Medworth Energy from Waste
Combined Heat and Power Facility

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Applicant's response to Deadline 1 Submission

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1. Introduction

1.1 Background

1.1.1 The ExA's Rule 8 letter [**PD-006**], established a series of document submission deadlines for the Applicant, Interested Parties, Affected Persons, statutory organisations and the Host Authorities to prepare and submit further information.

1.1.2 At Deadline 1, Interested Parties, Affected Persons, statutory organisations and the Host Authorities were invited to submit the following:

- Comments on Relevant Representations (RRs);
- Summaries of all RRs exceeding 1500 words;
- Post-hearing submissions including written submissions of oral cases as heard on OFH1, OFH2 and ISH1;
- Local Impact Report(s);
- Notification by Statutory Parties of their wish to be considered as an IP by the ExA;
- Requests by Interested Parties to be heard at a subsequent Open Floor Hearing (OFH);
- Requests by Affected Persons (defined in section 59(4) of the Planning Act 2008) to be heard at a Compulsory Acquisition Hearing (CAH);
- Any further information requested by the ExA under Rule 17 of The Infrastructure Planning (Examination Procedure) Rules 2010; and
- Comments on any information/submissions accepted by the ExA.

1.2 Purpose of this Document

1.2.1 This document summarises the Applicant's response to the Deadline 1 submissions of Interested Parties, Affected Persons, statutory organisations and the Host Authorities.

1.3 Structure of this document

1.3.1 Section 2 presents a Tables summarising the Applicant's response to the Deadline 1 Submissions.

2. Summary of the Applicant's response to Deadline 1 submissions

Table 2.1 Summary of the Applicant's response to IP's Deadline 1 submissions

ExA ID	Interest	ExA document name	Applicant Response
REP1-059	Interested Party	Summary and full account of representation made by [ ] at OFH1	Issue raised: national policy: The Applicant provided a response to these matters in **Summary of Oral Submissions made by Interested Parties at Open Floor Hearings 1 and 2 and the Applicant's Response (Volume 9.23) [REP1-056]**, see ID: • NP01 (National policy and climate change). Issue raised: Climate Change assessment methodology: It is acknowledged that as a standalone entity the Proposed Development results in net carbon emissions when considering emissions from the EfW combustion processes compared to avoided emissions for energy generated by the EfW CHP Facility. However, the GHG assessment in **Section 14.9** of **ES Chapter 14 Climate Change (Volume 6.2) [APP-041]** indicates that relative to the 'without Proposed Development' case, the Proposed Development is estimated to result in a net decrease in GHG emissions equivalent to approximately 2,571 $ktCO_2e$ over its lifetime. It is therefore concluded that as the Proposed Development has net GHG emissions below zero, causing an indirect reduction in atmospheric GHG emissions, it would have a positive impact on the UK Government meeting its carbon budgets/targets. Issue raised: waste composition: It is recognised that the composition of waste is unknown and variable, so the GHG assessment (**Chapter 14 Climate Change (Volume 6.2) [APP-041]**) uses the most appropriate information currently available regarding waste composition and determination of associated emissions for landfill and the EfW CHP Facility. This is based on WRAP 2017

ExA ID	Interest	ExA document name	Applicant Response
			residual waste composition[1], Defra guidance on landfill emissions modelling[2] and the operating parameters for the EfW CHP Facility. It is acknowledged that variation in residual waste composition affects the estimation of GHG emissions associated with EfW and LFG processes, so the GHG assessment also includes a sensitivity analysis of waste composition and GHG emissions (**Appendix 14C (Volume 6.4) [APP-088]**), which considered relevant scenarios for increased recycling and a consequent reduction in recyclable materials entering residual waste. The analysis indicates that with increased recycling the EfW CHP Facility would provide a net saving on GHG emissions compared to landfill. The three cases considered for residual waste composition in the sensitivity analysis are: • Current residual waste (Core Case): based on WRAP 2017 residual waste composition, assuming this accounts for a recycling rate of 45%.[1] • Reduced Recyclables: assuming a further 20% reduction in recyclable materials (paper, card, plastics, glass, metals, food, garden, wood and textiles) in the WRAP 2017 residual waste composition (in line with UK Government policy to achieve a 65% recycling for municipal solid waste by 2035[3]). • Reduced Food and Plastics: assuming a 90% reduction in food and plastic in the WRAP 2017 residual waste composition, along with a 20% reduction in other recyclable materials (as for the Reduced Recyclables scenario). There is uncertainty on how waste composition could change in the future, so the sensitivity analysis provides an indication of the broad direction and scale of the impact of emissions attributable to the EfW CHP Facility compared to landfill. The uncertainty regarding waste composition is also highlighted in the findings of the revised **Waste Fuel Availability Assessment (Volume 7.3)** submitted at Deadline 2. The Waste Fuel Availability Assessment highlights that Waste Collection Authorities (WCAs) within the local study area already engage in the separate collection of food waste and considered that whilst the provisions of the Environment Act 2021 and the Government's Net Zero Strategy, will undoubtedly have a positive effect on increasing municipal recycling rates, it is questionable

[1] WRAP (2020). National Municipal Waste Composition, England 2017, Table 3.

[2] Defra (2014). Review of Landfill Methane Emissions Modelling (WR1908).

[3] HM Government (2018). *England's National Waste Strategy. OUR WASTE, OUR RESOURCES: A STRATEGY FOR ENGLAND*.

ExA ID	Interest	ExA document name	Applicant Response
			that this measure would facilitate the national achievement of a further 21% points in municipal waste recycling, to achieve an overall target of 65%. Therefore, the scenarios considered in the sensitivity analysis (**Appendix 14C (Volume 6.4) [APP-088]**) may be optimistic in terms of increased recycling rates, particularly with respect to opportunities to decrease the proportion of food (a biogenic carbon source) in residual waste. Issue raised: grid decarbonisation: The UK Grid Average emissions factor for electricity generation, from DUKES (2021)[4], was used in the ES (rather than gas-fired power stations (CCGT)) in response to comments at the PEIR stage: *"Concern that the assumption that energy generated by the development is only substituting fossil fuels is not consistent with the current energy mix where gas is used to generate only 41% of the electricity used in 2019*." For the purposes of the assessment in the ES, to provide a conservative estimate of avoided emissions it was assumed that rather than displacing electricity generated by fossil fuels, the electricity generated by the EfW CHP Facility (Proposed Development case) and LFG (without Proposed Development case) would displace UK Grid Average electricity generation. Displacement of conventional fossil fuels is the most likely scenario for the EfW CHP Facility. In response to comments received from Cambridgeshire County Council (CCC) and a meeting on 20 October 2022 with representatives from CCC, and King's Lynn and West Norfolk Council, a Technical Meeting Note (TNCC01) (provided at **Appendix 9.2c (Part 9) [REP1-036]**) was provided that additionally considered a gradual decarbonisation of the UK electricity grid over time. The Technical Meeting Note (TNCC01) indicates that as reported in the comment from CCC, compared to the results presented in the ES, considering current forecasts for decarbonisation of UK grid electricity generation, the net savings in GHG emissions compared to LFG would be reduced from 2,571 $ktCO_2e$ to 414 $ktCO_2e$ over its lifetime. However, as identified in the ES Core Case and the previous sensitivity analysis for the ES, this additional sensitivity analysis for lifetime grid mix decarbonisation shows that GHG emissions will still be lower in the 'with Proposed Development' case compared to the 'without Proposed Development' case, albeit at a reduced scale.

[4] BEIS (2021). Digest of UK Energy Statistics (DUKES) 2021.

ExA ID	Interest	ExA document name	Applicant Response
			As stated above, the assumption that electricity generated by the EfW CHP Facility would displace UK grid average electricity generation is considered to be a conservative approach. If the sensitivity analysis takes account of lifetime avoided emissions for replacing electricity generated by CCGT (as per current Defra guidance and assuming an emissions factor for electricity generation from natural gas of 380 tCO_2/GWh^4), then the net savings in GHG emissions compared to LFG are estimated to be approximately twice that indicated in the ES Core Case, at 5,167 $ktCO_2e$ over the lifetime of the EfW CHP Facility.
REP1-060	Interested Party	Summary with references of Oral presentation by [ ] at Open Floor Hearing (OFH2)	The Applicant provided a response to these matters in **Summary of Oral Submissions made by Interested Parties at Open Floor Hearings 1 and 2 and the Applicant's Response (Volume 9.23) [REP1-056]**, including ID: • NP01 (National policy and climate change); • PP03 (proximity principle); and • WF12 (waste need).
REP1-061	Interested Party	Post-hearing submission	The Applicant provided a response to these matters in **Summary of Oral Submissions made by Interested Parties at Open Floor Hearings 1 and 2 and the Applicant's Response (Volume 9.23) [REP1-056]**, including ID: • LE05 (areas of deprivation); • AT02 (attraction of professionals); • LJ03 (local jobs); • NP02 (National policy); and • DP02 (local democracy).
REP1-062	Interested Party	Post-hearing submission	The **WFAA (Volume 7.3) [APP-094]** and its update submitted at Deadline 2, demonstrate that in 2021, over 220,000 tonnes of 'in scope' household and commercial waste was disposed of to landfill in Cambridgeshire alone. Furthermore, the capacity assessment which underpins the Cambridgeshire Waste Local Plan, relies on all 200,000 tonnes per annum capacity of the Waterbeach MBT facility as final disposal capacity. This is simply not the case as a significant proportion of the 200,000 tonnes throughput of this facility emerges from the plant as refuse derived fuel (RDF). This RDF must then either be sent for recovery or disposed of in landfill. It is considered a conservative assumption that 50% of MBT input emerges from the plant as

ExA ID	Interest	ExA document name	Applicant Response
			RDF. With these two points in mind, over 320,000 tonnes per annum of residual waste from Cambridgeshire alone could be accommodated by the Proposed Development. The location of the Proposed Development, therefore, fully accords with the proximity principle in that it would provide its host County with much needed residual waste management capacity. In addition to approximately half of the capacity of the Proposed Development (320,000 tonnes per annum) potentially being sourced from Cambridgeshire alone, the remaining capacity offered by the Proposed Development would meet the needs of neighbouring and nearby Waste Planning Authorities. Whilst it is accepted that the highest concentration of 'in scope' HIC waste sent to landfill takes place in Essex (located to the South of Cambridgeshire), using the 2021 updated data (which has been set out in the revised WFAA), the next highest Waste Planning Authorities who dispose 'in scope' HIC to landfill are: REP1-091 • Leicestershire (approx. 232,000 tonnes) • Northamptonshire (approx. 211,000 tonnes) • Hertfordshire (approx. 209,000 tonnes) • Lincolnshire (approx. 102,000 tonnes) With the exception of Hertfordshire, these WPA's are all located west and north of the Proposed Development. Furthermore, whilst the **WFAA (Volume 7.3) [submitted at Deadline 2]** has been focused **solely** on the potential for the Proposed Development to divert residual waste from landfill – and not re-distribute material that is already sent for energy recovery, it is worth noting that at present, Norfolk exports its HIC waste a considerable distance to Bedfordshire (Rookery Pit EfW) for final disposal. Clearly, a facility at Wisbech would be a significantly more proximate option for the management of Norfolk's waste. Finally, there is no evidence to support the assertion that it is easier to divert waste from landfill contracts than EfW contracts. The key point to note is that the diversion of waste from landfill to energy recover **fully accords with current national planning policy.** Furthermore, as highlighted in the **WFAA (Volume 7.3) [submitted at Deadline 2]**, the focus of the assessment is on residual waste suitable for management by the Proposed Development i.e., that part of

ExA ID	Interest	ExA document name	Applicant Response
			the waste stream that is left over after recycling has taken place. In this context, the Proposed Development would **not** undermine recycling efforts.
REP1-063	Interested Party	Written submission of oral case	The Applicant provided a response to these matters in **Summary of Oral Submissions made by Interested Parties at Open Floor Hearings 1 and 2 and the Applicant's Response (Volume 9.23) [REP1-056]**, including ID: • WF09 (waste hierarchy); • HT04 (highway capacity); • TR04 (traffic management); • AW05 (Algores Way); and • PP02 (proximity principle).
REP1-064	Host Authority (KLWN)	Local Impact Report	The Applicant's response to the Joint Local Impact Report prepared by NCC and the KLWN is provided in a separate Deadline 2 submission document – **Applicant's Response to NCC and BCKLWN's Local Impact Report (Volume 10.4)**.
REP1-065	Host Authority (KLWN)	Post-hearing submissions including written submissions of oral cases	The Applicant provided a response to these matters in **Summary of Oral Submissions made by Interested Parties at Open Floor Hearings 1 and 2 and the Applicant's Response (Volume 9.23) [REP1-056]**, including ID: • AL03 (alternatives); • IL01 (local energy demands); and • YP02 (health impacts).
REP1-066	Interested Party	Submission	The Applicant provided a response to these matters in the **Summary of Oral Submissions made by Interested Parties at Open Floor Hearings 1 and 2 and the Applicant's Response (Volume 9.23) [REP1-056]**, including ID: • YP05 (health impacts); • HM01 (heavy metals and dioxins); • CC02 (climate); • WF09 (waste hierarchy); and

ExA ID	Interest	ExA document name	Applicant Response
			• HM03 (emissions monitoring). Relevant Representation **RR-031, Table 2.1, Applicant's Comments on the Relevant Representations – Part 2 Other Interested Parties and 3(b) Statutory Parties – Representations RR-001 – RR-099 (Volume 9.2) [REP1-029]** provides a response to matters raised by the IP in **REP1-066**. Concerning monitoring of heavy metals, further details are provided in the **Technical Note: Capture and Monitoring of Heavy Metals, Appendix A, Draft Written Summary of the Applicant's Oral Submissions at ISH 1, (Volume 9.23) [REP1-057]**. The Applicant's response to the ExA's **PND.1.2, First Written Questions (Volume 10.2)** provides further information on the preparation for and transport off-site of the Air Pollution Control residuals (APCr).
REP1-067	Host Authority (CCC)	ExA requested confirmation regarding adoption of Algores Way from CCC as LHA	See Applicant's response to the actions from Issues Specific Hearing 1, **ISH1-AP5 to AP6, Table 1.2 ISH1 Action Points: Applicant's response, Draft Written Summary of the Applicant's Oral Submissions at ISH 1, (Volume 9.23) [REP1-057]**.
REP1-068	Host Authority (CCC)	Post-hearing submission	The Applicant provided a response to these matters in **Summary of Oral Submissions made by Interested Parties at Open Floor Hearings 1 and 2 and the Applicant's Response (Volume 9.23) [REP1-056]**, including ID: • SZ06 (visual impacts); • RE04 (road and rail schemes); • NP05 (net zero); • CC03 (climate change); • DP04 (local waste policy); and • HT05 (highway mitigation).

