DRAFT SOUTH LONDON WASTE PLAN

APPENDICES TO THE REPRESENTATION SCHEDULE

Appendix 1: Electricity Transmission Lines (National Grid)

Appendix 2 Day Group Ltd (Firstplan agent)

Appendix 3: D B Cargo (Firstplan agent)

Appendix 4: The climate change impact of burning municipal waste in Scotland (Councillor Nick Mattey)

Appendix 5: How councils can improve their recycling rates (South West London Air Quality Monitoring Group)

APPENDIX 1: Electricity Transmission Lines (National Grid)

B&T@Work, Unit 5c, Wandle Way, Merton CR4 4NA

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Electric_Assets_1587

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Development_Plan_Monitoring_v2_977

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Contains OS data © Crown Copyright and database right 2020
Contains data from OS Zoomstack, Contains OS data © Crown Copyright and database right 2019

Web AppBuilder for ArcGIS

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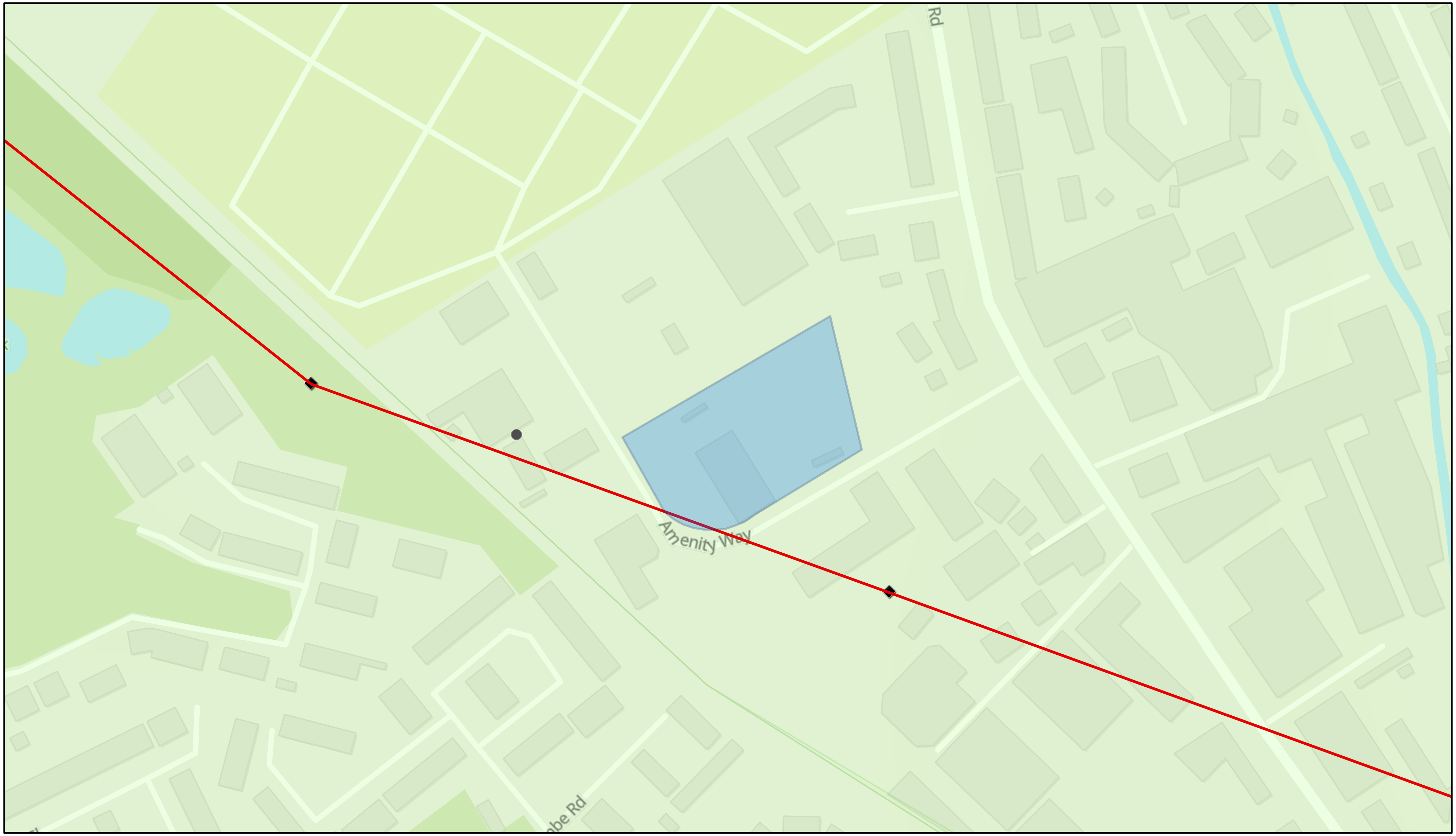

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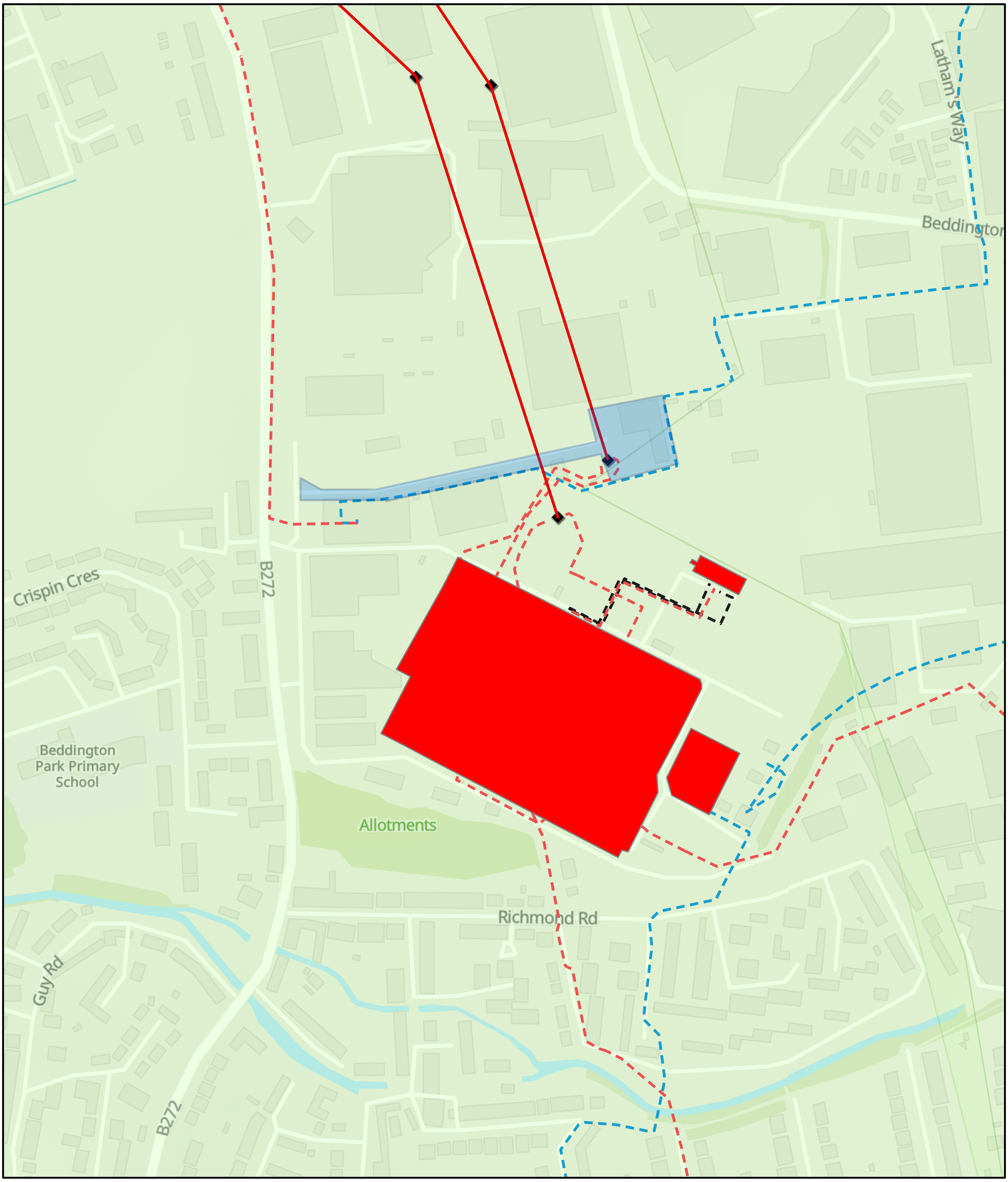

