs	CCUS could **reduce or largely prevent** CO_2 emissions and **enhance** sequestration of biogenic CO_2 with a beneficial effect.	Safeguarding land for future CCUS infrastructure within the development site. Five-yearly CCUS opportunities monitoring and reporting to BCP, secured by planning condition, and delivery of CCUS if commercially viable.	Applicant and third parties (CCUS network)	BCP Council