ExA ID	Interest	ExA document name	Applicant Response
REP1-069	Host Authority (CCC)	Summaries of Relevant Representation	The Applicant's response to Cambridgeshire County Council's and Fenland District Council's summary of relevant representations is provided in a separate Deadline 2 submission document – **Table 2.1, Summary of the Applicant's response to Local Host Authorities Summary of Relevant Representations (Volume 10.8)**.
REP1-070	Host Authority (CCC)	Local Impact Report	**T**he Applicant's response to the Joint Local Impact Report prepared by CCC and FDC is provided in a separate Deadline 2 submission document – **Applicant's Response to NCC and BCKLWN's Local Impact Report (Volume 10.4)**.
REP1-071	Interested Party	Post-hearing submission	The Applicant provided a response to these matters in **Summary of Oral Submissions made by Interested Parties at Open Floor Hearings 1 and 2 and the Applicant's Response (Volume 9.23) [REP1-056]**, including ID: • PP01 (proximity principle); • YP03 (health impacts); • AG01 (agriculture); • PR01 (proximity to receptors); • PR02 (proximity to receptors); • RT01 (recycling targets) • LE01 (areas of deprivation); and • FR01 (flood risk).
REP1-072	Interested Party	Post-hearing submission	The Applicant provided a response to these matters in **Summary of Oral Submissions made by Interested Parties at Open Floor Hearings 1 and 2 and the Applicant's Response (Volume 9.23) [REP1-056]**, including ID: • HT08 (highway stability): and • FR03 (flood risk).
REP1-073	Interested Party	Post-hearing submission	The Applicant provided a response to these matters in **Summary of Oral Submissions made by Interested Parties at Open Floor Hearings 1 and 2 and the Applicant's Response (Volume 9.23) [REP1-056]**, including ID:

ExA ID	Interest	ExA document name	Applicant Response
			• AP01 (air pollution); • LE02 (deprivation); and • AT01 (attraction of professionals).
REP1-074	Host Authority (FDC)	Local Impact Report	**T**he Applicant's response to the Joint Local Impact Report prepared by CCC and FDC is provided in a separate Deadline 2 submission document – **Applicant's Response to NCC and BCKLWN's Local Impact Report (Volume 10.4)**.
REP1-075	Host Authority (FDC)	Summary of Relevant Representations	The Applicant's response to Cambridgeshire County Council's and Fenland District Council's summary of relevant representations is provided in a separate Deadline 2 submission document – **Table 2.1, Summary of the Applicant's response to Local Host Authorities Summary of Relevant Representations (Volume 10.8)**.
REP1-076	Interested Party	Post-hearing submission	<u>Accompanied site inspection to IP's business:</u> The Applicant supports the proposed site visit to the IP's premises, and to understand how MVV operate their EfW CHP facilities, recommends the ExA and other IP's visit the Devonport facility, see **Appendix B: Site Visit Proposal: Devonport EfW CHP Facility, Draft Written Summary of the Applicant's Oral Submissions at ISH1 (Volume 9.23) [REP1-057]**. Concerning the management of pest and vermin, the Applicant has provided a response in, for example, **RR-131, Table 2.2, Applicant's Comments on the Relevant Representations – Part 2 Other Interested Parties and 3(b) Statutory Parties – Representations RR-100 – RR-199 (Volume 9.2) [REP1-030]**. To answer general queries about operation of the EfW CHP Facility and how the Applicant manages pests and vermin at its existing facilities, the Applicant met representatives of the IP on 23 March 2023.

ExA ID	Interest	ExA document name	Applicant Response
REP1-077	Interested Party	Post-hearing submission	The Applicant provided a response to these matters in **Summary of Oral Submissions made by Interested Parties at Open Floor Hearings 1 and 2 and the Applicant's Response (Volume 9.23) [REP1-056]**, including ID: • TR03 (HGV's and emissions); • IT02 (traffic assessment); • AG01 and LW02 (farming/soil pollution); and • HM03 (emissions monitoring).
REP1-078	Interested Party	Post-hearing submission	The Applicant provided a response to these matters in **Summary of Oral Submissions made by Interested Parties at Open Floor Hearings 1 and 2 and the Applicant's Response (Volume 9.23) [REP1-056]**, including ID: • RE02 (local industry); • AW02 (Algores Way);and • LJ01 (local jobs).
REP1-079	Interested Party	Post-hearing submission	The Applicant provided a response to these matters in **Summary of Oral Submissions made by Interested Parties at Open Floor Hearings 1 and 2 and the Applicant's Response (Volume 9.23) [REP1-056]**, including ID: • AW01 and AW03 (Algores Way); • CO03 (consultation); and • HT02.(HGV routing). Concerning road safety and children attending Fenland Gymnastics Academy, Thomas Clarkson Academy and the TBAP Unity Academy (2 Algores Way), the Applicant has provided a response in, for example, **RR- 56, Table 2.1, Applicant's Comments on the Relevant Representations – Part 2 Other Interested Parties and 3(b) Statutory Parties – Representations RR-001 – RR-099 (Volume 9.2) [REP1-029]**. Concerning the reasons why the Applicant considers a site visit to MVV's operational EfW CHP facility in Plymouth is a good comparison for the Proposed Development, see **Appendix B: Site Visit Proposal: Devonport EfW CHP Facility, Draft Written Summary of the Applicant's Oral Submissions at ISH1 (Volume 9.23) [REP1-057]**.

ExA ID	Interest	ExA document name	Applicant Response
REP1-080	Interested Party (Huntingdonshire District Council)	Submission	Huntingdonshire District Council's position is noted.
REP1-081	Interested Party	Post-hearing submission	The Applicant provided a response to these matters in **Summary of Oral Submissions made by Interested Parties at Open Floor Hearings 1 and 2 and the Applicant's Response (Volume 9.23) [REP1-056]**, including ID: • WF06 (waste need); • AL01 and AL05 (alternatives); • LE06 (discrimination); • NP03 (National Policy); • DP03 (local democracy); • SZ02 (size and consenting process); and • PP01 and PP03 (proximity principle).
REP1-082	Interested Party	Post-hearing submission	The Applicant provided a response to these matters in: **Summary of Oral Submissions made by Interested Parties at Open Floor Hearings 1 and 2 and the Applicant's Response (Volume 9.23) [REP1-056]**, see ID: • LE12 (water supply). **RR-391, Table 2.4, Applicant's Comments on the Relevant Representations – Part 2 Other Interested Parties and 3(b) Statutory Parties – Representations RR-300 – RR-399 (Volume 9.2) [REP1-032]**.
REP1-083	Interested Party	Post-hearing submission	The Applicant provided a response to these matters in, for example:**RR-007** (Waste hierarchy), **RR-040** (air quality and land), **RR-047** (Health) **RR-074** (food production), **Table 2.1, Applicant's Comments on the Relevant Representations – Part 2 Other Interested Parties and 3(b) Statutory Parties – Representations RR-300 – RR-399 (Volume 9.2) [REP1-032]**.

ExA ID	Interest	ExA document name	Applicant Response
REP1-084	Interested Party	Post-hearing submissions	The Applicant provided a response to these matters in **Summary of Oral Submissions made by Interested Parties at Open Floor Hearings 1 and 2 and the Applicant's Response (Volume 9.23) [REP1-056]**, including **Section 1.3.7** and ID: • CC04, CO05 and CO06 (consultation).
REP1-085	Statutory Organisation (Natural England)	Answer to ExQ1	Natural England confirmed that it is satisfied with the conclusions and the methodology used in the Habitat Regulations Assessment No Significant Effects Report (NSER). The Applicant notes Natural England's position; reflected in **Table 3.5, Habitat Regulations Assessment,** and in the **Statement of Common Ground between Medworth CHP Limited and Natural England (DRAFT) (Volume 9.9) [REP1-043]**.
REP1-086	Interested Party	Post-hearing submission	The Applicant provided a response to these matters in: **Summary of Oral Submissions made by Interested Parties at Open Floor Hearings 1 and 2 and the Applicant's Response (Volume 9.23) [REP1-056]**, including ID: • WF05 and AL01 (waste need); • HT03 and HT04 (highway capacity/safety); • AG01 and LW02 (farming/soil pollution); • TR05 and HT08 (road stability); • TR02, TR04, HT1 and HT07 (HGV route restrictions); • YP04 and LE01 (health); • LE08 (socio-economic); and • LE11 (Property). Concerning major accidents and fires, the Applicant has provided a response in **RR-032** (in part) and **RR-390 Table 2.1 and Table 2.4, Applicant's Comments on the Relevant Representations – Part 2 Other Interested Parties and 3(b) Statutory Parties – Representations RR-001 to RR-099 and RR-300 (Volume 9.2) [REP1-029] and RR-301 to RR-399 (Volume 9.2) [REP1-032] respectively.** The Applicant has consulted the emergency services to ensure they are aware of and suitable arrangements for the construction and operation of the Proposed Development are secured. Further information can be found in:

ExA ID	Interest	ExA document name	Applicant Response
			• **Section 4.9.2** and **Section 3.5.21**, **Outline Construction Environmental Management Plan (Volume 7.12) [AEP1-024]**; and • **Section 2.5, Outline Operational traffic Management Plan (Volume 7.15) [REP1-026]**. The Applicant's response to the ExA's **PND.1.2, First Written Questions (Volume 10.2)** provides information on the preparation for and transport off site of the Air Pollution Control residuals (APCr).
REP1-087	Host Authority (NCC)	Summaries of Relevant Representation	The Applicant's response to NCC and KLWN's summary of relevant representations is provided in a separate Deadline 2 submission document – **Table 3.1, Summary of the Applicant's response to Local Host Authorities Summary of Relevant Representations (Volume 10.8)**.
REP1-088	Host Authority (NCC)	Local Impact Report	The Applicant's response to the Joint Local Impact Report prepared by NCC and the KLWN is provided in a separate Deadline 2 submission document – **Applicant's Response to NCC and BCKLWN's Local Impact Report (Volume 10.4)**.
REP1-089	Interested Party (North Norfolk District Council)	Submission	The Applicant notes North Norfolk District Council position that it does not wish to participate in the examination.
REP1-090	Interested Party	Post hearing submission	The Applicant provided a response to these matters in **Summary of Oral Submissions made by Interested Parties at Open Floor Hearings 1 and 2 and the Applicant's Response (Volume 9.23) [REP1-056]**, including ID: • AW01 and AW02 (Algores Way); • LE12 (water supply); and • LW02, AG01, IL01 and RE05 (farming/business/soil pollution). To answer general queries about operation of the EfW CHP Facility and how the Applicant would manage construction and operation of the EfW CHP Facility, the Algores Way Access

ExA ID	Interest	ExA document name	Applicant Response
			Improvements (including matters relating to compulsory acquisition, and Water Connection (foul), the Applicant met a representative of Mackle Apple's on 23 March 2023.
REP1-091	Interested Party	Post hearing submission	The Applicant provided a response to these matters in **Summary of Oral Submissions made by Interested Parties at Open Floor Hearings 1 and 2 and the Applicant's Response (Volume 9.23) [REP1-056]**, including ID: • AP01, AG01 (particulate matter and human health) • HM01 – (heavy metals) • WF02, WF07 and WF10 (waste need) • TR01, HT03 and HT04 (highway capacity/safety) • TR05 and HT08 (road suitability) • TR02, TR04, HT1 and HT07 (HGV route restrictions and diversions). **Climate change:** **Issue raised: assessment scope and methodology.** The approach to quantifying GHG emissions from the construction, operation and decommissioning of the Proposed Development has been undertaken in line with the latest IEMA guidance for assessing GHG emissions and the infrastructure life-cycle modules set out in PAS 2080: Carbon Management Infrastructure. Assumptions remain in line with published material and the guidance documents. The assessment methodology for the quantification of GHG emissions is clearly described in **Section 14.8** and **14.9** of **Chapter 14: Climate Change (Volume 6.2) [APP-041]**. The assessment includes quantification of emissions from operational transport including HGVs, considering the likely origin of the residual waste. A summary of the desktop data used to inform the assessment is provided in **Table 14.10** of **Chapter 14: Climate Change (Volume 6.2) [APP-041]** and a full list of assumptions made in the GHG assessment are appended to the ES (**Appendix 14B: Assumptions and limitations (Volume 6.4) [APP-088]**), including the operating parameters and waste composition that have been assumed for the EfW CHP Facility. The ES also includes a sensitivity analysis of waste composition and GHG emissions (**Appendix 14C: Sensitivity Analysis (Volume 6.4) [APP-088]**).

ExA ID	Interest	ExA document name	Applicant Response
			The Applicant has submitted its GHG emissions assessment spreadsheets to the examination as a Appendix 10.6A to this document – **Summary of Submissions made by Interested Parties at Deadline 1 and the Applicant's Response - Appendix 10.6A - Climate Data (Volume 10.6)** . **Issue raised: efficiency of landfills.** Landfill operations vary in efficiency, so to avoid assuming a worse-case scenario for the 'without development' case, the determination of the GHG emissions in the ES (**Chapter 14 (Volume 6.2) [APP-041]**) has used Defra guidance on landfill methane emissions modelling[5], which is considered to be the most appropriate approach for a UK scenario. With respect to landfill capture rates, it is noted that the Defra guidance identifies an average landfill gas ((LFG) capture rate of 52% for UK landfills; however, to avoid assuming a worse-case scenario the determination of the GHG emissions for the 'without development' case has been based on a subset of modern, large landfill operations in the UK, with a higher collection efficiency for LFG of 68% (as reported in **Section 14.9** of **Chapter 14** paragraph 14.9.15). Issue raised: alternatives to landfill: The EfW CHP Facility provides an option for the management of residual waste, remaining after the removal of recyclables, which moves the management higher up the waste hierarchy than the alternative 'without Proposed Development' scenario where waste is sent to landfill. The revised **Waste Fuel Availability Assessment (Volume 7.3)** submitted at Deadline 2 identifies that landfill disposal is the reasonable alternative for the management of residual waste proposed to be used at the EfW CHP Facility. The revised **Waste Fuel Availability Assessment (Volume 7.3)** submitted at Deadline 2 also identifies that some residual waste is incorporated in exports of Refuse Derived Fuel (RDF) to northern continental Europe (Netherlands and Germany) and Scandinavia (Sweden, Norway and Denmark), but highlights that RDF exports have been reducing due to recent tax changes[6] and the increase in the price of haulage making this disposal route a less financially viable option. Additionally, UK Government policy[7] is based on applying the proximity principle (i.e. managing waste at a

[5] Defra (2014). Review of Landfill Methane Emissions Modelling (WR1908).
[6] The Netherlands implemented the RDF tax which is a €32-per-tonne (£28.75) tax on the import of all foreign waste for incineration. This came into effect on 1 January 2020. Norway introduced a mandatory waste incineration tax of NOK192 (£16) per tonne of fossil-based CO_2, which has been levied on waste delivered to plants in Norway. This came into effect on 1 January 2022.
[7] Ministry of Housing, Communities and Local Government (2014). National Planning Policy for Waste.