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APPENDIX 2: Day Group Ltd (Firstplan agent)

FIRSTPLAN
Broadwall House, 21 Broadwall, London
SE1 9PL
T: 020 3096 7000 **W:** www.firstplan.co.uk

Our Ref: 20040/VW
Your Ref:
Email: vwalsh@firstplan.co.uk
Date: 15 October 2020

Planning Policy
London Borough of Sutton
24 Denmark Road
Carshalton
SM5 2JG

By email only: planningpolicy@sutton.gov.uk

Dear Sir/Madam,

DRAFT SOUTH LONDON WASTE PLAN (SUBMISSION VERSION) CONSULTATION SEPTEMBER - OCTOBER 2020
RESPONSE ON BEHALF OF DAY GROUP LTD

1. Introduction

We are instructed by our client, Day Group Ltd, to provide the following response in respect of the South London Waste Plan (Submission Version) consultation, September 2020.

This response follows that made on behalf of Day Group in January 2020 to the South London Waste Plan - Issues and Preferred Options Consultation.

In light of the objections/matters raised by the Day Group response to the earlier consultation, and the positive response that has been made via changes now included in the Draft Submission Version, we would confirm that Day Group wish to support the soundness of the SLWP, in particular with regard to the following:

- Site Safeguarding: C4, Day Aggregates Purley Depot, Approach Road, Croydon CR8 2AL
- Policy WP3 - Existing Waste Sites
- Policy WP8 - New Development Affecting Waste Sites
- Appendix 2 – Sites Counting Towards the Apportionment and C&D Target

As required individual response forms have been completed in relation to each of the above parts of the draft SLWP. However, the matters raised by each of the above are interlinked and are as such dealt with jointly within this letter (Statement of Response). This is provided in particular in context of Response Form Question 6 – to provide our comments in support of the soundness of the SLWP.

On this basis we have reiterated the relevant background information previously provided which underpinned the need for the changes which have been made to the SLWP from the Issues and Preferred Options stage and now incorporated in the Submission Draft SLWP.

In this context it is reconfirmed that Day Group are the operators of the Purley Rail Depot, accessed from Approach Road and located adjacent to and south of Purley Station. The site is identified as 'Safeguarded Site C4' within the Draft South London Waste Plan.

From the rail depot Day Group operate their rail served aggregates business which includes supply of an on-site concrete batching plant (CBP) and operate a construction and demolition (C&D) waste recycling facility.

These types of rail served sites comprise a scarce resource which are particularly difficult to replace. Indeed, the importance of safeguarding of rail served minerals sites is underpinned by policy requirements both at national level and within the existing and emerging London Plan as detailed below. This policy context, together with a full appreciation of how the depot functions and the role these type of facilities play in assisting with the sustainable supply of building materials, is critical to understanding the basis for the comments made to the South London Waste Plan Consultation and, in summary, to ensure that the identification of the site as 'safeguarded for waste' does not prejudice the future operation of the rail depot and its mineral function.

2. Purley Goods Yard

Day Group has operated the rail served aggregates depot at Purley since the 1990's and it has been an active goods yard for much longer. This long-established facility comprises a highly sustainable source of supply to the construction industry. The Goods Yard currently accommodates around 250 train loads of construction aggregates each year. The ability to supply essential materials such as this by train keeps in the region of 30,000 long distance lorry trips (that would cover c.2 million road miles and generate 2,400 tonnes of CO_2 each year) off the road network. This makes a significant contribution to reducing road congestion, CO_2, particulates and nitrogen oxides emissions, as well as reducing road-risks. All of which is consistent with both Croydon's and the Mayor of London's policies on transport, growth and air quality.

These sustainably supplied construction materials are vital to supporting existing and planned redevelopment within and close to Croydon as well as other nearby infrastructure maintenance and improvements.

Specifically, the Goods Yard is operated as follows:

- Aggregate brought in by rail is discharged from 'hopper' wagons into a covered below-ground receiving facility and then conveyed into on-site storage areas before being loaded onto HGVs as required for redistribution by road. This facility operates under permitted development rights accruing to rail sites and as such there are no restrictions on operating hours.
- The long-established concrete batching plant on site uses rail supplied aggregates in its production of ready-mixed concrete.
- The enclosed on-site recycling plant handles c.150,000 tonnes p.a. of locally sourced construction & demolition waste to provide aggregates for local construction projects, thereby removing the need for additional extraction and importation of primary aggregates, with all the associated environmental benefits.
- There is also potential for the expansion of activities and uses on the site which, as indicated below, is supported by policy.

Day Group, as an experienced rail depot operator, is clear that rail served sites such as the Purley Rail Depot are a scarce resource and not easily replaced. This is because of the costs involved in creating new railhead facilities and the difficulties in securing land where appropriate access to the rail and road network can be achieved. The importance of such sites is underpinned by the protective policies found in the NPPF and London Plan.

3. Relevant Policy Context

Critical to the consideration of 'soundness' of the South London Waste Plan and how the Purley Depot Site (C4) is approached are the relevant National and London Plan policy requirements. The draft plan is clear in setting out the waste policy background and Day Group recognise that the Councils must respond to the forthcoming London Plan target of reuse/recycling/recovery of 95% of construction and demolition waste.

However, in the case of the Purley Depot site it is also important to recognise the sites minerals function as an aggregate rail depot, which is supported by the NPPF and London Plan as follows:

i) NPPF

The National Planning Policy Framework (NPPF) (2019), in the context of *Facilitating the Sustainable Use of Minerals,* requires at Para 204(e) that:

> *"Planning policies should*
> *e) Safeguard existing, planned and potential sites for: the bulk transport, handling and processing of minerals; the manufacture of concrete and concrete products..."*

ii) Draft London Plan – Intend to Publish Version (December 2019)

The draft London Plan, whilst not yet adopted, has reached an advanced stage and can be considered a material consideration. In December 2019, the Mayor issued to the Secretary of State an 'Intend to Publish London Plan'. The Secretary of State responded to the Mayor in March 2020 setting out his consideration of the Plan. With a further response issued by the Mayor in April 2020.