ExA ID	Interest	ExA document name	Applicant Response
			location as close as reasonably possible to where waste is generated). Therefore, the climate chapter (**ES Chapter 14 Climate Change (Volume 6.2) [APP-041]**) considers a 'without Proposed Development' case where waste is collected and transported to available landfill sites.
REP1-092	Interested Party	Post hearing submission	The Applicant provided a response to these matters in **Summary of Oral Submissions made by Interested Parties at Open Floor Hearings 1 and 2 and the Applicant's Response (Volume 9.23) [REP1-056]**, including ID: • WF07 and WF08 (waste need); • AP02 (air pollution); • HM02 (heavy metals); • RT02 (recycling); • CC01 (climate change); and • HT03 (highway capacity).
REP1-093	Interested Party	Post hearing submission	The Applicant provided a response to these matters in **Summary of Oral Submissions made by Interested Parties at Open Floor Hearings 1 and 2 and the Applicant's Response (Volume 9.23) [REP1-056] at** paragraph 1.3.7 and ID: • TR02 (HGV routing); • WF03,WF05, WF10 (waste need); and • PP02 (proximity principle).
REP1-094	Interested Party	Post hearing submission	<u>Need for the facility/Waste Fuel Availability:</u> Submitted at Deadline 2, Applicant refers the IP to the updated version (Revision 2) of the **Waste Fuel Availability Assessment (WFAA) (Volume 7.3)**. <u>Alternative Technologies:</u> The Applicant does not accept that mixed waste sorting in front of the EfW CHP Facility would result in reduced electrical output of 45MW gross and 41MW net. This is because the EfW CHP Facility will be designed to treat residual waste having a calorific value (CV) range from 9MJ/kg to 14 MJ/kg. In practice, this means that waste throughput would increase as the CV decreased and conversely, waste throughput would decrease as the CV increased.

ExA ID	Interest	ExA document name	Applicant Response
			Throughout this range of CV, the boiler steam production would remain at 100% and power output would therefore remain at 60MW gross and approximately 55MW net. Based on MVV's operational experience, the Applicant does not seek residual waste containing high amounts of plastics as this leads to increased operational costs due to higher consumable consumption and maintenance burden. In Germany, where, in 2020, the recycling rate was approximately 20 percentage points higher than the average across Europe, and where the Applicant has been operating waste incineration facilities since the 1960s, there has been no such decrease in CV due to increased recycling rates. In fact, the opposite has been observed. The Applicant will provide further details at Deadline 3. The Applicant cannot comment further on the estimated reduction in the quantity of waste of the order of 20% or the 32% reduction in waste calorific content as the study cited lacks explanation of these figures. If further comment is required, the Applicant would welcome additional explanatory information on this point. Climate change (non-fossil CO_2 emissions): The assessment of methane emissions for landfill in **ES Chapter 14: Climate Change (Volume 6.2) [APP-041]** assumes that rather than all non-fossil (biogenic) carbon being turned into methane, only a proportion of the non-fossil carbon in residual waste is turned into methane. Therefore allowance has been made for the proportion of non-fossil carbon sequestered in landfill, which has been deducted from the landfill emissions. Assumptions regarding the proportion of non-fossil carbon converted to methane are reported in **Section 14.9** of **Chapter 14** (paragraphs 14.9.14 to 14.9.15), which as referenced, are based on factors published by Defra on landfill emissions modelling for a UK scenario. The following assumptions are included in **Section 14.9**: biogenic (non-fossil) carbon in residual waste is converted to landfill gas (LFG); the percentage of biogenic carbon converted to LFG is 50% of the total biogenic (non-fossil) carbon in the residual waste; the ratio of methane to carbon dioxide in LFG at UK landfill sites is calculated to be 57:43%; and fossil (non-biogenic) carbon in landfill waste does not contribute to GHG emissions. Therefore, whilst an assumption is stated that non-fossil carbon in the waste turns in to LFG, the assessment

ExA ID	Interest	ExA document name	Applicant Response
			has also considered that LFG represents a proportion of non-fossil carbon in the waste (half), and of this, only some of the LFG would be available as methane (57%). Climate Change (grid decarbonisation): The UK Grid Average emissions factor for electricity generation, from DUKES (2021)[8], was used in the ES (rather than gas-fired power stations (CCGT)) in response to comments at PEIR stage: *"Concern that the assumption that energy generated by the development is only substituting fossil fuels is not consistent with the current energy mix where gas is used to generate only 41% of the electricity used in 2019*." For the purposes of the assessment in the ES, to provide a conservative estimate of avoided emissions it was assumed that rather than displacing electricity generated by fossil fuels, the electricity generated by the EfW CHP Facility (Proposed Development case) and LFG (without Proposed Development case) would displace UK Grid Average electricity generation. Displacement of conventional fossil fuels is the most likely scenario for the EfW CHP Facility. In response to comments received from Cambridgeshire County Council (CCC) and a meeting on 20 October 2022 with representatives from CCC, and King's Lynn and West Norfolk Council, a Technical Meeting Note (TNCC01) (provided at **Appendix 9.2c (Part 9) [REP1-036]** was provided that additionally considered a gradual decarbonisation of the UK electricity grid over time. The Technical Meeting Note (TNCC01) indicates that as reported in the comment from CCC, compared to the results presented in the ES, considering current forecasts for decarbonisation of UK grid electricity generation, the net savings in GHG emissions compared to LFG would be reduced from 2,571 $ktCO_2e$ to 414 $ktCO_2e$ over its lifetime. However, as identified in the ES Core Case and the previous sensitivity analysis for the ES, this additional sensitivity analysis for lifetime grid mix decarbonisation shows that GHG emissions will still be lower in the 'with Proposed Development' case compared to the 'without Proposed Development' case, albeit at a reduced scale. As stated above, the assumption that electricity generated by the EfW CHP Facility would displace UK grid average electricity generation is considered to be a conservative approach. If

[8] BEIS (2021). Digest of UK Energy Statistics (DUKES) 2021.

ExA ID	Interest	ExA document name	Applicant Response
			the sensitivity analysis takes account of lifetime avoided emissions for replacing electricity generated by CCGT (as per current Defra guidance and assuming an emissions factor for electricity generation from natural gas of 380 tCO_2/GWh[8]), then the net savings in GHG emissions compared to LFG are estimated to be approximately twice that indicated in the ES Core Case, at 5,167 $ktCO_2e$ over the lifetime of the EfW CHP Facility. Air Quality: An application has been made by the Applicant for an Environmental Permit (EP) in August 2022. An assessment of the Best Available Technology (BAT) for the plant is included in the EP submission. The BAT Assessment concludes that selective non-catalytic reduction (SNCR) represents the BAT option for the proposed EfW CHP Facility. Whilst selective catalytic reduction (SCR) performs better from a NO_X emissions release perspective (NO_X emission reductions achieved with SNCR are expected to be 78% of those achieved with SCR), SNCR has fewer cross media effects than SCR (e.g. ammonia slip and spent catalyst waste streams). SNCR, on its own, will meet the required BAT Associated Emission Levels (BAT-AELs) and prevent an exceedance of environmental benchmarks. Balancing these factors, SNCR was found to be the BAT for the proposed EfW CHP Facility. Further detail on the BAT-AELs applied and the emission rates used in the Applicant's dispersion modelling, and consideration of baseline air quality will be provided for Deadline 3. DCO and Compulsory Purchase: Comments noted. Written Submissions: Comments noted.
REP1-095	Interested Party	Post-hearing submission	The Applicant provided a response to these matters in **Summary of Oral Submissions made by Interested Parties at Open Floor Hearings 1 and 2 and the Applicant's Response (Volume 9.23) [REP1-056]**, including ID: • IL03 and IL04 (local energy demands) ; and

ExA ID	Interest	ExA document name	Applicant Response
			• AL01, AL03 and AL07 9alternatives). Concerning the suitability of the highway network, the Applicant has provided a response in, for example, **RR-006, Table 2.1, Applicant's Comments on the Relevant Representations – Part 2 Other Interested Parties and 3(b) Statutory Parties – Representations RR-001 – RR-099 (Volume 9.2) [REP1-029]**.
REP1-096	Interested Party	Post-hearing submission	Waste Need: The Applicant submitted an updated version (Revision 2) of the WFAA **(Volume 7.3)** at Deadline 2. This updated document sets out: Consideration of the Government's Environmental Improvement Plan (EIP) to reduce residual waste arisings to 50% of 2019 levels. Consideration of the Government's Jet Zero Strategy and the move towards the production of sustainable aviation fuel (SAF). Updated document to reflect latest available published data sets as follows: • Defra Local Authority Collected Waste Statistics, 2019/20/21. • Waste Data Interrogator (WDI) EWC chapters 19 and 20; Waste Received 201921 (published January 2023). • WasteDataFlow (WDF), 2019/20/21 (Q100 data). • EA data 'Remaining landfill capacity: England as at end 201921' (published January 2023). • UK Statistics on Waste, Defra (published May 2022 update). • UK Energy from Waste Statistics - 20210, Tolvik Consulting Ltd (May 2022). • Overview of Statistics for RDF Export from England, Footprint Services (November 2022). Updated document to reflect updated Waste Local Plan evidence bases in the following Waste Planning Authorities: • Bedford City Council • Central Bedfordshire Council

ExA ID	Interest	ExA document name	Applicant Response
			• Luton Borough Council • Hertfordshire Council • Norfolk County Council • Leicestershire County Council • Northamptonshire County Council • Rutland County Council Updated document includes consideration of Mechanical Biological Treatment (MBT) capacity. Climate change: The approach to quantifying GHG emissions from the construction, operation and decommissioning of the Proposed Development has been undertaken in line with the latest IEMA guidance for assessing GHG emissions and the infrastructure life-cycle modules set out in PAS 2080: Carbon Management Infrastructure. Assumptions remain in line with published material and the guidance documents. The assessment methodology for the quantification of GHG emissions is described in **Section 14.8** and **14.9** of **Chapter 14: Climate Change (Volume 6.2) [APP-041]**. A summary of the desktop data used to inform the assessment is provided in **Table 14.10** of **Chapter 14 Climate Change (Volume 6.2) [APP-041]** and a full list of assumptions made in the GHG assessment is appended to the ES (**Appendix 14B: Assumptions and limitations (Volume 6.4) [APP-088]**), including the operating parameters and waste composition that have been assumed for the EfW CHP Facility. The Applicant has submitted its GHG emissions assessment spreadsheets to the examination as Appendix 10.6A to this document – **Summary of Submissions made by Interested Parties at Deadline 1 and the Applicant's Response Appendix 10.6A Climate Data (Volume 10.6)**.
REP1-097	Interested Party	Post-hearing submission	The Applicant provided a response to these matters in **Summary of Oral Submissions made by Interested Parties at Open Floor Hearings 1 and 2 and the Applicant's Response (Volume 9.23) [REP1-056]**, including ID: • WF10 (waste need); • YP01 (health impacts); • SZ07 (visual impact);

ExA ID	Interest	ExA document name	Applicant Response
			• TR05 (road stability); • HT07 (HGV routes); and • IT03 (traffic surveys).
REP1-098	Interested Party	Post-hearing submission	The Applicant provided a response to these matters in **Summary of Oral Submissions made by Interested Parties at Open Floor Hearings 1 and 2 and the Applicant's Response (Volume 9.23) [REP1-056]**, including ID: • IL03 (traffic surveys); • AL06 and AL07 (alternatives); • LE08 (socio-economic); • LW02 (farming and pollution); • FR02 (flood risk); and • CO04 (consultation).
REP1-099	Interested Party	Post-hearing submission	The Applicant notes the support for the Proposed Development.
REP1-100	Interested Party	Comments on Relevant Representations	The Applicant provided a response to these matters in **Summary of Oral Submissions made by Interested Parties at Open Floor Hearings 1 and 2 and the Applicant's Response (Volume 9.23) [REP1-056]**, including ID: • SZ08 (visual impact); and • LE09, RE05 and LJ05 (socio-economic).

Appendix 10.6A - Climate Data

GHG Assessment page 1 of 6 Embodied carbon

Based on assumptions from the Waste and Resources Action Programme (WRAP), Net Waste Tool (2008), wastage rates used to assess the material quantities based on the amount of waste, and the Waste Benchmark Calculator data from Query submitted on BRE Smartwaste 21/03/2019, this calculates the estimated material resource required for the project over the construction period. The calculation uses a 15,000 m2 estimate of the gross internal area (GIA) of the Proposed Development and categorises this as civil engineering under BRE Smartwaste's defined component categories. Material quantities for concrete and metals are based upon information available from the Applicant from similar facilities. Using the total materials required for the Proposed Development (inclusive of waste) and the Inventory of Carbon and Energy (ICE) Database carbon factors / BEIS 2021 emission factors the embodied carbon GHG emissions over the construction phase is determined.

Floor Area (m2)	15,000
Category	Civil Engineering
GHG Emissions (kt CO2e)	35.55

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Process emissions

Scope: The carbon emissions arising from any on- or off-site construction-related activities must be considered in [A5]. This includes any energy consumption for site accommodation, plant use and the impacts associated with any waste generated through the construction process, its treatment and disposal.

KPI: 1400kgCO2e/£100k

Source: https://www.rics.org/profession-standards/rics-standards-and-guidance/sector-standards/building-surveying-standards/whole-life-carbon-assessment-for-the-built-environment

Construction Cost (£)	350,000,000
Construction KPI (at 1400kgCO2e/ £100k)	1,400
Estimated Process emissions during construction (kgCO2e)	4,900,000.00
Estimated Process emissions during construction (tCO2e)	4,900.00
Estimated Process emissions during construction (ktCO2e)	4.90

Note: construction costs excluding consultancy fees

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Maintenance

MVV provided data - diesel 1,939,360 l per annum including 5d (4b would be 10% of it)

BEIS emissions factors - liquid fuels - gas oil - 0.63253 kg CO2e per litre

Total diesel use per annum (litres)	1,939,360
Maintenance diesel use per annum (litres)	193,936
Years of operation	40
Lifetime biodiesel use (litres)	7,757,440
Emissions conversion factor gas oil (kg CO2e per litre)	0.63253
Lifetime diesel use emissions (kg CO2e)	4,906,813.52
Lifetime diesel use emissions (t CO2e)	4,906.81
Lifetime diesel use emissions (kt CO2e)	**4.91**

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Operational water use

MVV provided data - 40,000 tpa

BEIS emissions factors - water supply - 0.149 kg CO2e per m3

One metric tonne of water converted into cubic meter of water equals = 1.00 m3 - cu m

Water use per annum (tonnes)	40,000
Water use per annum (m3)	40,000
Years of operation	40
Lifetime water use (m3)	1,600,000
Emissions conversion factor (CO2e per m3)	0.149
Lifetime operational water use emissions (kg CO2e)	238,400.00
Lifetime operational water use emissions (t CO2e)	238.40
Lifetime operational water use emissions (kt CO2e)	**0.24**

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IBA and APCr

The IBA remaining after combustion equates to approximately 26.5% by weight of the input waste, this equates to approximately 165,600tpa assuming a maximum waste throughput of 625,600tpa

The IBA would be sent to a suitably licenced facility and in the UK where possible, for recycling

BEIS emissions factors - waste disposal - refuse - commercial and industrial waste - open-loop recycling (note factor greyed out assumed the same as closed-loop) - 21.294 kg CO2e per tonne

The APC residues amount to approximately 5% of the total waste by volume, this equates to approximately 31,280tpa assuming a maximum waste throughput of 625,600tpa

The APC residues are not dissimilar to powdered cement

The APC residues would be sent to a suitable licenced facility and in the UK where possible, for disposal

BEIS emissions factors - waste disposal - construction - aggregates - landfill - 1.239 kg CO2e per tonne

IBA per annum (tonnes)	165,600
Years of operation	40
Lifetime IBA (tonnes)	6,624,000
Emissions conversion factor (CO2e per tonne)	21.294
Lifetime IBA emissions (kg CO2e)	141,051,456.00
Lifetime IBA emissions (t CO2e)	141,051.46
Lifetime IBA emissions (kt CO2e)	**141.05**

APCr per annum (tonnes)	31,280
Years of operation	40
Lifetime APCr (tonnes)	1,251,200
Emissions conversion factor (CO2e per tonne)	1.239
Lifetime APCr emissions (kg CO2e)	1,550,236.80
Lifetime APCr emissions (t CO2e)	1,550.24
Lifetime APCr emissions (kt CO2e)	**1.55**

Total lifetime IBA and APCr emisisons (kt CO2e)	**142.60**

Summary

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kt	No Development					With Development											Difference		UKCB (kt)		
	Operation			Avoided		Construction			Operation					Decom	Avoided						
	Landfill	Road Traffic	Energy		Total	Materials	Process	Transport	Maintenance	Combustion	Op Water Use	IBA and APCr	Road Traffic			Total					
2023					0.00	11.85	1.63	2.67								16.15	16.15	4th UKCB	-83.41	1,950,000	-0.0043%
2024					0.00	11.85	1.63	2.65								16.13	16.13				
2025					0.00	11.85	1.63	2.62								16.10	16.10				
2026	287.23	3.10	0.63	-20.04	270.92				0.12	273.33	0.006	3.57	8.11		-80.08	205.05	-65.87				
2027	287.23	3.07	0.63	-20.04	270.89				0.12	273.33	0.006	3.57	8.04		-80.08	204.98	-65.92				
2028	287.23	3.04	0.63	-20.04	270.87				0.12	273.33	0.006	3.57	7.97		-80.08	204.91	-65.96	5th UKCB	-330.55	1,725,000	-0.0192%
2029	287.23	3.02	0.63	-20.04	270.84				0.12	273.33	0.006	3.57	7.90		-80.08	204.84	-66.00				
2030	287.23	2.96	0.63	-20.04	270.78				0.12	273.33	0.006	3.57	7.74		-80.08	204.68	-66.10				
2031	287.23	2.90	0.63	-20.04	270.72				0.12	273.33	0.006	3.57	7.59		-80.08	204.53	-66.20				
2032	287.23	2.85	0.63	-20.04	270.67				0.12	273.33	0.006	3.57	7.45		-80.08	204.39	-66.28				
2033	287.23	2.80	0.63	-20.04	270.62				0.12	273.33	0.006	3.57	7.32		-80.08	204.26	-66.36	6th UKCB	-332.47	965,000	-0.0345%
2034	287.23	2.75	0.63	-20.04	270.58				0.12	273.33	0.006	3.57	7.20		-80.08	204.14	-66.43				
2035	287.23	2.71	0.63	-20.04	270.54				0.12	273.33	0.006	3.57	7.10		-80.08	204.04	-66.50				
2036	287.23	2.68	0.63	-20.04	270.50				0.12	273.33	0.006	3.57	7.00		-80.08	203.94	-66.56				
2037	287.23	2.64	0.63	-20.04	270.47				0.12	273.33	0.006	3.57	6.91		-80.08	203.85	-66.62				
2038	287.23	2.61	0.63	-20.04	270.43				0.12	273.33	0.006	3.57	6.83		-80.08	203.77	-66.67				
2039	287.23	2.58	0.63	-20.04	270.41				0.12	273.33	0.006	3.57	6.76		-80.08	203.70	-66.71				
2040	287.23	2.56	0.63	-20.04	270.38				0.12	273.33	0.006	3.57	6.70		-80.08	203.64	-66.75				
2041	287.23	2.53	0.63	-20.04	270.36				0.12	273.33	0.006	3.57	6.62		-80.08	203.56	-66.80				
2042	287.23	2.51	0.63	-20.04	270.34				0.12	273.33	0.006	3.57	6.57		-80.08	203.51	-66.83				
2043	287.23	2.50	0.63	-20.04	270.32				0.12	273.33	0.006	3.57	6.53		-80.08	203.47	-66.85				
2044	287.23	2.49	0.63	-20.04	270.31				0.12	273.33	0.006	3.57	6.50		-80.08	203.44	-66.87				
2045	287.23	2.48	0.63	-20.04	270.30				0.12	273.33	0.006	3.57	6.48		-80.08	203.42	-66.88				
2046	287.23	2.47	0.63	-20.04	270.29				0.12	273.33	0.006	3.57	6.45		-80.08	203.39	-66.90				
2047	287.23	2.46	0.63	-20.04	270.29				0.12	273.33	0.006	3.57	6.44		-80.08	203.38	-66.91				
2048	287.23	2.46	0.63	-20.04	270.28				0.12	273.33	0.006	3.57	6.43		-80.08	203.37	-66.92				
2049	287.23	2.46	0.63	-20.04	270.28				0.12	273.33	0.006	3.57	6.42		-80.08	203.36	-66.92				
2050	287.23	2.45	0.63	-20.04	270.28				0.12	273.33	0.006	3.57	6.41		-80.08	203.35	-66.92	Net Zero			
2051	287.23	2.45	0.63	-20.04	270.28				0.12	273.33	0.006	3.57	6.41		-80.08	203.35	-66.92				
2052	287.23	2.45	0.63	-20.04	270.28				0.12	273.33	0.006	3.57	6.41		-80.08	203.35	-66.92				
2053	287.23	2.45	0.63	-20.04	270.28				0.12	273.33	0.006	3.57	6.41		-80.08	203.35	-66.92				
2054	287.23	2.45	0.63	-20.04	270.28				0.12	273.33	0.006	3.57	6.41		-80.08	203.35	-66.92				
2055	287.23	2.45	0.63	-20.04	270.28				0.12	273.33	0.006	3.57	6.41		-80.08	203.35	-66.92				
2056	287.23	2.45	0.63	-20.04	270.28				0.12	273.33	0.006	3.57	6.41		-80.08	203.35	-66.92				
2057	287.23	2.45	0.63	-20.04	270.28				0.12	273.33	0.006	3.57	6.41		-80.08	203.35	-66.92				
2058	287.23	2.45	0.63	-20.04	270.28				0.12	273.33	0.006	3.57	6.41		-80.08	203.35	-66.92				
2059	287.23	2.45	0.63	-20.04	270.28				0.12	273.33	0.006	3.57	6.41		-80.08	203.35	-66.92				
2060	287.23	2.45	0.63	-20.04	270.28				0.12	273.33	0.006	3.57	6.41		-80.08	203.35	-66.92				
2061	287.23	2.45	0.63	-20.04	270.28				0.12	273.33	0.006	3.57	6.41		-80.08	203.35	-66.92				
2062	287.23	2.45	0.63	-20.04	270.28				0.12	273.33	0.006	3.57	6.41		-80.08	203.35	-66.92				
2063	287.23	2.45	0.63	-20.04	270.27				0.12	273.33	0.006	3.57	6.41		-80.08	203.35	-66.92				
2064	287.23	2.45	0.63	-20.04	270.27				0.12	273.33	0.006	3.57	6.41		-80.08	203.36	-66.91				
2065	287.23	2.45	0.63	-20.04	270.27				0.12	273.33	0.006	3.57	6.41		-80.08	203.36	-66.91				
2066					0.00									16.15		16.15	16.15				
2067					0.00									16.13		16.13	16.13				
2068					0.00									16.10		16.10	16.10				
Total	11,489.35	103.85	25.04	-801.42	10,816.83	35.55	4.90	7.93	4.91	10,933.05	0.24	142.60	271.68	48.38	- 3,203.20	8,246.03	- 2,570.80				
	See waste spreadsheet	See transport spreadsheet		See waste spreadsheet				See transport spreadsheet		See waste spreadsheet			See transport spreadsheet		See waste spreadsheet						

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	Data Sources					
	Description	**Value**	**Unit**	**Source**	**Further info**	**Website**
Construction	Average freight haul of glass cement metal	99.7	km	DfT Freight statistic (TSGB04)		https://www.gov.uk/government/statistical-data-sets/tsgb04-freight
Construction and Operation	Average commuting distance	14.6	km	DfT: NTS0403: Average number of trips, miles and time spent travelling by trip purpose: England	9.11 miles = 14.58 km	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/905985/nts0403.ods

Transport GHG Calculations page 2 of 6 Construction data

	2023 to 2026 (36 months)
Total HGV movements	90,934
Total LGV movements	298,031

Table RFS0105

https://www.gov.uk/government/statistical-data-sets/tsgb04-freight

Goods lifted[1] by commodity[2] and length of haul[3]: 2020

UK activity of GB-registered heavy goods vehicles

Million tonnes

		Length of haul							
Commodity		**Up to 25km**	**Over 25km to 50km**	**Over 50km to 100km**	**Over 100km to 150km**	**Over 150km to 200km**	**Over 200km to 300km**	**Over 300km**	**All lengths**
Metal, mineral and chemical products									
Glass, cement and other non-metallic mineral products		34	25	23	10	6	8	4	111
Metal products		6	4	5	3	3	4	1	25

Table RFS0105

Goods moved[1] by commodity[2] and length of haul[3]: 2020

UK activity of GB-registered heavy goods vehicles

Million tonne kilometres

		Length of haul							
Commodity		**Up to 25km**	**Over 25km to 50km**	**Over 50km to 100km**	**Over 100km to 150km**	**Over 150km to 200km**	**Over 200km to 300km**	**Over 300km**	**All lengths**
Metal, mineral and chemical products									
Glass, cement and other non-metallic mineral products		484	932	1,654	1,235	1,013	1,965	1,685	**8,967**
Metal products		75	136	330	369	593	922	541	**2,965**

Glass, cement and other non-metallic mineral products	Average distance:	80.8
Metal products	Average distance:	118.6
	Total average:	99.7

Transport GHG Calculations page 3 of 6

Operational data

	Weekly	Annual
Total HGV movements	1,548	80,496
Total LDV movements	96	4,992
Total car movements	358	18,616

Number of weeks per year
52

2011 Census: Usual resident population and population density, local authorities in the United Kingdom
https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/2011censuspopulationandhouseholdestimatesfortheunitedkingdom

	Administrative centre	Source	Centre postcode	Miles Distance to PE13 2TQ (Google maps)	km
Essex	Basildon	2011 Census	SS14 1LD	99.7	160.5
Hertfordshire	Watford	[redacted]	WD17 2PA	99.4	160.0
Leicester City	Leicester	2011 Census	LE1 5BD	61.7	99.3
Leicestershire	Loughborough	[redacted]	LE11 2QG	70.2	113.0
Lincolnshire	Lincoln	[redacted]	LN2 1HL	58.7	94.5
Luton	Luton	2011 Census	LU1 2NB	78.1	125.7
Norfolk	Norwich	[redacted]	NR1 3RU	57.1	91.9
Northamptonshire	Northampton	2011 Census	NN1 2SQ	63.6	102.4
Rutland	Oakham	2011 Census	LE15 6AL	44.4	71.5
Thurrock	Thurrock	2012 Census		102.0	164.2

1.60934 km in 1 mile

Origin WPA	Shortfall (tonnes)	% share of overall shortfall after 2030	Largest settlement	Distance to Proposed Development (km)	HDV Movements (annual)	HDV km	LDV Movements (annual)	LDV km
Central Bedfordshire, Bedford City Council and Luton Borough Council	229,000	11	Luton	125.7	8,854.56	1,112,924.81	549.12	69,018.59
Essex (including Southend on Sea)	209,000	10	Basildon	160.5	8,049.60	1,291,567.96	499.20	80,097.24
Hertfordshire	507,363	24	Watford	160.0	19,319.04	3,090,435.84	1,198.08	191,654.94
Norfolk	703,000	33	Norwich	91.9	26,563.68	2,441,024.59	1,647.36	151,381.37
Thurrock	71,200	3	Thurrock	164.2	2,414.88	396,409.02	149.76	24,583.51
Leicester City	*unquantified*	*unquantified*	Leicester	99.3	*unquantified*	*unquantified*	*unquantified*	*unquantified*
Leicestershire	23,448	1	Loughborough	113.0	804.96	90,940.89	49.92	5,639.75
Lincolnshire	101,604	5	Lincoln	94.5	4,024.80	380,215.84	249.60	23,579.28
Northamptonshire	250,000	12	Northampton	102.4	9,659.52	988,690.74	599.04	61,314.15
Rutland	27,000	1	Oakham	71.5	804.96	57,518.17	49.92	3,567.02
TOTAL	2,121,615	100	**Average:**	118.3	80,496.00	9,849,727.88	4,992.00	610,835.84

Total HGV movements	80,496
Total LDV movements	4,992
Total car movements	18,616

Table RFS0105

Goods lifted[1] by commodity[2] and length of haul[3]: 2020

https://www.gov.uk/government/statistical-data-sets/tsgb04-freight

UK activity of GB-registered heavy goods vehicles

Million tonnes

		Length of haul							
Commodity		**Up to 25km**	**Over 25km to 50km**	**Over 50km to 100km**	**Over 100km to 150km**	**Over 150km to 200km**	**Over 200km to 300km**	**Over 300km**	**All lengths**
	Waste related products	43	40	42	10	7	7	2	151

1. Goods lifted: the weight of goods carried, measured in tonnes.

Table RFS0105

Goods moved[1] by commodity[2] and length of haul[3]: 2020

UK activity of GB-registered heavy goods vehicles

Million tonne kilometres

		Length of haul							
Commodity		**Up to 25km**	**Over 25km to 50km**	**Over 50km to 100km**	**Over 100km to 150km**	**Over 150km to 200km**	**Over 200km to 300km**	**Over 300km**	**All lengths**
	Waste related products	648	1,431	3,005	1,245	1,215	1,673	960	**10,177**