The key Draft London Plan policies relevant to safeguarding minerals/rail functions are detailed as follows:

Draft Policy SI10, 'Aggregates', maintains the requirement in the context of plan making that development plans should:

> *'ensure sufficient capacity of aggregates wharves and aggregate rail depots is available to ensure a steady and adequate supply of imported and marine aggregate to London and maximise the movement of aggregates by sustainable modes'.*

The draft policy goes on to confirm that Council's Development Plans should:

> *'identify and safeguard sites and facilities, including wharves and railheads, with existing, planned or potential capacity for transportation, distribution, processing and /or production of primary and/or secondary/recycled aggregates.'*

The draft policy also requires that:

> *'development proposals should be designed to avoid and mitigate potential conflicts with sites safeguarded for the transportation, distribution, processing and/or production of aggregates, in line with the Agent of Change principle.'*

Draft supporting paragraph 9.10.5 acknowledges the importance of railway depots for importing crushed rock from other parts of the UK. It concludes that railheads are vital to the sustainable movement of aggregates and boroughs should safeguard them.

Draft Policy T7, 'Deliveries, Servicing and Construction' has been amended in response to the Panel's recommendation and the 'Intend to Publish' version includes an additional sentence stating that *'development plans and development proposals should facilitate sustainable freight movement by rail, waterway and road'*. Draft Policy T7 also places a further requirement on local authorities to safeguard railheads in plan-making.

iii) Adopted Croydon Local Plan (2018)

It is noted that the existence of the Purley Depot is referenced within the Adopted Croydon Local Plan. Para 10.24 confirms that *"the sidings at Purley, currently occupied by an aggregates company, is an active rail freight site"* and Para 11.161 confirms that *"Realisation of the potential of the Warren Road railhead to transfer freight to rail will be supported".*

4. Support for Soundness of the Submission Draft SLWP

i) Appendix 2 – Sites Counting Towards Apportionment and C&D Target

As noted in our earlier representations, capacity for construction and demolition waste is notoriously difficult to measure as much takes place on construction sites or at waste management facilities with exemptions from Environment Agency permits. This is why it is not included within the London Plan apportionment figures (Paragraph 9.8.13 of the London Plan intend to adopt version). Nevertheless, the draft South London Issues and Options did seek to measure it in Figure 16. This table presented the maximum throughput figures, the licence figures and the 'throughput counting towards apportionment' figures. These Figures were transcribed across to the then Appendix 1 and the relevant Site Safeguarding Description Sheets.

For the Day Aggregates Site (C4), Day Group agreed with the maximum throughput and licence figure for their site. However, they raised issue with regard to why '0' of this was counted towards the C&D target. At the Purley Site construction and demolition waste is brought in from local sites by road, processed by the construction and demolition waste recycling plant to produce recycled aggregate which is then exported directly to local construction sites for use in construction, predominantly as sub-base materials for roads. It should therefore not be considered as a 'waste transfer operation' but as a construction and demolition waste processing site. The only material which is transferred for further recycling is a small quantity of metal waste. Overall, 99.6% of the construction and demolition waste that is brought to site is recycled into aggregate on site.

It was therefore put forward that the correct figure for the final column for the Day Aggregates site (C4) is in the order of 178,593 tonnes (99.6% of 179,300). It was further noted that if the processing of construction and demolition waste is better understood then there may potentially be no shortfall in terms of capacity for this waste stream.

In response to Question 6 of the Response Form – it is confirmed that the Submission Draft SLWP is supported on the basis that it has corrected the 'qualifying throughput' for Site C4 within both Appendix 2 and the Site Description. The correction ensures that the plan is 'justified' in that it is based on a proportionate and up to date evidence base and is in all other respects 'sound'.

ii) WP3 – The Safeguarding of Existing Waste Sites

The Issues and Preferred Options Draft Policy WP3 (a) stated that *'The sites set out on Pages 42 – 90 of the South London Waste Plan will be safeguarded for waste use only.'* This policy wording was identified as being problematic for the Day Aggregate site at Purley (Site C4) as it also accommodates an important rail depot site for minerals use as set out in the background section above.

In this context, and in response to Question 6 of the Response Forms, amendments to Policy WP3 as provided by the Submission Draft SWLP which confirm in the context of safeguarding that *'(a) The sites set out on Pages 44-91 of this South London Waste Plan will be safeguarded for waste uses or <u>waste/minerals uses only</u>'* are supported.

This amendment ensures that the Plan meets the tests of soundness in terms of being 'consistent with national' policy which requires safeguarding of rail served mineral uses such as those co-located with the waste use at the Purley site.

iii) <u>Site C4 – Days Aggregates Purley Depot, Approach Road, Croydon</u>

As confirmed in the context of the Issues and Preferred Options response, Day Group do not object to their site being safeguarded for waste uses provided that the minerals function of the site is also recognised and allowed to intensify in principle should this be put forward in the future.

The response within the SLWP Representations Schedule (May 2020) that '*The Councils have no intention to prejudice Day Aggregates' minerals operations and will ensure that the waste safeguarding does not hamper that side of the operation*' and that *'The Councils note Day Aggregates' plans for expansion'* are welcomed.

In this context, and in response to Question 6 of the Response Forms, the amended 'Site Description' details for Site C4 in the Submission SLWP are supported in that they acknowledge that this is a *'..dual use site, with minerals operation within the site. If the minerals operations are intensified, the current waste management throughput should continue at the current level'.*

This amendment ensures that the Plan meets the tests of soundness in terms of being 'consistent with national policy' which requires safeguarding of rail served mineral uses such as those co-located with the waste use at the Purley site.

iv) <u>Policy WP8 – New Development Affecting Waste Sites</u>

The Day Group response at Issues and Preferred Options stage highlighted the need to reflect National requirements in terms of the 'Agent of Change Principle'.

In this context, and in response to Question 6 of the Response Forms, it is confirmed that the introduction of new Policy WP8 within the Submission Draft SLWP is fully supported. It is required to ensure the SLWP meets the tests of soundness and specifically the requirement to be 'consistent with National Policy'. Paragraph 182 of the NPPF is clear that: *'<u>Planning policies</u> and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities….Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed'.*

Policy WP8 is considered essential to ensuring the effective safeguarding of sites such as the Day Group Site (C4) identified in the SLWP. Day Group are an experienced operator of sites such as this and are fully aware of the threat posed by the introduction of new sensitive development in proximity to sites such as the Purley

Depot. The Policy is considered to robustly address the overarching issues which need to be considered when new development is proposed in the vicinity of such sites. However, to maximise the prospects that new development will not prejudice, directly or indirectly, the waste function of safeguarded sites it is key that baseline assessments take fully into account all operations and potential sources of noise and disturbance. This is to ensure that new development is designed based on a full understanding of the operation of the safeguarded site -taking into account all activities and hours of operation. This is best achieved via early engagement between the developer and the waste site operator.

In response to Question 7 of the Response Form, whilst not considered sufficient to render the SLWP unsound, in light of the above it is suggested that consideration should be given to adding the following wording (shown bold and underlined) to Policy WP8 to further strengthen the protection it affords to safeguarded waste sites. This would underpin the 'effectiveness' of the plan and its 'consistency with national policy'.

WP8 New Development Affecting Waste Sites

(a) New development should be …..
(b) Where new development is proposed that may be affected by and an existing waste site……….the applicant should:

(i) Ensure that good design…..
(ii) Explore mitigation measures early in the ….
<u>(iii) Engage early with the operator of the waste site to ensure a full understanding of the operation (including on-site activities and hours of operation) and to ensure baseline assessments are robust.</u>

I trust this response in support of the soundness of the Submission Draft South London Waste Plan are helpful. I would be grateful for confirmation of receipt of these representations and confirmation that they have been duly made.

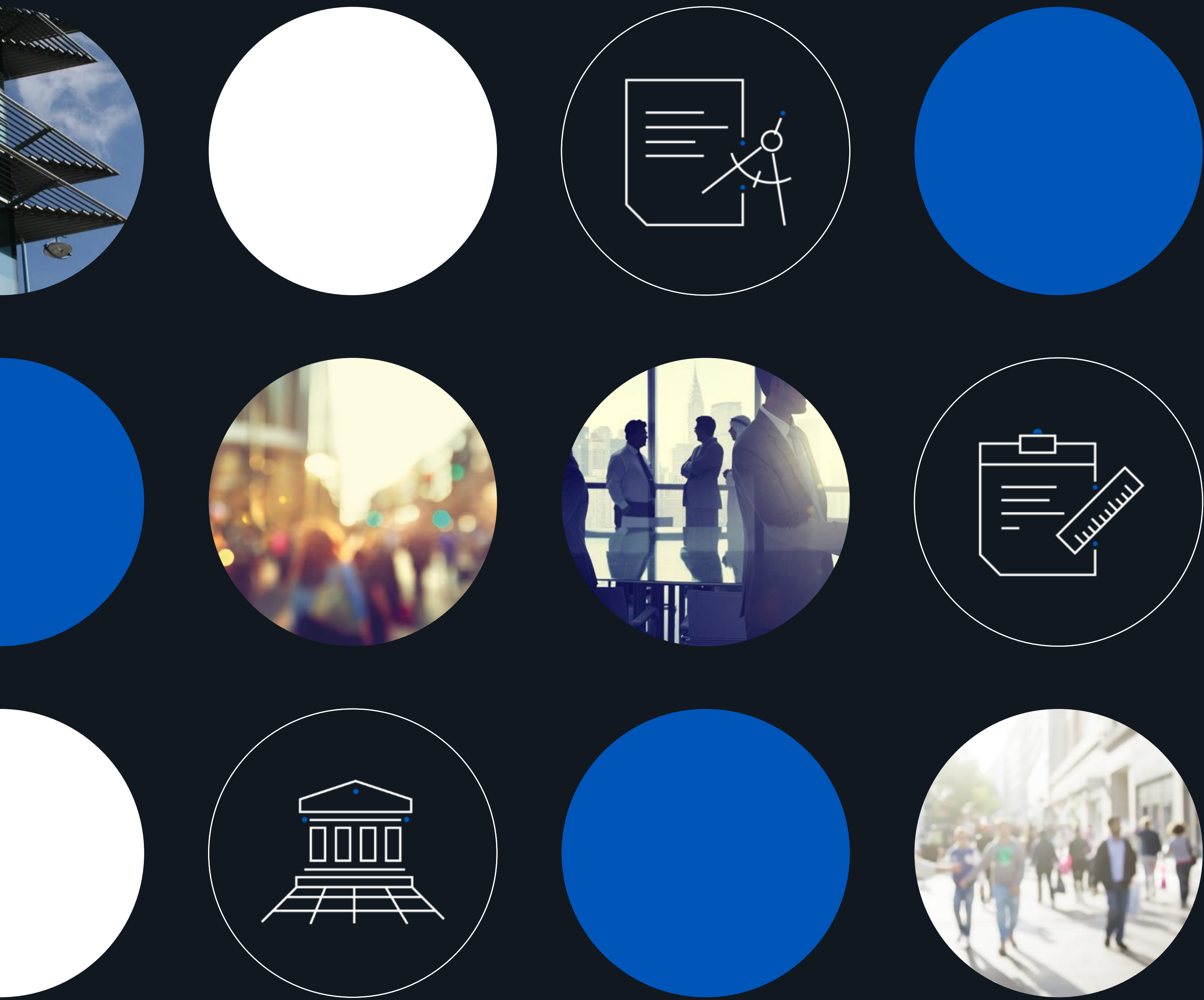
Yours faithfully

VILNA WALSH
<u>Director</u>

cc. Phil Aust - Day Group

APPENDIX 3: D B Cargo (Firstplan as agent)

FIRSTPLAN



SOUTH LONDON WASTE PLAN – DRAFT FOR SUBMISSION - CONSULTATION SEPT – OCT 2020

Statement of Response by Firstplan on behalf of DB Cargo, October 2020

Firstplan Ref: VW/jc/17218_16.10.20

Date: 16 October 2020

Status: Submission

CONTENTS

SECTION 1: INTRODUCTION

1.1 The following statement of objection is made by Firstplan Ltd ('Firstplan') on behalf of DB Cargo ('DBC') with respect to the South London Waste Plan ('SLWP') Draft for Submission to Government – Consultation Document (September 2020).

1.2 The issues raised by DB Cargo and changes sought to the Submission Draft SLWP are all interlinked and relate to the failure of the SLWP Submission draft to appropriately identify and safeguard the Chessington Railhead site at Garrison Lane, South Chessington as a dual use minerals and waste rail transfer site. It is full appreciated that the site is being put forward at a late stage and that consideration has been previously given by the SLWP to inclusion of the site at a much earlier stage in the plan process. At that stage the only reason the site was not progressed was as a result of the SLWP Councils being informed the site was not available for waste management purposes. Whilst that was correct at the time the situation has changed significantly in the interim.

1.3 The site, also known as the 'Coal Depot' site, and adjoining railway sidings were historically used for the transfer of freight by rail and has been in the ownership/control of the rail industry since the yard first opened. The site was operated as a coal concentration depot until around the early 1990's. The current tenant, CPL Distribution, continue to operate the site as a fuel depot but no longer use the rail sidings. CPL have found a relocation site for their road served operation and will vacate the Chessington Railhead site by May 2021 at the latest.

1.4 The site is owned by NR and comprises a 'Strategic Freight Site ('SFS'). These are sites within Network Rail's freehold, defined at privatisation in 1994, that are subject to protective provisions to ensure their availability for hosting rail freight related activities. These sites can be formally 'called-down' by freight operating companies if they propose to use them for rail freight purposes. In recent years, due to a lack of interest from freight operating companies, the site has been let for non-freight use and, as detailed, occupied by CPL for storage and distribution of bagged fuel. However, in September 2020 DB Cargo, having called-down the site, were granted a 125 year head lease for the Chessington Railhead site expressly for the purposes of ensuring the site is once again used for the transfer of freight by rail.

1.5 DBC is the UK's largest rail freight operating company authorised by statute to undertake railway operations. It comprises as such a 'railway undertaker' for the purposes of the General Permitted Development Order ('GPDO') 2015. Having now been established as the freight operating company for the Chessington site they intend to progress works, including repair and upgrading of the sidings, to facilitate the reinstatement of the site as fully active freight site which will enable the bulk transport of minerals and waste. These works are to be progressed by DB Cargo under their rail related permitted development rights, as afforded by Part 8, Class A of the General Permitted Development Order (2015).

1.6 DBC have also conferred a sublease of 25 years to their rail freight end user tenant, Cappagh Public Works Ltd ('Cappagh') a highly experienced minerals and waste operator. Once works are completed to repair and upgrade the sidings the mineral and waste transfer operations will be progressed by DBC and Cappagh as allowed for under their rail related permitted development rights. It is anticipated that reinstatement works will be complete by early 2021 and the first train are expected to start serving the site in spring/summer 2021.

1.7 DBC / Cappagh propose to operate the site as dual use minerals and wate rail transfer site. This would facilitate the import of aggregate by train to supply the local construction market and export of inert waste by rail for the purposes of filling/restoration of mineral workings. This would be progressed as detailed under rail-related permitted development rights. However, any proposal for co-located waste operations (for example C&D recycling) which would have clear sustainability advantages in being co-located at a rail served transfer site would require planning permission. The concern is that as currently worded the SLWP would appear to place a policy bar on such operations if they are not on an identified 'safeguarded' waste site within the SLWP. Given the key operational and sustainability advantages of co-locating waste uses at the Chessington site – it is assumed that this would not be the intent of the SLWP. However, without changes to the Submission Draft this would be effect of the Plan as currently drafted and this is not considered to be 'sound'.