Average distance:	67.4
Average distance up to 150km (approx the 2 hours catchment)	46.9

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Without development

Detailed Option 1, Rural (Not London), 48 kph

	100% HGV CO2 (g/km)	HGV km	kT CO2	100% LGV CO2 (g/km)			100% Car CO2 (g/km)	Total
2023	828			186			113	
2024	823			184			110	
2025	816			181			107	
2026	809	3,773,772	3.1	178	234032	0.04	104	3.10
2027	802	3,773,772	3.0	176	234032	0.04	100	3.07
2028	795	3,773,772	3.0	173	234032	0.04	97	3.04
2029	789	3,773,772	3.0	170	234032	0.04	94	3.02
2030	773	3,773,772	2.9	164	234032	0.04	89	2.96
2031	758	3,773,772	2.9	159	234032	0.04	85	2.90
2032	744	3,773,772	2.8	155	234032	0.04	81	2.85
2033	732	3,773,772	2.8	150	234032	0.04	78	2.80
2034	720	3,773,772	2.7	146	234032	0.03	75	2.75
2035	710	3,773,772	2.7	142	234032	0.03	72	2.71
2036	700	3,773,772	2.6	139	234032	0.03	69	2.68
2037	691	3,773,772	2.6	136	234032	0.03	66	2.64
2038	683	3,773,772	2.6	134	234032	0.03	63	2.61
2039	677	3,773,772	2.6	132	234032	0.03	61	2.58
2040	670	3,773,772	2.5	129	234032	0.03	58	2.56
2041	663	3,773,772	2.5	127	234032	0.03	56	2.53
2042	658	3,773,772	2.5	125	234032	0.03	53	2.51
2043	654	3,773,772	2.5	124	234032	0.03	51	2.50
2044	651	3,773,772	2.5	122	234032	0.03	49	2.49
2045	649	3,773,772	2.4	121	234032	0.03	47	2.48
2046	646	3,773,772	2.4	120	234032	0.03	45	2.47
2047	645	3,773,772	2.4	118	234032	0.03	44	2.46
2048	644	3,773,772	2.4	117	234032	0.03	43	2.46
2049	644	3,773,772	2.4	116	234032	0.03	42	2.46
2050	643	3,773,772	2.4	114	234032	0.03	41	2.45
2051	643	3,773,772	2.4	114	234032	0.03	41	2.45
2052	643	3,773,772	2.4	114	234032	0.03	41	2.45
2053	643	3,773,772	2.4	114	234032	0.03	41	2.45
2054	643	3,773,772	2.4	114	234032	0.03	41	2.45
2055	643	3,773,772	2.4	114	234032	0.03	41	2.45
2056	643	3,773,772	2.4	114	234032	0.03	41	2.45
2057	643	3,773,772	2.4	114	234032	0.03	41	2.45
2058	643	3,773,772	2.4	114	234032	0.03	41	2.45
2059	643	3,773,772	2.4	114	234032	0.03	41	2.45
2060	643	3,773,772	2.4	114	234032	0.03	41	2.45
2061	643	3,773,772	2.4	114	234032	0.03	41	2.45
2062	643	3,773,772	2.4	114	234032	0.03	41	2.45
2063	643	3,773,772	2.4	114	234032	0.03	41	2.45
2064	643	3,773,772	2.4	114	234032	0.03	41	2.45
2065	643	3,773,772	2.4	114	234032	0.03	41	2.45

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With development

Detailed Option 1, Rural (Not London), 48 kph

	100% HGV CO2 (g/km)	HGV km	kT CO2	100% LGV CO2 (g/km)			100% Car CO2 (g/km)			Total
2023	828	3,021,787	2.50	186			113	1,448,429	0.16	2.67
2024	823	3,021,787	2.49	184			110	1,448,429	0.16	2.65
2025	816	3,021,787	2.46	181			107	1,448,429	0.15	2.62
2026	809	9,849,728	7.97	178	610,836	0.11	104	271,421	0.03	8.11
2027	802	9,849,728	7.90	176	610,836	0.11	100	271,421	0.03	8.04
2028	795	9,849,728	7.83	173	610,836	0.11	97	271,421	0.03	7.97
2029	789	9,849,728	7.77	170	610,836	0.10	94	271,421	0.03	7.90
2030	773	9,849,728	7.61	164	610,836	0.10	89	271,421	0.02	7.74
2031	758	9,849,728	7.47	159	610,836	0.10	85	271,421	0.02	7.59
2032	744	9,849,728	7.33	155	610,836	0.09	81	271,421	0.02	7.45
2033	732	9,849,728	7.21	150	610,836	0.09	78	271,421	0.02	7.32
2034	720	9,849,728	7.10	146	610,836	0.09	75	271,421	0.02	7.20
2035	710	9,849,728	6.99	142	610,836	0.09	72	271,421	0.02	7.10
2036	700	9,849,728	6.90	139	610,836	0.09	69	271,421	0.02	7.00
2037	691	9,849,728	6.81	136	610,836	0.08	66	271,421	0.02	6.91
2038	683	9,849,728	6.73	134	610,836	0.08	63	271,421	0.02	6.83
2039	677	9,849,728	6.66	132	610,836	0.08	61	271,421	0.02	6.76
2040	670	9,849,728	6.60	129	610,836	0.08	58	271,421	0.02	6.70
2041	663	9,849,728	6.53	127	610,836	0.08	56	271,421	0.02	6.62
2042	658	9,849,728	6.48	125	610,836	0.08	53	271,421	0.01	6.57
2043	654	9,849,728	6.44	124	610,836	0.08	51	271,421	0.01	6.53
2044	651	9,849,728	6.41	122	610,836	0.07	49	271,421	0.01	6.50
2045	649	9,849,728	6.39	121	610,836	0.07	47	271,421	0.01	6.48
2046	646	9,849,728	6.37	120	610,836	0.07	45	271,421	0.01	6.45
2047	645	9,849,728	6.35	118	610,836	0.07	44	271,421	0.01	6.44
2048	644	9,849,728	6.35	117	610,836	0.07	43	271,421	0.01	6.43
2049	644	9,849,728	6.34	116	610,836	0.07	42	271,421	0.01	6.42
2050	643	9,849,728	6.33	114	610,836	0.07	41	271,421	0.01	6.41
2051	643	9,849,728	6.33	114	610,836	0.07	41	271,421	0.01	6.41
2052	643	9,849,728	6.33	114	610,836	0.07	41	271,421	0.01	6.41
2053	643	9,849,728	6.33	114	610,836	0.07	41	271,421	0.01	6.41
2054	643	9,849,728	6.33	114	610,836	0.07	41	271,421	0.01	6.41
2055	643	9,849,728	6.33	114	610,836	0.07	41	271,421	0.01	6.41
2056	643	9,849,728	6.33	114	610,836	0.07	41	271,421	0.01	6.41
2057	643	9,849,728	6.33	114	610,836	0.07	41	271,421	0.01	6.41
2058	643	9,849,728	6.33	114	610,836	0.07	41	271,421	0.01	6.41
2059	643	9,849,728	6.33	114	610,836	0.07	41	271,421	0.01	6.41
2060	643	9,849,728	6.33	114	610,836	0.07	41	271,421	0.01	6.41
2061	643	9,849,728	6.33	114	610,836	0.07	41	271,421	0.01	6.41
2062	643	9,849,728	6.33	114	610,836	0.07	41	271,421	0.01	6.41
2063	643	9,849,728	6.33	114	610,836	0.07	41	271,421	0.01	6.41
2064	643	9,849,728	6.33	114	610,836	0.07	41	271,421	0.01	6.41
2065	643	9,849,728	6.33	114	610,836	0.07	41	271,421	0.01	6.41

Waste Composition (incl. sensitivity cases) page 1 of 6

	Assumptions	Reference
1	The GHG assessment methodology is based on the Carbon Assessment carried out by the Carbon Trust for the Cory Riverside EfW Facility, comparing emissions from the combustion of residual waste as a fuel source in the EfW Facility, with the alternative scenario of landfill disposal with electricity generation from the collection of landfill gas (LFG)	Carbon Trust 2017. Cory Riverside Energy: A Carbon Case, Carbon Trust Peer Review https://www.coryenergy.com/wp-content/uploads/2018/01/Cory-Carbon-Report-v1.1.pdf
2	Waste to be used as fuel for the Medworth EfW Facility is assumed to be the residual portion of commercial and household municpial solid waste (MSW) after recycling	WRAP 2020, National Municipal Waste Composition, England 2017, Table 3 https://wrap.org.uk/sites/default/files/2020-11/WRAP-National%20municipal%20waste%20composition_%20England%202017.pdf
3	The following is assumed for MSW biogenic carbon, non-biogenic (fossil) carbon and Net Calorific Value (NCV) values used in the assessment: - The separate WRAP categories for 'Recyclable Paper' and 'Card' are assumed to be equivalent to the WRATE category for 'Paper and Card' - The WRAP categories for 'Other Organic' and 'Wood' wastes are assumed to be equivalent to the WRATE category for 'Garden Organics' - The WRAP category for 'Other Waste' is assumed to be equivalent to the WRATE category for 'Misc Non-Combustibles'. - Assumed no carbon content or NCV for metals	WRAP 2020, National Municipal Waste Composition, England 2017, Table 3 https://wrap.org.uk/sites/default/files/2020-11/WRAP-National%20municipal%20waste%20composition_%20England%202017.pdf WRATE (2011), Greenhouse Gas Calculator for Municipal Waste. WRATE v2. (provided by MVV) Zero Waste Scotland, 2020, The climate change impacts of burning municipal waste in Scotland - Technical Report, Table 2 The estimated composition and carbon content of municipal waste in Scotland in 2018 https://www.zerowastescotland.org.uk/content/climate-change-impact-burning-municipal-waste-scotland
4	The Proposed Development is based on receiving 625,000 tonnes of residual (non-recyclable) waste per annum at a NCV of 9.53 MJ/kg. The net electricity generation for the EfW CHP Facility, operating in electricity only mode is 55 MWe (allowing for 5 MWe parasitic load. The EfW CHP Facility is designed to maintain a constant fuel input capacity, so the quantity of waste inputs may be adjusted according to the calorific value of the material. i.e. less waste may be required for material with a higher calorific value and vice versa.	Based on design information confirmed by MVV 02Feb22 (Medworth ES - questions for MVV_SG.docx) and NCV value calculated from WRAP and WRATE info
5	The GHG assessment includes an esimate of N_2O and CH_4 emissions associated with Stationary Combustion Processes, based on IPCC Guidelines for Greenhouse Gas Inventories and factors for Global Warming Potential (GWP): - N_2O default emissions factor for Stationary Combustion, municipal wastes (non-biomass fraction) = 4 kg N_2O/TJ - N_2O to CO_2 GWP = 265 kg CO_{2e} /kg N_2O - CH_4 default emissions factor for Stationary Combustion, municipal wastes (non-biomass fraction) = 30 kg CH_4/TJ - CH_4 to CO_2 GWP = 28 kg CO_{2e} /kg CH_4	IPCC 2006. IPCC Guidelines for Greenhouse Gas Inventories, Vol 2, table 2.2 Default Emissions Factors for Stationary Combustion in the Energy Industries https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf IPCC 2014. IPCC 5th Assessment Report (AR5) https://www.ipcc.ch/pdf/assessmentreport/ar5/wg1/WG1AR5_Chapter08_FINAL.pdf
6	The GHG assessment includes an estimate of GHG emissions for the use of fuel in auxiliary burners during the start-up and shut-down of the EfW CHP Facility. It is assumed that: - The EfW CHP Facility would use 1,939,360 litres per annum of gas oil (diesel), 90% of which would be used for the auxiliary burners and the remaining 10% would be used for maintenance, repair, replacement and refurbishment activities. - 'Gas Oil' represents the type of fuel that would be used in the auxilliary burners, with an equivalent CO2 emissions factor of 2.75857 kgCO2e/litre (BEIS 2021)	Based on design information confirmed by MVV 02Feb22 (Medworth ES - questions for MVV_SG.docx) BEIS UK Government GHG Conversion Factors for Company Reporting 2021 https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2021
7	The GHG assement includes an estimate of GHG emissions offset by electricty generated by the EfW (the benefits for generated heat is not included in the main GHG assessment). It is assumed that: - the net electrical output for export to local users and the national grid is 55MWe (allowing 5MWe for parasitic load) - for the assessment it is assumed that the EFW Facility would operate for a miniumum of 8,000 hrs per year (not stated in the PEIR) - electricity generated by the EfW Facility would displace the use of UK gid average electricity with an equivalent CO2 emissions factor of 182 g/kWh (BEIS 2020-2021)	Based on design information confirmed by MVV 02Feb22 (Medworth ES - questions for MVV_SG.docx) BEIS Fuel Mix Disclosure Data Table 2020-2021 https://www.gov.uk/government/publications/fuel-mix-disclosure-data-table
8	The estimate of GHG emissions associated with landfill disposal of residual waste and electricty generation from landfill gas (LFG) is based on the following factors referenced in a DEFRA report on landfill methane emissions modelling based on a UK scenario: - The percentage of biogenic carbon which is converted to LFG is 50% - The ratio of methane to carbon dioxide in UK landfill gas is calculated to be 57:43% rather than the generally assumed 50:50% - The quantum of methane that is flared from operational sites with landfill gas utliisation is estimated to be 1/11th of the methane utilised in gas engines. (i.e. 9.1%) - Net electrical efficiency assumption of 36% (including losses for parasitic load) - The collection efficiency for a subset of modern, large landfill operations in the UK is 68% (data from 2011) - Landfill Methane Oxidation. It is recommended that until further measurements are made at UK landfill sites, the IPCC default value for methane oxidation of 10% is retained.	DEFRA 2014. DEFRA Review of Landfill Methane Emissions Modelling http://randd.defra.gov.uk/Document.aspx?Document=12439_WR1908ReviewofMethaneEmissionsModelling.pdf
9	The GHG assement includes an estimate of GHG emissions offset by electricty generated by the use of LFG in gas engines at landfill sites. It is assumed that: - the calorific value of methane is 50 MJ/kg - electricity generated by the EfW Facility would displace the use of Natural Gas with an equivalent CO2 emissions factor of 371 g/kWh (BEIS 2019-2020)	DEFRA 2014. DEFRA Review of Landfill Methane Emissions Modelling http://randd.defra.gov.uk/Document.aspx?Document=12439_WR1908ReviewofMethaneEmissionsModelling.pdf
	For the sensitivity analysis: - ***Waste composition:*** two additional waste compostion scenarios are assumed: Reduced Recyclables - assuming a 20% increase in recyclables, and Reducedfood/plastics - assuming a further 90% increase in recycling of food/plastics.	BEIS Fuel Mix Disclosure Data Table 2020-2021 https://www.gov.uk/government/publications/fuel-mix-disclosure-data-table
	- ***UK grid decarbonisation:*** Current CO2 emissions factors for: UK Grid average electricity =182 g/kWh; and Natural Gas =380 g/kWh (BEIS 2020-2021). Future forecast CO2 emissions factors UK Grid average electricity = 23 g/kWh in 2035; and 6 g/kWh in 2050 (BEIS 2021: Treasury Green Book – Data Tables 1-19)	BEIS (2021). Treasury Green Book – Data Tables 1-19 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1024043/data-tables-1-19.xlsx.
	- ***CHP - steam generation:*** information provided by MVV for the CHP design for exporting steam assumes export of 48.8MWe (allowing for 5MWe parasitic load) and 23.6 MWth of steam. Avoided emissions from steam generation are assumed to replace the use of Natural Gas up to 2035, with a CO2 emissions factor for Natural Gas = 202.97 g/kWh (BEIS: GHG reporting conversion factors 2021), and assumed to replace electricity in 2050, with a CO2 emissions factor for UK grid electricity in 2050 = 6 g/kWh (BEIS 2021: Treasury Green Book – Data Tables 1-19).	Based on design information confirmed for steam generation by MVV 02Feb22 (Medworth ES - questions for MVV_SG.docx) BEIS (2021). Greenhouse gas reporting: conversion factors 2021 https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2021