1.8 Further, and more critically, DBC would be concerned to ensure their site and operations are fully 'safeguarded' not just in terms of the uses which can be progressed on the site but how development is considered in the surrounding area which could prejudice the future operation of the mineral and waste transfer site. Again, as currently worded the relevant 'agent of change' policy would only appear to apply to identified 'safeguarded' sites in the SLWP. Again, it is assumed that in the full knowledge that the Chessington Railhead is in the process of being brought forward as a dual use mineral and waste site that this would not be the intent of the Plan. Without changes to the Plan in this respect this again calls into question the soundness of the Plan.

1.9 For these reasons it is considered key that the Chessington Railhead site is in some form identified and referenced in the SLWP so that it can be 'safeguarded' in the fullest sense of the word and that subject to consideration of other relevant SLWP policies and Local Plan policies that there is potential for co-location of waste uses at the site.

1.10 Strategic freight sites such as Chessington Railhead are key to supporting the transfer of as much freight as possible from road to rail and there is a key policy drive which supports this. Proposals which could compromise the function and integrity of such sites risk placing more freight on the road network with associated HGV road mile and emissions implications.

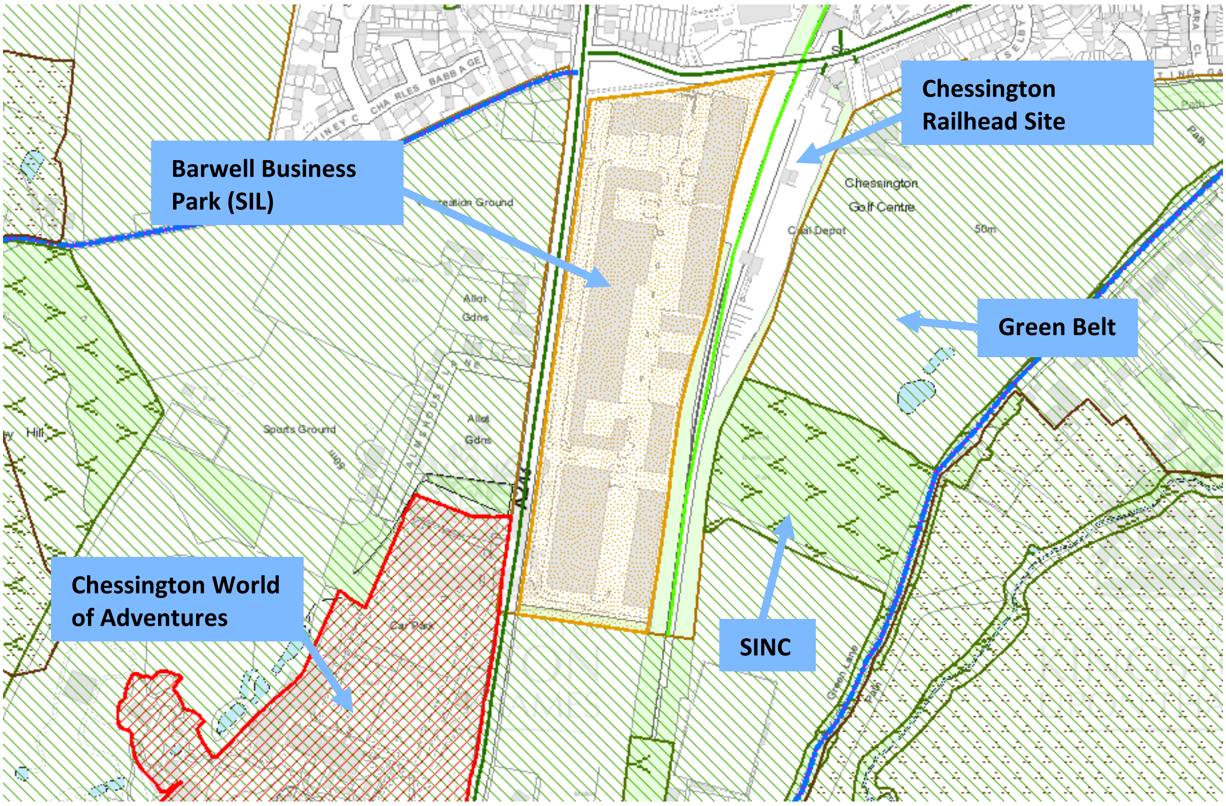
SECTION 2: SITE AND OTHER BACKGROUND INFORMATION

2.1 The Chessington Railhead site (also known as the 'coal depot' site) comprises a 1.7 ha site as defined on accompanying Site Location Plan ref: 2719_10. The site is laid to hardstanding and accommodates a number of large storage buildings, site office, parking and weighbridge. The rail sidings run along the western boundary of the site – parallel to the railway line which ends just south of the site. Vehicular access is via Garrison Lane on the northern boundary of the site which provides access to the Leatherhead Road (A243) to the west. The site is located opposite to Chessington South Station and is reasonably isolated from nearby properties.

2.2 The site including the railway sidings, also known as the 'Coal Depot' site, is owned by Network Rail and comprises a Strategic Freight Site held for the purposes of ensuring such sites are available for rail freight related activities.

2.3 As detailed, the site was historically used for the transfer of freight by rail and has been in the ownership/control of the rail industry since the yard first opened. The site was operated as a coal concentration depot until around the early 1990's. CPL Distribution, continue to operate the site as a fuel depot but no longer use the rail sidings. CPL have found a relocation site for their road served operation and will vacate the site by May 2021.

Figure 1: Annotated Extract from Adopted Kingston Proposals Map



2.4 The site itself is not subject to any site specific designations and is identified simply as 'white land' in the relevant Local Plan (Kingston Core Strategy – Adopted 2012). The railway line is designated as a 'Green Corridor'. Land to the east of the site, including Chessington Golf Centre, comprises designated Green Belt. Land to the south east is designated as a Site of Importance for Nature Conservation. To the west, on the other side of the railway line, is Barwell Business Park, designated as Strategic Industrial Land. An extract from the Kingston Proposals Map is attached at Figure 1.

2.5 Representations were made by DBC to the Kingston Local Plan review in 2019 as Kingston were at that stage considering the site for allocation for residential purposes. At that date DBC were still in the process of formally securing the site for rail freight uses, and both DBC and NR alerted LB Kingston to fact that the site would not be available for residential purposes. In response Kingston have advised that as a result of the submissions made the site will be considered as 'unavailable' for residential development, and that the site will be safeguarded for rail freight/transport uses in the emerging new Local Plan. The Local Plan is of course at an early stage and no formal consultation on the next stage of the plan has yet taken place – notably the Local Plan will not of course deal with waste uses. It is noted that the Chessington railhead site is located within the emerging Local Plan in a wider area defined as *'Possible Opportunity Area boundary'*.

2.6 As already detailed, in September 2020 DBC secured a head lease on the site of 125 years and conferred a sublease of 25 years to Cappagh an experienced minerals and waste operator. Having now been established as the freight operating company for the Chessington site DBC intend to progress works, including repair and upgrading of the sidings, to facilitate the reinstatement of the site as fully active freight site which will enable the bulk transport of minerals and waste. These works are to be progressed by DB Cargo under their rail related permitted development rights, as afforded by Part 8, Class A of the General Permitted Development Order (2015).