Waste Composition (incl. sensitivity cases) page 2 of 6

Core case

Waste Material GHG Assessment

1) Residual Waste Composition Data

Waste Stream	WRAP 2017 Residual Waste (UK Grid - Emissions Factor)
Recyclable Paper	5.9%
Card	6.3%
Non-recyclable Paper	8.9%
Dense Plastic	7.8%
Plastic film	8.2%
Textiles	5.5%
Misc. Combustible	9.3%
Misc. Non-Combustible	3.6%
Other Wastes	0.3%
Glass	2.6%
Ferrous Metals	2.4%
Non-Ferrous Metals	1.1%
Food Waste	27.0%
Garden Waste	2.7%
Other Organic	2.3%
Wood	2.3%
WEEE	1.1%
Hazardous	0.5%
Fines	2.2%
Net Calorific Value (MJ/kg)	9.53
Total waste input (tonnes/yr)	625,600
Total Carbon (% by weight)	26.20%
Biogenic Carbon (% of Total Carbon)	57.20%
Non-Biogenic Carbon (% of Total Carbon)	42.80%

2) Net carbon emissions from residual waste combustion in EfW Facility

Parameter	WRAP 2017 Residual Waste (UK Grid - Emissions Factor)
Total waste input (tonnes/yr)	625,600
Total Carbon (% by weight)	26.20%
Non-Biogenic Carbon (% of Total Carbon)	42.80%
Mass of fossil carbon in residual waste (tonnes carbon)	70,142
Fossil derived CO2 emissions (tCO2)	257,187
N2O emissions from residual waste combustion (tonnes)	24
Equivalent CO2 emissions (tCO2e)	6,318
CH4 emissions from residual waste combustion (tonnes)	179
Equivalent CO2 emissions (tCO2e)	5,007
Auxilliary Burners - Fuel: Gas Oil (litres)	1,745,424
Auxilliary Burners - emissions for use of fuel (tCO2e)	*4,815*
EfW Total emissions (tCO2e)	**273,326**
EfW Facility electricity generation (MWe)	55
EfW Facility operations (hrs/yr)	8,000
Electricity generated by EfW Facility (MWh)	440,000
CO2 emissions factor for energy generation (g/kWh)	182
EfW Equivalent CO2 offset for electricity generation by Facility (tCO2e)	**80,080**
EfW Net emissions (tCO2e)	**193,246**
Annual difference versus LFG	-73,952

3) Net carbon emissions from landfilling residual waste and LFG combustion

Parameter	WRAP 2017 Residual Waste (UK Grid - Emissions Factor)
Mass of biogenic carbon in residual waste (tonnes carbon)	93,735
Total carbon converted to LFG (tonnes carbon)	46,867
Methane in LFG released from residual waste (tCH4)	35,619
Methane in LFG captured for use in gas engines (tCH4)	24,221
Uncaptured LFG oxidised to CO2 in landfill cap (tCH4)	1,140
Uncaptured LFG released to atmosphere as methane (tCH4)	10,258
LFG Equivalent CO2 emissions released to atmosphere (tCO2e)	**287,234**
Methane in LFG captured for use in gas engines (tCH4)	24,221
Methane used in gas engines (tCH4)	22,017
Fuel input to LFG engines (GJ)	396,306
Power generated by LFG engines (MWh)	110,085
UK grid CO2 emissions factor for electricity generation (g/kWh)	182
LFG Equivalent CO2 offset for electricity generation from combustion (tCO2e)	**20,035**
LFG Net emissions (tCO2e)	**267,198**

EfW Parameters:

N2O Emissions Factor 4 kgN2O/TJ (IPCC)	4
N20 Global Warming Potential (kgCO2e / kgN2O)	265
CH4 Emissions Factor 4 kgCH4/TJ (IPCC)	30
CH4 Global Warming Potential (kgCO2e / kgCH4)	28
EfW Total themal capacity (MW)	200
Total Gas Oil (diesel) consumption (litres)	1,939,360
Auxilliary burners - % of annual Gas Oil consumption	90%
Fuel (Gas Oil) emissions factor (kgCO2e/kWh)	0.2731
Fuel (Gas Oil) emissions factor (kgCO2e/litre)	2.75857

LFG Parameters:

Calorific value of methane (MJ/kg)	50
Biogenic carbon in resdual waste converted to landfill gas (LFG)	50%
Proprtion of methane in LFG	57%
Proportion of LFG recovered from residual waste	68%
Oxidation of LFG released from residual waste to CO2 in landfill cap	10%
Proportion of LFG used in gas engines	91%
LFG engine efficiency: 36%	36%

Waste Composition (incl. sensitivity cases) page 3 of 6

Waste Material GHG Assessment

Core case - sensitivity

1) Residual Waste Composition Data

Waste Stream	Case 1: Core WRAP 2017
Recyclable Paper	5.9%
Card	6.3%
Non-recyclable Paper	8.9%
Dense Plastic	7.8%
Plastic film	8.2%
Textiles	5.5%
Misc. Combustible	9.3%
Misc. Non-Combustible	3.6%
Other Wastes	0.3%
Glass	2.6%
Ferrous Metals	2.4%
Non-Ferrous Metals	1.1%
Food Waste	27.0%
Garden Waste	2.7%
Other Organic	2.3%
Wood	2.3%
WEEE	1.1%
Hazardous	0.5%
Fines	2.2%
Net Calorific Value (MJ/kg)	9.53
Total waste input (tonnes/yr)	625,600
Total Carbon (% by weight)	26.20%
Biogenic Carbon (% of Total Carbon)	57.20%
Non-Biogenic Carbon (% of Total Carbon)	42.80%

1) Core Waste Composition	UK Grid Emissions Factor (gCO2e/kWh)			
	Current: gas	Current: ave	2035	2050
	380	182	23	6
Electricity only	139,275	73,952	21,496	15,887
CHP	158,748	103,246	58,675	16,722
	Core Case: % change	73,952		
Electricity only	88%	0%	-71%	-79%
CHP	115%	40%	-21%	-77%
	Core Case: relative change		>100%: +++/----	
			>50%: ++/---	
			>0%: +/-	
Electricity only	++		--	--
CHP	+++	+	-	--

Additional sensitivity parameters:

CO2 emissions factor for electricity generation - UK grid (g/kWh)	380	182	23	6	380	182	23	6
CO2 emissions factor for heat generation - natural gas (g/kWh)	202.97	202.97	202.97	6	202.97	202.97	202.97	6
CHP (MWe)	60	60	60	60	53.8	53.8	53.8	53.8
CHP (MWth)	0	0	0	0	23.6	23.6	23.6	23.6
EfW vs Landfill difference (tCO2e)	139,275	73,952	21,496	15,887	158,748	103,246	58,675	16,722
EfW vs Landfill difference (tCO2e/tonne of waste)	0.22	0.12	0.03	0.03	0.25	0.17	0.09	0.03

2) Net carbon emissions from residual waste combustion in EfW Facility

Parameter	Case 1: Core WRAP 2017	Case 1: Core WRAP 2017	Case 1: Core WRAP 2017	Case 1: Core WRAP 2017	Case 1: Core WRAP 2017	Case 1: Core WRAP 2017	Case 1: Core WRAP 2017	Case 1: Core WRAP 2017
Total waste input (tonnes/yr)	625,600	625,600	625,600	625,600	625,600	625,600	625,600	625,600
Total Carbon (% by weight)	26.20%	26.20%	26.20%	26.20%	26.20%	26.20%	26.20%	26.20%
Non-Biogenic Carbon (% of Total Carbon)	42.80%	42.80%	42.80%	42.80%	42.80%	42.80%	42.80%	42.80%
Mass of fossil carbon in residual waste (tonnes carbon)	70,142	70,142	70,142	70,142	70,142	70,142	70,142	70,142
Fossil derived CO_2 emissions (tCO_2)	257,187	257,187	257,187	257,187	257,187	257,187	257,187	257,187
N_2O emissions from residual waste combustion	24	24	24	24	24	24	24	24
Equivalent CO_2 emissions (tCO_{2e})	6,318	6,318	6,318	6,318	6,318	6,318	6,318	6,318
CH_4 emissions from residual waste combustion	179	179	179	179	179	179	179	179
Equivalent CO_2 emissions (tCO_{2e})	5,007	5,007	5,007	5,007	5,007	5,007	5,007	5,007
Auxilliary Burners - Fuel: Gas Oil (litres)	1,745,424	1,745,424	1,745,424	1,745,424	1,745,424	1,745,424	1,745,424	1,745,424
Auxilliary Burners (MWh)								
Auxilliary Burners - emissions for use of fuel (tCO_{2e})	*4,815*	*4,815*	*4,815*	*4,815*	*4,815*	*4,815*	*4,815*	*4,815*
EfW Total emissions (tCO_{2e})	**273,326**	**273,326**	**273,326**	**273,326**	**273,326**	**273,326**	**273,326**	**273,326**
EfW Facility operations (hrs/yr)	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000
EfW Facility net electricity generation (MWe)	55	55	55	55	49	49	48.8	48.8
Electricity generated by EfW Facility (MWh)	440,000	440,000	440,000	440,000	390,400	390,400	390,400	390,400
CO2 emissions factor for electricity generation (g/kWh)	380	182	23	6	380	182	23	6
EfW Equivalent CO_2 offset for electricity generation by Facility (tCO_{2e})	*167,200*	*80,080*	*10,120*	*2,640*	*148,352*	*71,053*	*8,979*	*2,342*
EfW Facility heat generation (MWh)	0	0	0	0	24	24	23.6	23.6
Heat exported by EfW facility (MWh)	0	0	0	0	188,800	188,800	188,800	188,800
CO2 emissions factor for heat generation (g/kWh) - gas: current/2035, elec: 2050	203	203	203	6	203	203	203	6
EfW Equivalent CO_2 offset for heat generation by Facility (tCO_{2e})	*0*	*0*	*0*	*0*	*38,321*	*38,321*	*38,321*	*1,133*
EfW Equivalent CO_2 offset for energy generation by Facility (tCO_{2e})	**167,200**	**80,080**	**10,120**	**2,640**	**186,673**	**109,374**	**47,300**	**3,475**
EfW Net emissions (tCO_{2e})	**106,126**	**193,246**	**263,206**	**270,686**	**86,654**	**163,953**	**226,026**	**269,851**

3) Net carbon emissions from landfilling residual waste and LFG combustion

Parameter	Case 1: Core WRAP 2017	Case 1: Core WRAP 2017	Case 1: Core WRAP 2017	Case 1: Core WRAP 2017	Case 1: Core WRAP 2017	Case 1: Core WRAP 2017	Case 1: Core WRAP 2017	Case 1: Core WRAP 2017
Mass of biogenic carbon in residual waste (tonnes carbon)	93,735	93,735	93,735	93,735	93,735	93,735	93,735	93,735
Total carbon converted to LFG (tonnes carbon)	46,867	46,867	46,867	46,867	46,867	46,867	46,867	46,867
Methane in LFG released from residual waste (tCH_4)	35,619	35,619	35,619	35,619	35,619	35,619	35,619	35,619
Methane in LFG captured for use in gas engines (tCH_4)	24,221	24,221	24,221	24,221	24,221	24,221	24,221	24,221
Uncaptured LFG oxidised to CO_2 in landfill cap (tCH_4)	1,140	1,140	1,140	1,140	1,140	1,140	1,140	1,140
Uncaptured LFG released to atmosphere as methane (tCH_4)	10,258	10,258	10,258	10,258	10,258	10,258	10,258	10,258
LFG Equivalent CO_2 emissions released to atmosphere (tCO_{2e})	**287,234**	**287,234**	**287,234**	**287,234**	**287,234**	**287,234**	**287,234**	**287,234**
Methane in LFG captured for use in gas engines (tCH_4)	24,221	24,221	24,221	24,221	24,221	24,221	24,221	24,221
Methane used in gas engines (tCH_4)	22,017	22,017	22,017	22,017	22,017	22,017	22,017	22,017
Fuel input to LFG engines (GJ)	396,306	396,306	396,306	396,306	396,306	396,306	396,306	396,306
Power generated by LFG engines (MWh)	110,085	110,085	110,085	110,085	110,085	110,085	110,085	110,085
CO2 emissions factor for energy generation (g/kWh)	380	182	23	6	380	182	23	6
LFG Equivalent CO_2 offset for electricity generation from combustion (tCO_{2e})	**41,832**	**20,035**	**2,532**	**661**	**41,832**	**20,035**	**2,532**	**661**
LFG Net emissions (tCO_{2e})	**245,402**	**267,198**	**284,702**	**286,573**	**245,402**	**267,198**	**284,702**	**286,573**

EfW Parameters:

N_2O Emissions Factor 4 kgN_2O/TJ (IPCC)	4	4	4	4	4	4	4	4
N_20 Global Warming Potential ($kgCO_{2e}$ / kgN_2O)	265	265	265	265	265	265	265	265
CH_4 Emissions Factor 4 $kgCH_4/TJ$ (IPCC)	30	30	30	30	30	30	30	30
CH_4 Global Warming Potential ($kgCO_{2e}$ / $kgCH_4$)	28	28	28	28	28	28	28	28
Total Gas Oil (diesel) consumption (litres)	1,939,360	1,939,360	1,939,360	1,939,360	1,939,360	1,939,360	1,939,360	1,939,360
Auxilliary burners - % of annual Gas Oil consumption	90%	90%	90%	90%	90%	90%	90%	90%
Fuel (Gas Oil) emissions factor ($kgCO_2e$/kWh)	0.2731	0.2731	0.2731	0.2731	0.2731	0.2731	0.2731	0.2731
Fuel (Gas Oil) emissions factor ($kgCO_2e$/litre)	2.75857	2.75857	2.75857	2.75857	2.75857	2.75857	2.75857	2.75857