2.7 Waste management throughput is yet to be established but is expected in the first instance to comprise in the region of 100,000 tonnes of inert waste exported from the site by rail to be used for the filling and restoration of a mineral extraction sites at Barrington, Cambridgeshire. This is a highly sustainable way of moving inert waste that would otherwise be moved by HGV. Each train will be able to carry approximately 1,500 tonnes of material, the equivalent of around 75 lorry loads.

2.8 In addition to the waste and minerals transfer use which can be progressed under rail related permitted development rights, there is potential for the site, subject of course to planning permission being secured, to be used for other co-located minerals or waste related uses. This could include the co-location of a C&D recycling operation to produce recycled aggregates, with residual waste from the recycling process being exported from site by rail as part of the wider waste transfer use, and recycled aggregate sold on to the local construction market as an additional product to the primary material imported by rail.

2.9 Strategic Freight Sites comprise part of a network of sites around the country which contribute toward the sustainable movement of material by rail rather than by road. However, sites within London with all of the infrastructure in place to support rail freight development are a scarce resource both in terms of existing operational facilities and in terms of the very small number of new sites which have the potential to be brought into operational use.

2.10 With considerable investment the Chessington Railhead site is being brought back into active use, but it is critical to its future ability to operate effectively that it is appropriately safeguarded for such uses.

2.11 Reactivation of the Chessington Railhead site for rail related freight use will inevitably mean that operations at the site will include the arrival, unloading and departure of trains as well as activity within an open yard area. Train arrival times will be subject to NR train path availability and can occur throughout the day or night. As would be expected these types of operations can give rise to some degree of noise and potential disturbance. Albeit the site has been in an open storage and distribution use for some considerable period of time.

2.12 It is for this reason that any development that may come forward on adjoining or nearby sites should be required to take account of the strategic importance of the Chessington Railhead site and its dual use for minerals and waste transfer, to ensure it does not raise any potential to prejudice its future operation.

SECTION 3: PLANNING POLICY CONTEXT & CONSIDERATION OF CHESSINGTON SITE

3.1 The following planning policy review is provided both for the purposes of underscoring the importance and policy drive there is to appropriately safeguard rail served sites for freight – and to underscore the need to identify and safeguard the Chessington Railhead having regard to its dual use as a minerals and waste site. This would be consistent with the way that the existing, and comparable, Day Aggregates Purley Depot site, C4, is referenced and proposed to be safeguarded in the Draft Submission SLWP.

3.2 The policy review also highlights how the Chessington Railhead site has been considered in the context of the SLWP, including both that adopted in 2012 and that currently under review – with its potential for waste use being clearly identified and the only matter at issue being one of availability. The issue of 'availability' has now been resolved as confirmed by these representations.

a) National Planning Policy for Waste (2014)

3.3 The National Planning Policy for Waste, October 2014, in the context of identifying suitable sites and uses, confirms at paragraph 4, that waste planning authorities should, amongst other things:

- ***consider a broad range of locations including industrial sites, looking for opportunities to co-locate waste management facilities together and with complementary activities…….***
- ***give priority to the re-use of previously-developed land***

3.4 Paragraph 5 of the NPPW confirms that waste planning authorities should assess the suitability of sites and/or areas for new or enhanced waste management facilities against criteria including:

> ***"the capacity of existing and potential transport infrastructure to <u>support the sustainable movement of waste</u>, and products arising from resource recovery, seeking when practicable and <u>beneficial to use modes other than road transport</u>"*** (our underlining)

3.5 In this context it is noted that the Chessington site allows for re-use of previously developed land, has the potential to accommodate co-located waste management facilities and will allow for the sustainable movement of waste.

3.6 As detailed further below, the site has been previously assessed by the SLWP in terms of its suitability for accommodating waste management uses and the only point at issue previously raised was one of availability.

b) National Planning Policy Framework (2019)

3.7 The National Planning Policy Framework (NPPF) updated in February 2019 sets out the government's planning policies for England and how these are expected to be applied and should be read in conjunction with the NPPW.

3.8 In the context of facilitating the sustainable use of minerals paragraph 203 of the NPPF is clear that:

> ***"It is essential that there is a sufficient supply of minerals to provide the infrastructure, buildings, energy and goods that the country needs." (our underlining)***

3.9 The NPPF expressly requires at paragraph 204 (e) that planning policies should:

> ***"safeguard existing, planned and potential sites for: the bulk transport, handling, and processing of minerals; the manufacture of concrete and concrete products; and the handling, processing, and distribution of substitute, recycled and secondary aggregate"***

3.10 It is in this context that reference to the Chessington site within the proposed SLWP should be clear that this is a dual use site for minerals and waste transfer by rail – and should be clear that both elements are safeguarded. This is consistent with the approach taken to Site C4, Day Aggregates Purley Depot, which is proposed to be safeguarded – with full acknowledgement that it is a dual use site, with a minerals operation within the site.

c) London Plan (March 2016)

3.11 The London Plan Consolidated with Alterations since 2011 (March 2016) acknowledges the role rail can play in the sustainable management of waste and the contribution that recycling can making to delivering environmental and economic benefits to London.

3.12 Policy 5.17, Waste Capacity, confirms planning decisions should consider, among other things, the full transport and environmental impact of collection, transfer and disposal movements including the scope to *maximise use of rail transport*.

3.13 Paragraph 5.86 states that: *where movement of waste is required, priority should be given to facilities for movement by river or rail…Developments adjacent to waste management sites should be designed to minimise the potential for disturbance and conflicts of use.*

3.14 Policy 5.18, *Construction, Excavation and Demolition Waste,* confirms that facilities for management of this type of waste should be encouraged at existing waste sites.

3.15 Policy 5.20, *Aggregates,* confirms that LDFs should: *safeguard railheads with existing or potential capacity for aggregate distribution*. Supporting paragraph 5.90 is clear that London requires a reliable supply of construction materials to support continued growth. It goes on to confirm that most aggregates used in the capital come from outside London.

3.16 Policy 6.14, *Freight,* in strategic terms seeks to promote movement of freight by rail. In the context of plan making it requires that: *DPDs should promote sustainable freight transport by: safeguarding existing sites and identifying new sites to enable the transfer of freight to rail and water and by safeguarding railheads for aggregate distribution.*

3.17 Supporting paragraph 6.49 reiterates the point that safeguarding existing, and identifying new, facilities to promote movement by rail or water will be encouraged as this will ease congestion on the highway network and help combat climate change.

3.18 Rail served sites are a scarce resource and in this context the Adopted London Plan policy is clear in underpinning the need to safeguard such sites and make best use of them where possible for freight uses including for waste and minerals related purposes.

d) <u>Draft London Plan – Intend to Publish Version (December 2019)</u>

3.19 The draft London Plan, whilst not yet adopted, has reached an advanced stage, and can be considered a material consideration. In December 2019, the Mayor issued to the Secretary of State an 'Intend to Publish London Plan'. The Secretary of State responded to the Mayor in March 2020 setting out his consideration of this Plan. With a further response issued by the Mayor in April 2020.

3.20 In line with the adopted London Plan, the emerging London Plan continues to place a strong emphasis on and expressly requires the safeguarding of railheads and associated infrastructure linked to the sustainability benefits of moving freight from road to rail.

3.21 In the context of C, D&E waste it is noted, Policy S1 7, *Reducing waste and supporting the circular economy,* that targets set are very much on the basis of meeting or exceeding. Specifically the policy states that waste reduction will be achieved by the Mayor, waste planning authorities and industry working in collaboration to meet or exceed the targets for construction and demolition - 95 per cent reuse/recycling/recovery and excavation – 95 per cent beneficial use.