LFG Parameters:

Calorific value of methane (MJ/kg)	50	50	50	50	50	50	50	50
Biogenic carbon in resdual waste converted to landfill gas (LFG)	50%	50%	50%	50%	50%	50%	50%	50%
Proprtion of methane in LFG	57%	57%	57%	57%	57%	57%	57%	57%
Proportion of LFG recovered from residual waste	68%	68%	68%	68%	68%	68%	68%	68%
Oxidation of LFG released from residual waste to CO_2 in landfill cap	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%
Proportion of LFG used in gas engines	91%	91%	91%	91%	91%	91%	91%	91%
LFG engine efficiency: 36%	36%	36%	36%	36%	36%	36%	36%	36%

Reduced recyclables - sensitivity

Waste Composition (incl. sensitivity cases) page 4 of 6

Waste Material GHG Assessment

1) Residual Waste Composition Data

Waste Stream	Case 2: 20% Recyclables
Recyclable Paper	5.5%
Card	5.9%
Non-recyclable Paper	10.4%
Dense Plastic	7.3%
Plastic film	7.7%
Textiles	5.1%
Misc. Combustible	10.9%
Misc. Non-Combustible	4.2%
Other Wastes	0.4%
Glass	2.4%
Ferrous Metals	2.2%
Non-Ferrous Metals	1.0%
Food Waste	25.2%
Garden Waste	2.5%
Other Organic	2.7%
Wood	2.1%
WEEE	1.3%
Hazardous	0.6%
Fines	2.6%
Net Calorific Value (MJ/kg)	9.50
Total waste input (tonnes/yr)	625,600
Total Carbon (% by weight)	26.21%
Biogenic Carbon (% of Total Carbon)	58.35%
Non-Biogenic Carbon (% of Total Carbon)	41.65%

2) 20% recyclables reduction	UK Grid Emissions Factor (gCO2e/kWh) Current: gas 380	Current: ave 182	2035 23	2050 6
Electricity only	151,217	86,351	34,261	28,692
CHP	170,689	115,644	71,441	29,527
Core Case: % change		73,952		
Electricity only	104%	17%	-54%	-61%
CHP	131%	56%	-3%	-60%
Core Case: relative change		>100%: +++/---- >50%: ++/--- >0%: +/-		
Electricity only	+++	+	--	--
CHP	+++	++	-	--

Additional sensitivity parameters:

CO2 emissions factor for electricity generation - UK grid (g/kWh)	380	182	23	6	380	182	23	6
CO2 emissions factor for heat generation - natural gas (g/kWh)	202.97	202.97	202.97	6	202.97	202.97	202.97	6
CHP (MWe)	60	60	60	60	53.8	53.8	53.8	53.8
CHP (MWth)	0	0	0	0	23.6	23.6	23.6	23.6
EfW vs Landfill difference (tCO2e)	151,217	86,351	34,261	28,692	170,689	115,644	71,441	29,527
EfW vs Landfill difference (tCO2e/tonne of waste)	0.24	0.14	0.05	0.05	0.27	0.18	0.11	0.05

2) Net carbon emissions from residual waste combustion in EfW Facility

Parameter	Case 2: 20% Recyclables	Case 2: 20% Recyclables	Case 2: 20% Recyclables	Case 2: 20% Recyclables	Case 2: 20% Recyclables	Case 2: 20% Recyclables	Case 2: 20% Recyclables	Case 2: 20% Recyclables
Total waste input (tonnes/yr)	625,600	625,600	625,600	625,600	625,600	625,600	625,600	625,600
Total Carbon (% by weight)	26.21%	26.21%	26.21%	26.21%	26.21%	26.21%	26.21%	26.21%
Non-Biogenic Carbon (% of Total Carbon)	41.65%	41.65%	41.65%	41.65%	41.65%	41.65%	41.65%	41.65%
Mass of fossil carbon in residual waste (tonnes carbon)	68,298	68,298	68,298	68,298	68,298	68,298	68,298	68,298
Fossil derived CO_2 emissions (tCO_2)	250,425	250,425	250,425	250,425	250,425	250,425	250,425	250,425
N_2O emissions from residual waste combustion	24	24	24	24	24	24	24	24
Equivalent CO_2 emissions (tCO_{2e})	6,301	6,301	6,301	6,301	6,301	6,301	6,301	6,301
CH_4 emissions from residual waste combustion	178	178	178	178	178	178	178	178
Equivalent CO_2 emissions (tCO_{2e})	4,993	4,993	4,993	4,993	4,993	4,993	4,993	4,993
Auxilliary Burners - Fuel: Gas Oil (litres)	1,745,424	1,745,424	1,745,424	1,745,424	1,745,424	1,745,424	1,745,424	1,745,424
Auxilliary Burners (MWh)								
Auxilliary Burners - emissions for use of fuel (tCO_{2e})	*4,815*	*4,815*	*4,815*	*4,815*	*4,815*	*4,815*	*4,815*	*4,815*
EfW Total emissions (tCO_{2e})	**266,534**	**266,534**	**266,534**	**266,534**	**266,534**	**266,534**	**266,534**	**266,534**
EfW Facility operations (hrs/yr)	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000
EfW Facility net electricity generation (MWe)	55	55	55	55	48.8	48.8	48.8	48.8
Electricity generated by EfW Facility (MWh)	440,000	440,000	440,000	440,000	390,400	390,400	390,400	390,400
CO2 emissions factor for electricity generation (g/kWh)	380	182	23	6	380	182	23	6
EfW Equivalent CO_{2e} offset for electricity generation by Facility (tCO_{2e})	*167,200*	*80,080*	*10,120*	*2,640*	*148,352*	*71,053*	*8,979*	*2,342*
EfW Facility heat generation (MWth)	0	0	0	0	23.6	23.6	23.6	23.6
Heat exported by EfW facility (MWh)	0	0	0	0	188,800	188,800	188,800	188,800
CO2 emissions factor for heat generation (g/kWh) - gas: current/2035, elec: 2050	203	203	203	6	203	203	203	6
EfW Equivalent CO_{2e} offset for heat generation by Facility (tCO_{2e})	*0*	*0*	*0*	*0*	*38,321*	*38,321*	*38,321*	*1,133*
EfW Equivalent CO_2 offset for energy generation by Facility (tCO_{2e})	**167,200**	**80,080**	**10,120**	**2,640**	**186,673**	**109,374**	**47,300**	**3,475**
EfW Net emissions (tCO_{2e})	**99,334**	**186,454**	**256,414**	**263,894**	**79,861**	**157,160**	**219,234**	**263,059**

3) Net carbon emissions from landfilling residual waste and LFG combustion

Parameter	Case 2: 20% Recyclables	Case 2: 20% Recyclables	Case 2: 20% Recyclables	Case 2: 20% Recyclables	Case 2: 20% Recyclables	Case 2: 20% Recyclables	Case 2: 20% Recyclables	Case 2: 20% Recyclables
Mass of biogenic carbon in residual waste (tonnes carbon)	95,702	95,702	95,702	95,702	95,702	95,702	95,702	95,702
Total carbon converted to LFG (tonnes carbon)	47,851	47,851	47,851	47,851	47,851	47,851	47,851	47,851
Methane in LFG released from residual waste (tCH_4)	36,367	36,367	36,367	36,367	36,367	36,367	36,367	36,367
Methane in LFG captured for use in gas engines (tCH_4)	24,729	24,729	24,729	24,729	24,729	24,729	24,729	24,729
Uncaptured LFG oxidised to CO_2 in landfill cap (tCH_4)	1,164	1,164	1,164	1,164	1,164	1,164	1,164	1,164
Uncaptured LFG released to atmosphere as methane (tCH_4)	10,474	10,474	10,474	10,474	10,474	10,474	10,474	10,474
LFG Equivalent CO_2 emissions released to atmosphere (tCO_{2e})	**293,260**	**293,260**	**293,260**	**293,260**	**293,260**	**293,260**	**293,260**	**293,260**
Methane in LFG captured for use in gas engines (tCH_4)	24,729	24,729	24,729	24,729	24,729	24,729	24,729	24,729
Methane used in gas engines (tCH_4)	22,479	22,479	22,479	22,479	22,479	22,479	22,479	22,479
Fuel input to LFG engines (GJ)	404,621	404,621	404,621	404,621	404,621	404,621	404,621	404,621
Power generated by LFG engines (MWh)	112,395	112,395	112,395	112,395	112,395	112,395	112,395	112,395
CO2 emissions factor for energy generation (g/kWh)	380	182	23	6	380	182	23	6
LFG Equivalent CO_2 offset for electricity generation from combustion (tCO_{2e})	**42,710**	**20,456**	**2,585**	**674**	**42,710**	**20,456**	**2,585**	**674**
LFG Net emissions (tCO_{2e})	**250,550**	**272,804**	**290,675**	**292,586**	**250,550**	**272,804**	**290,675**	**292,586**

EfW Parameters:

N_2O Emissions Factor 4 kgN_2O/TJ (IPCC)	4	4	4	4	4	4	4	4
N_20 Global Warming Potential ($kgCO_{2e}$ / kgN_2O)	265	265	265	265	265	265	265	265
CH_4 Emissions Factor 4 $kgCH_4/TJ$ (IPCC)	30	30	30	30	30	30	30	30
CH_4 Global Warming Potential ($kgCO_{2e}$ / $kgCH_4$)	28	28	28	28	28	28	28	28
Total Gas Oil (diesel) consumption (litres)	1,939,360	1,939,360	1,939,360	1,939,360	1,939,360	1,939,360	1,939,360	1,939,360
Auxilliary burners - % of annual Gas Oil consumption	90%	90%	90%	90%	90%	90%	90%	90%
Fuel (Gas Oil) emissions factor ($kgCO_2e$/kWh)	0.2731	0.2731	0.2731	0.2731	0.2731	0.2731	0.2731	0.2731
Fuel (Gas Oil) emissions factor ($kgCO_2e$/litre)	2.75857	2.75857	2.75857	2.75857	2.75857	2.75857	2.75857	2.75857

LFG Parameters:

Calorific value of methane (MJ/kg)	50	50	50	50	50	50	50	50
Biogenic carbon in resdual waste converted to landfill gas (LFG)	50%	50%	50%	50%	50%	50%	50%	50%
Proprtion of methane in LFG	57%	57%	57%	57%	57%	57%	57%	57%
Proportion of LFG recovered from residual waste	68%	68%	68%	68%	68%	68%	68%	68%
Oxidation of LFG released from residual waste to CO_2 in landfill cap	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%
Proportion of LFG used in gas engines	91%	91%	91%	91%	91%	91%	91%	91%
LFG engine efficiency: 36%	36%	36%	36%	36%	36%	36%	36%	36%

Reduced food and plastic - sensitivity

Waste Composition (incl. sensitivity cases) page 5 of 6

Waste Material GHG Assessment

1) Residual Waste Composition Data

Waste Stream	Case 3: 90% Food/Plastic
Recyclable Paper	8.5%
Card	9.1%
Non-recyclable Paper	16.0%
Dense Plastic	1.4%
Plastic film	1.5%
Textiles	7.9%
Misc. Combustible	16.7%
Misc. Non-Combustible	6.5%
Other Wastes	0.5%
Glass	3.7%
Ferrous Metals	3.5%
Non-Ferrous Metals	1.6%
Food Waste	4.9%
Garden Waste	3.9%
Other Organic	4.1%
Wood	3.3%
WEEE	2.0%
Hazardous	0.9%
Fines	4.0%
Net Calorific Value (MJ/kg)	8.85
Total waste input (tonnes/yr)	625,600
Total Carbon (% by weight)	25.49%
Biogenic Carbon (% of Total Carbon)	74.58%
Non-Biogenic Carbon (% of Total Carbon)	25.42%

3) 90% of food & plastics

Electricity only	314,582
CHP	334,055
Electricity only	325%
CHP	352%
Electricity only	+++
CHP	+++

UK Grid Emissions Factor (gCO2e/kWh)

Current: gas	Current: ave	2035	2050
380	182	23	6
314,582	255,113	207,358	202,253
334,055	284,407	244,538	203,088
	73,952		
325%	245%	180%	173%
352%	285%	231%	175%
+++	+++	+++	+++
+++	+++	+++	+++

Core Case: % change

Core Case: relative change

>100%: +++/----
>50%: ++/---
>0%: +/-

Additional sensitivity parameters:

CO2 emissions factor for electricity generation - UK grid (g/kWh)	380	182	23	6	380	182	23	6
CO2 emissions factor for heat generation - natural gas (g/kWh)	202.97	202.97	202.97	6	202.97	202.97	202.97	6
Methane capture rate (%)	68%	68%	68%	68%	68%	68%	68%	68%
CHP (MWe)	60	60	60	60	53.8	53.8	53.8	53.8
CHP (MWth)	0	0	0	0	23.6	23.6	23.6	23.6
EfW vs Landfill difference (tCO2e)	314,582	255,113	207,358	202,253	334,055	284,407	244,538	203,088
EfW vs Landfill difference (tCO2e/tonne of waste)	0.50	0.41	0.33	0.32	0.53	0.45	0.39	0.32