3.22 Draft Policy SI 8, *Waste capacity and net waste self-sufficiency,* states that existing waste management sites should be safeguarded. Part (E) (5) of the Policy, whilst in the context of evaluating development proposals, is clear that this will include consideration of the use of rail to transport waste being supported. It should be self-evident that unless sites that can transport waste by rail (such as the Chessington site) which are a scarce resource are appropriately identified, safeguarded and supported then meeting the objective of this and related policies will be challenging.

3.23 Paragraph 9.8.19 is clear that where movement of waste is required, priority should be given to facilities for movement by river or rail.

3.24 Paragraph 9.8.1 confirms that the London Plan target for net self-sufficiency does not apply to excavation waste. It states that: *The term net self-sufficiency is meant to apply to all waste streams, with the exception of excavation waste. The particular characteristics of this waste stream mean that it will be challenging for London to provide either the sites or the level of compensatory provision needed to apply net self-sufficiency to this waste stream.*

3.25 In this context the policy imperative of ensuring that this waste stream, if it cannot be dealt with in London, is transported out of London in the most sustainable way (i.e. by rail or river) should be clear.

3.26 Draft Policy, SI10, *Aggregates*, in the context of plan making requires development plans to: *ensure sufficient capacity of aggregates wharves and aggregate rail depots is available to ensure a steady and adequate supply of imported and marine aggregate to London and maximise the movement of aggregates by sustainable modes.* The draft policy goes on to confirm that Development Plans should: *Identify and safeguard sites and facilities, including wharves and railheads, with existing, planned or potential capacity for transportation, distribution, processing and /or production of primary and/or secondary/recycled aggregates.*

3.27 Draft Policy T7, *Deliveries, Servicing and Construction*, places a further requirement on Development Plans to facilitate sustainable freight movement by rail and to safeguarded railheads.

3.28 The Draft London Plan is clear in its requirements to safeguard rail sites and to deliver modal shift from road to rail. The failure to expressly identify the Chessington railhead site for a dual use minerals and waste rail transfer use with the potential for sustainable co-location of other waste management operations would not be in accordance with the draft London Plan.

e) Adopted South London Waste Plan (2012) – Evidence Base Review

3.29 It is relevant that in preparation of the now adopted SLWP (2012), the Chessington railhead/Coal Depot Site was considered as a potential waste site.

3.30 The then SLWP Stage 2 Consultation July – October 2009 identified the Site as *'Site 46: Leatherhead Road, Chessington, Coal Depot adjacent to Barwell Business Park, Kingston'*. At that stage it was indicated that the site scored well.

3.31 The SLWP 'Deliverability of Sites *Assessment'* (November 2010), Appendix 1 *'Land Availability Study for South London Waste Plan* (25 October 2010)' provided an assessment of the site's potential for redevelopment and availability. This concluded that the site 'has potential' for redevelopment and deliverability and that: it : *Site scores well against suitability criteria.*

3.32 However, despite the site scoring well, having been assessed on the basis on a wide range of criteria, it was on the basis only of availability that the site was not progressed.

3.33 Para *3.2.9 and 3.2.10 of the Deliverability of Sites Assessment concluded that:*

> ***This site has low potential for deliverability in the short, medium and longer term due to the covenants imposed on the lease from Network Rail for Strategic Freight Sites.***
>
> ***Network Rail owns the freehold of this site and CPL Distribution has a lease on this Strategic Freight Site. Lease renewal discussions are currently under way and Network Rail intends to renew with CPL Distribution for a further 12-15 years. It is CPL Distribution's intention to remain on site for the short, medium and long term.***

3.34 It is helpful that the site has previously been assessed against suitability criteria and that the only reason it was not progressed was one of availability. As confirmed, that position has changed, and the site is now in the control of a freight operating company and a minerals and waste operator and in the process of being reactivated for minerals and wase rail related uses.

f) South London Waste Plan – Draft for Submission to Government – Consultation Document, September 2020

3.35 It is also relevant to acknowledge that some consideration has been given to the Chessington railhead in the review of the SLWP. The Sustainability Appraisal at Paragraph 9.7, under the heading of 'Identifying Sites for Appraisal, confirms that:

> ***"The sites included in the appraisal therefore consist of all of the existing waste treatment sites within the four Boroughs with all of the Strategic Industrial Locations (SILs) and locally significant industrial locations (LSILs) across the plan area. It also includes Site C4: Day Aggregates, which utilises the Purley Railhead. The Chessington railhead has not been included as the operators have informed officers that the site will not be used for waste management purposes and so would fail the availability strand of the developability test"***

3.36 That position has now changed and the site is actively being brought into a dual minerals and waste use. Further, having regard to all of the assessment criteria in the Sustainability Appraisal it is clear that the Chessington Railhead site would score particularly favourably. The only key area on which it has not previously scored well, as detailed, is that of 'availability' which has now been resolved.

SECTION 4: SOUNDNESS OF THE DRAFT SOUTH LONDON WASTE PLAN (Response Form Question 6)

4.1 It is fully acknowledged again that the availability of the Chessington Railhead site is something that was not known at the time the preparation of the draft South London Waste Plan commenced. Now that it has been confirmed that the site has been secured by DB Cargo and is in the process of being brought into a rail served mineral and waste transfer use and that there is potential for co-located waste recycling activities it is considered that the plan would be unsound if the Chessington site is not appropriately referenced and safeguarded in the SLWP.

4.2 There is as detailed a clear policy drive both at National and London Plan level to shift freight from road to rail (or other sustainable means of transport) – and a clear imperative to safeguard sites for such facilities.

4.3 In the context specifically of excavation waste the draft SLWP acknowledges at para 5.14 that the 2019 ItP London Plan does not expect the capital to be net self-sufficient in excavation waste *as "the particular characteristics of this waste stream means that it will be challenging for London to provide either the sites or the level of compensatory provision to apply net self-sufficiency to this waste stream.* Instead, as the draft SLWP confirms, the 2019 ItP London Plan expects 95% of excavation waste to go to beneficial use. This includes contributing towards the restoration of landfill sites or mineral workings. The Chessington site will be railing such material out of London for that express purpose.

4.4 Para 5.16 of the draft SLWP goes on to rightly reference the South East Planning Advisory Group's Joint Position Statement on the Deposit of Land in the South East of England (2019) which state: *"the export of waste [from London] for management within the South East will continue for the foreseeable future [and] inert waste arising in London can be used to restore mineral workings in the South East of England".*

4.5 It is relevant to note that Policy WP4, *Sites for Compensatory Provision*, in considering new waste sites in this context requires particular regard to be had to sites which have access to sustainable modes of transport for incoming and outgoing materials, particularly rail and water and will consider the advantages of co-location of waste facilities. Applying these principles to the Chessington site, albeit it is of course not being proposed as a compensatory provision site, does nonetheless underpin the policy objectives which the site addresses and why it should be expressly referenced.

4.6 As the site is confirmed as coming forward for waste transfer uses and given the above considerations there is every reason to support at minimum identification and reference of the site in the SLWP and ideally express safeguarding. Further, there should be no in principle policy bar on co-location of complementary waste management facilities. This would of course be subject to consideration of other policies in the SLWP and the relevant local plan. As currently worded the draft SLWP, particularly, Policy WP2 (b), is considered to be overly restrictive. Without identification of the Chessington site and/or additions/amendments to this policy this could prevent sustainable co-location of related recycling activities contrary to the objectives of moving waste up the waste hierarchy and circular economy principles and the NPPF requirement, paragraph 11, that plans should apply a presumption in favour of sustainable development.