2) Net carbon emissions from residual waste combustion in EfW Facility

Parameter	Case 3: 90% Food/Plastic	Case 3: 90% Food/Plastic	Case 3: 90% Food/Plastic	Case 3: 90% Food/Plastic	Case 3: 90% Food/Plastic	Case 3: 90% Food/Plastic	Case 3: 90% Food/Plastic	Case 3: 90% Food/Plastic
Total waste input (tonnes/yr)	625,600	625,600	625,600	625,600	625,600	625,600	625,600	625,600
Total Carbon (% by weight)	25.49%	25.49%	25.49%	25.49%	25.49%	25.49%	25.49%	25.49%
Non-Biogenic Carbon (% of Total Carbon)	25.42%	25.42%	25.42%	25.42%	25.42%	25.42%	25.42%	25.42%
Mass of fossil carbon in residual waste (tonnes carbon)	40,528	40,528	40,528	40,528	40,528	40,528	40,528	40,528
Fossil derived CO_2 emissions (tCO_2)	148,603	148,603	148,603	148,603	148,603	148,603	148,603	148,603
N_2O emissions from residual waste combustion	22	22	22	22	22	22	22	22
Equivalent CO_2 emissions (tCO_{2e})	5,868	5,868	5,868	5,868	5,868	5,868	5,868	5,868
CH_4 emissions from residual waste combustion	166	166	166	166	166	166	166	166
Equivalent CO_2 emissions (tCO_{2e})	4,650	4,650	4,650	4,650	4,650	4,650	4,650	4,650
Auxilliary Burners - Fuel: Gas Oil (litres)	1,745,424	1,745,424	1,745,424	1,745,424	1,745,424	1,745,424	1,745,424	1,745,424
Auxilliary Burners (MWh)								
Auxilliary Burners - emissions for use of fuel (tCO_{2e})	*4,815*	*4,815*	*4,815*	*4,815*	*4,815*	*4,815*	*4,815*	*4,815*
EfW Total emissions (tCO_{2e})	**163,935**	**163,935**	**163,935**	**163,935**	**163,935**	**163,935**	**163,935**	**163,935**
EfW Facility operations (hrs/yr)	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000
EfW Facility net electricity generation (MWe)	55	55	55	55	48.8	48.8	48.8	48.8
Electricity generated by EfW Facility (MWh)	440,000	440,000	440,000	440,000	390,400	390,400	390,400	390,400
CO2 emissions factor for electricity generation (g/kWh)	380	182	23	6	380	182	23	6
EfW Equivalent CO_2 offset for electricity generation by Facility (tCO_{2e})	*167,200*	*80,080*	*10,120*	*2,640*	*148,352*	*71,053*	*8,979*	*2,342*
EfW Facility heat generation (MWth)	0	0	0	0	23.6	23.6	23.6	23.6
Heat exported by EfW facility (MWh)	0	0	0	0	188,800	188,800	188,800	188,800
CO2 emissions factor for heat generation (g/kWh) - gas: current/2035, elec: 2050	203	203	203	6	203	203	203	6
EfW Equivalent CO_2 offset for heat generation by Facility (tCO_{2e})	*0*	*0*	*0*	*0*	*38,321*	*38,321*	*38,321*	*1,133*
EfW Equivalent CO_2 offset for energy generation by Facility (tCO_{2e})	**167,200**	**80,080**	**10,120**	**2,640**	**186,673**	**109,374**	**47,300**	**3,475**
EfW Net emissions (tCO_{2e})	**-3,265**	**83,855**	**153,815**	**161,295**	**-22,738**	**54,562**	**116,635**	**160,460**

3) Net carbon emissions from landfilling residual waste and LFG combustion

Parameter	Case 3: 90% Food/Plastic	Case 3: 90% Food/Plastic	Case 3: 90% Food/Plastic	Case 3: 90% Food/Plastic	Case 3: 90% Food/Plastic	Case 3: 90% Food/Plastic	Case 3: 90% Food/Plastic	Case 3: 90% Food/Plastic
Mass of biogenic carbon in residual waste (tonnes carbon)	118,912	118,912	118,912	118,912	118,912	118,912	118,912	118,912
Total carbon converted to LFG (tonnes carbon)	59,456	59,456	59,456	59,456	59,456	59,456	59,456	59,456
Methane in LFG released from residual waste (tCH_4)	45,187	45,187	45,187	45,187	45,187	45,187	45,187	45,187
Methane in LFG captured for use in gas engines (tCH_4)	30,727	30,727	30,727	30,727	30,727	30,727	30,727	30,727
Uncaptured LFG oxidised to CO_2 in landfill cap (tCH_4)	1,446	1,446	1,446	1,446	1,446	1,446	1,446	1,446
Uncaptured LFG released to atmosphere as methane (tCH_4)	13,014	13,014	13,014	13,014	13,014	13,014	13,014	13,014
LFG Equivalent CO_2 emissions released to atmosphere (tCO_{2e})	**364,386**	**364,386**	**364,386**	**364,386**	**364,386**	**364,386**	**364,386**	**364,386**
Methane in LFG captured for use in gas engines (tCH_4)	30,727	30,727	30,727	30,727	30,727	30,727	30,727	30,727
Methane used in gas engines (tCH_4)	27,931	27,931	27,931	27,931	27,931	27,931	27,931	27,931
Fuel input to LFG engines (GJ)	502,755	502,755	502,755	502,755	502,755	502,755	502,755	502,755
Power generated by LFG engines (MWh)	139,654	139,654	139,654	139,654	139,654	139,654	139,654	139,654
CO2 emissions factor for energy generation (g/kWh)	380	182	23	6	380	182	23	6
LFG Equivalent CO_2 offset for electricity generation from combustion (tCO_{2e})	**53,069**	**25,417**	**3,212**	**838**	**53,069**	**25,417**	**3,212**	**838**
LFG Net emissions (tCO_{2e})	**311,317**	**338,969**	**361,174**	**363,548**	**311,317**	**338,969**	**361,174**	**363,548**

EfW Parameters:

N_2O Emissions Factor 4 kgN_2O/TJ (IPCC)	4	4	4	4	4	4	4	4
N_2O Global Warming Potential ($kgCO_{2e}$ / kgN_2O)	265	265	265	265	265	265	265	265
CH_4 Emissions Factor 4 $kgCH_4/TJ$ (IPCC)	30	30	30	30	30	30	30	30
CH_4 Global Warming Potential ($kgCO_{2e}$ / $kgCH_4$)	28	28	28	28	28	28	28	28
Total Gas Oil (diesel) consumption (litres)	1,939,360	1,939,360	1,939,360	1,939,360	1,939,360	1,939,360	1,939,360	1,939,360
Auxilliary burners - % of annual Gas Oil consumption	90%	90%	90%	90%	90%	90%	90%	90%
Fuel (Gas Oil) emissions factor ($kgCO_2e$/kWh)	0.2731	0.2731	0.2731	0.2731	0.2731	0.2731	0.2731	0.2731
Fuel (Gas Oil) emissions factor ($kgCO_2e$/litre)	2.75857	2.75857	2.75857	2.75857	2.75857	2.75857	2.75857	2.75857

LFG Parameters:

Calorific value of methane (MJ/kg)	50	50	50	50	50	50	50	50
Biogenic carbon in resdual waste converted to landfill gas (LFG)	50%	50%	50%	50%	50%	50%	50%	50%
Proprtion of methane in LFG	57%	57%	57%	57%	57%	57%	57%	57%
Proportion of LFG recovered from residual waste	68%	68%	68%	68%	68%	68%	68%	68%
Oxidation of LFG released from residual waste to CO_2 in landfill cap	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%
Proportion of LFG used in gas engines	91%	91%	91%	91%	91%	91%	91%	91%
LFG engine efficiency: 36%	36%	36%	36%	36%	36%	36%	36%	36%

Waste composition - sensitivity

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Case 1: Core Case - Current Residual Waste (WRAP survey, 2017)

Waste Stream	Municipal Residual Waste: Commercial and Household (% by weight)	Biogenic Carbon (% of waste stream)	Non-Biogenic Carbon (% of waste stream)	Net Calorific Value (MJ/kg)	Biogenic Carbon (% by weight)	Non-Biogenic Carbon (% by weight)	Total Carbon (% by weight)	Total NCV (MJ/kg)
Recyclable Paper	5.9%	31.27%		10.749	1.84%		1.84%	0.63
Card	6.3%	31.27%		10.749	1.97%		1.97%	0.68
Non-recyclable Paper	8.9%	28.69%		9.735	2.55%		2.55%	0.87
Dense Plastic	7.8%		54.76%	24.682		4.27%	4.27%	1.93
Plastic film	8.2%		48.11%	21.279		3.95%	3.95%	1.74
Textiles	5.5%	19.93%	19.93%	14.327	1.10%	1.10%	2.19%	0.79
Misc. Combustible	9.3%	23.69%	15.79%	14.612	2.20%	1.47%	3.67%	1.36
Misc. Non-Combustible	3.6%	2.94%	4.05%	2.573	0.11%	0.15%	0.25%	0.09
Other Wastes	0.3%	2.94%	4.05%	2.573	0.01%	0.01%	0.02%	0.01
Glass	2.6%	0.31%		1.414	0.01%		0.01%	0.04
Ferrous Metals	2.4%							0.00
Non-Ferrous Metals	1.1%							0.00
Food Waste	27.0%	13.46%		3.460	3.63%		3.63%	0.93
Garden Waste	2.7%	17.17%		4.210	0.46%		0.46%	0.11
Other Organic	2.3%	17.17%		4.210	0.39%		0.39%	0.10
Wood	2.3%	17.17%		4.210	0.39%		0.39%	0.10
WEEE	1.1%		15.81%	7.060		0.17%	0.17%	0.08
Hazardous	0.5%	0.61%	19.76%	0.000	0.00%	0.10%	0.10%	0.00
Fines	2.2%	13.75%		3.479	0.30%	0.00%	0.30%	0.08
Total	100.0%				15.0%	11.2%	26.2%	9.53
					57.20%	42.80%		

Case 2: Waste Composition Sensitivity Analysis - Future Residual Waste (65% of municipal waste is recycled by 2035, with 44.5% already recycled in 2019)

Waste Stream	Current Residual Waste: Commercial and Household (% by weight)	Future Waste: 20% reduction in paper, card, food, plastics, glass, metals, garden and wood in residual waste	Equivalent weight of residual waste (tonnes)	Future Residual Waste: (% by weight)	Biogenic Carbon (% of waste stream)	Non-Biogenic Carbon (% of waste stream)	Net Calorific Value (MJ/kg)	Biogenic Carbon (% by weight)	Non-Biogenic Carbon (% by weight)	Total Carbon (% by weight)	Total NCV (MJ/kg)
Recyclable Paper	5.9%	20.0%	0.047	5.5%	31.27%		10.749	1.72%		1.72%	0.59
Card	6.3%	20.0%	0.050	5.9%	31.27%		10.749	1.84%		1.84%	0.63
Non-recyclable Paper	8.9%		0.089	10.4%	28.69%		9.735	2.98%		2.98%	1.01
Dense Plastic	7.8%	20.0%	0.062	7.3%		54.76%	24.682		3.99%	3.99%	1.80
Plastic film	8.2%	20.0%	0.066	7.7%		48.11%	21.279		3.69%	3.69%	1.63
Textiles	5.5%	20.0%	0.044	5.1%	19.93%	19.93%	14.327	1.02%	1.02%	2.05%	0.74
Misc. Combustible	9.3%		0.093	10.9%	23.69%	15.79%	14.612	2.57%	1.71%	4.29%	1.59
Misc. Non-Combustible	3.6%		0.036	4.2%	2.94%	4.05%	2.573	0.12%	0.17%	0.29%	0.11
Other Wastes	0.3%		0.003	0.4%	2.94%	4.05%	2.573	0.01%	0.01%	0.02%	0.01
Glass	2.6%	20.0%	0.021	2.4%	0.31%		1.414	0.008%		0.008%	0.03
Ferrous Metals	2.4%	20.0%	0.019	2.2%							
Non-Ferrous Metals	1.1%	20.0%	0.009	1.0%							
Food Waste	27.0%	20.0%	0.216	25.2%	13.46%		3.460	3.39%		3.39%	0.87
Garden Waste	2.7%	20.0%	0.022	2.5%	17.17%		4.210	0.43%		0.43%	0.11
Other Organic	2.3%		0.023	2.7%	17.17%		4.210	0.46%		0.46%	0.11
Wood	2.3%	20.0%	0.018	2.1%	17.17%		4.210	0.37%		0.37%	0.09
WEEE	1.1%		0.011	1.3%		15.81%	7.060		0.20%	0.20%	0.09
Hazardous	0.5%		0.005	0.6%	0.61%	19.76%	0.000	0.00%	0.12%	0.12%	0.00
Fines	2.2%		0.022	2.6%	13.75%		3.479	0.35%	0.00%	0.35%	0.09
Total	100.0%		0.856	100%				15.3%	10.9%	26.2%	9.50
								58.35%	41.65%		

Case 3: Sensitivity Analysis - Future Residual Waste (90% reduction in food and plastics, in addition to 20% reduction in other recyclables)

Waste Stream	Current Residual Waste: Commercial and Household (% by weight)	Future Waste: 90% reduction in plastics and food and 19.5% reduction in other recyclables in residual waste	Equivalent weight of residual waste (tonnes)	Future Residual Waste: (% by weight)	Biogenic Carbon (% of waste stream)	Non-Biogenic Carbon (% of waste stream)	Net Calorific Value (MJ/kg)	Biogenic Carbon (% by weight)	Non-Biogenic Carbon (% by weight)	Total Carbon (% by weight)	Total NCV (MJ/kg)
Recyclable Paper	5.9%	20.0%	0.047	8.5%	31.27%		10.749	2.66%		2.66%	0.91
Card	6.3%	20.0%	0.050	9.1%	31.27%		10.749	2.84%		2.84%	0.98
Non-recyclable Paper	8.9%		0.089	16.0%	28.69%		9.735	4.60%		4.60%	1.56
Dense Plastic	7.8%	90.0%	0.008	1.4%		54.76%	24.682		0.77%	0.77%	0.35
Plastic film	8.2%	90.0%	0.008	1.5%		48.11%	21.279		0.71%	0.71%	0.31
Textiles	5.5%	20.0%	0.044	7.9%	19.93%	19.93%	14.327	1.58%	1.58%	3.16%	1.14
Misc. Combustible	9.3%		0.093	16.7%	23.69%	15.79%	14.612	3.97%	2.64%	6.61%	2.45
Misc. Non-Combustible	3.6%		0.036	6.5%	2.94%	4.05%	2.573	0.19%	0.26%	0.45%	0.17
Other Wastes	0.3%		0.003	0.5%	2.94%	4.05%	2.573	0.02%	0.02%	0.04%	0.01
Glass	2.6%	20.0%	0.021	3.7%	0.31%		1.414	0.012%		0.012%	0.05
Ferrous Metals	2.4%	20.0%	0.019	3.5%							
Non-Ferrous Metals	1.1%	20.0%	0.009	1.6%							
Food Waste	27.0%	90.0%	0.027	4.9%	13.46%		3.460	0.65%		0.65%	0.17
Garden Waste	2.7%	20.0%	0.022	3.9%	17.17%		4.210	0.67%		0.67%	0.16
Other Organic	2.3%		0.023	4.1%	17.17%		4.210	0.71%		0.71%	0.17
Wood	2.3%	20.0%	0.018	3.3%	17.17%		4.210	0.57%		0.57%	0.14
WEEE	1.1%		0.011	2.0%		15.81%	7.060		0.31%	0.31%	0.14
Hazardous	0.5%		0.005	0.9%	0.61%	19.76%	0.000	0.01%	0.18%	0.18%	0.00
Fines	2.2%		0.022	4.0%	13.75%		3.479	0.54%	0.00%	0.54%	0.14
Total	100.0%		0.555	100%				19.0%	6.5%	25.5%	8.85
								74.58%	25.42%