4.7 It is acknowledged that the SLWP may not want to speculatively designate waste sites in the context of there being no capacity gap for C&D waste and in the context of industrial land demand. However, the Chessington site is somewhat individual in nature in that it is expressly being proposed by the site owner, is in any event in the process of being brought forward for a waste use, and whilst the site is currently in a storage and distribution use it is not identified under any industrial land designation.

4.8 Without recognition of the status of the Chessington site and the fact that it is being brought forward for waste uses and has the opportunity to accommodate additional waste management facilities – the SLWP is considered to be unduly inflexible. This inflexibility is contrary to the NPPF, paragraph 11, which requires plans to be sufficiently flexible to adapt to rapid change.

4.9 A plan which would leave a site being brought into waste use without any 'safeguarding' provision (in the context of protecting it from encroaching sensitive development) and which would appear to result in an outright preclusion on additional waste management facilities co-locating on the site – places it at odds with the soundness test of being 'positively prepared'.

4.10 By reference to **Response Form Question 6**, and in the absence of any recognition of the Chessington Railhead site in the SLWP, the Plan is not considered to meet the tests of soundness for the following reasons:

- **The plan is not positively prepared** – the Plan has not fully considered, identified and safeguarded waste sites within the waste plan area over the Plan period. It would place a policy bar on the possibility of co-locating complementary waste management facilities on a waste transfer site.

- **The plan is not justified** – the approach to not identifying and/or safeguarding the Chessington Railhead in the SLWP is not the most appropriate strategy when considered against the reasonable alternatives. The prudent and sound approach would be to either make policy provision in the form of an allocation or policy safeguarding for the Chessington Railhead site for waste uses or at minimum provide acknowledgement of the site given its particular circumstances within supporting text in the plan. This should be in tandem with ensuring its dual use as a minerals and waste site is reflected (consistent with how a comparable site, C4, has been dealt with in the draft SLWP).

- **The plan is not effective** – Whilst the minerals and waste transfer operations can progress under permitted development rights and irrespective of any waste safeguarding in the SLWP, the site would not have the benefit and protection afforded to it under Policy WP3, Safeguarding Waste Sites, which would only apply to identified 'existing waste sites' or those provided as compensatory provision. The intent of the policy is to cover both safeguarded and potential future site (compensatory sites) so it would be entirely consistent to additionally include reference to the Chessington Site which is confirmed as coming forward for waste uses. Sites such as these should be protected at every level.

- The Plan as currently drafted would place a policy bar on the co-location of other waste uses with the waste transfer operations. Whilst these might be overcome in the process of making an application under 'other material' consideration arguments, it cannot be effective for the waste plan to have a policy hurdle, which would preclude the principle of co-locating complementary and sustainable waste uses on what will be an existing waste transfer site.

- **Consistent with national policy** - the draft SLWP is not consistent with NPPF requirement that Plans should be prepared with the objective of contributing to the achievement of sustainable development. It is not consistent with national policy that plans should be sufficiently flexible to adapt to rapid change. It is not consistent with requirements in terms of safeguarding.

SECTION 5: CHANGES REQUIRED TO MAKE THE DRAFT SOUTH LONDON WASTE PLAN SOUND

(Response Form Question 7)

5.1 It is fully acknowledged that the SLWP Submission Plan was prepared based on the information (evidence) available at the time. However, with the updated information now provided by DB Cargo it is considered that unless changes are made to the SLWP as suggested that the Plan would not be sound. Whilst the waste transfer element of the site will be brought forward under PD rights it would not benefit from any safeguarding policy and any other co-located waste use (e.g. C&D recycling) would, as the Plan is currently drafted, be precluded.

5.2 In the context of the lack of safeguarding protection the Waste Plan would provide, it is reiterated that safeguarding is not just a matter of retaining sites for specific uses. As reflected by draft Policy WP8 it is also a matter of protecting waste sites from encroaching development in accordance with the 'Agent of Change' principle and with specific regard to the inter-relationship between new development and existing or future waste uses.

5.3 By reference to **Response Form Question 7** the following changes are required to make the Submission Draft South London Waste Plan sound. Specifically they are required to ensure the Plan is positively prepare, justified, effective and consistent with National Policy as identified in the preceding section of this statement and in regard to Question 6 of the Response Form:

<u>Identification of Chessington Railhead as a 'Safeguarded Waste Site'</u>

> Ideally, the Chessington Railhead site should be expressly identified and referenced as a 'safeguarded waste site'. The safeguarding should be clear that the site will be a 'dual-use site, with a minerals operation within the site' and should be clear that there is potential to further increase waste management by co-location of appropriate complementary waste uses (recycling of C&D waste).

5.4 Or, and at minimum, the SLWP, should be amended to provide for:

> Inclusion of a specific reference within supporting paragraph /text in Section 5 of the SLWP as follows (proposed text shown bold and underlined):
>
> **<u>The Chessington Railhead Site at Garrison Lane is known to be in the control of a freight operating company and a minerals and waste operator and is in the process of being brought into dual use as a rail served waste and minerals transfer site and is supported by the SLWP. Reactivation of this rail served site could in the future offer opportunities for intensification by co-location of other waste uses (C&D recycling) and would be supported subject to other policies in this South London Waste Plan and the relevant borough's Development Plan.</u>**

5.5 Subject to the above, and primarily if the second of the above two options is progressed the following changes will additionally be required (proposed text shown bold and underlined):

Amendment to Policy WP2 'Strategic Approach to Other Forms of Waste'

5.6 Amendments to be made to Policy WP2, *Strategic Approach to Other Forms of Waste,* to recognise Chessington Railhead being reactivated for waste transfer purposes as follows:

(e) Development for improvements to ……

(f) Development of C&D recycling facilities at the Chessington Railhead site, Garrison Lane, once reactivated as a dual use minerals and waste rail transfer site will be supported subject to other policies in this South London Waste Plan and the relevant borough's Development Plan.

Amendment to Policy WP3 'Existing Waste Sites'

5.7 Amendment to be made to Policy WP3, *Existing Waste Sites.* to appropriately reference the Chessington Railhead site as follows:

Safeguarding

(a) The sites set out on Pages 44-91 **and the Chessington Railhead site as detailed at Page [X]** of this South London Waste Plan will be safeguarded for waste uses or waste/mineral uses only.

Amendment to Policy WP8 'New Development Affecting Waste Sites'

5.8 Amendment to Policy WP8, *New Development Affecting Waste Sites,* so that it ensures that the Chessington Railhead site is appropriately protected under the 'agent of change principle' and the specific provisions of this policy at part (a) and (b). Additional amendments have been proposed at part (b) (iii) to further strengthen the protection the policy affords to safeguarded waste sites. This would underpin the 'effectiveness' of the plan and its 'consistency with national policy'. Proposed additions are shown in bold and underlined as follows:

(a) New development should be designed to ensure that existing waste sites, **the Chessington Railhead site once reactivated as a dual use mineral and waste rail transfer site** and sites developed for compensatory provision remain viable and can intensify without unreasonable restrictions being placed on them.

(b) Where new development is proposed that may be affected by an existing waste site, an extant scheme, permission for additional capacity**, the Chessington Railhead site once reactivated as a dual use mineral and waste rail transfer site** or a site developed for compensatory provision, the applicant should…

(i) Ensure that good design mitigates and minimizes existing and potential nuisances generated by the waste use…..

(ii) Explore mitigation measures early in the design stage…..

(iii) Engage early with the operator of the waste site to ensure a full understanding of the operation (including on-site activities and hours of operation) and to ensure baseline assessments are robust.

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Rev	Description	Date

CLIENT:
DB CARGO

PROJECT:
CHESSINGTON RAILHEAD (Coal depot) SITE
GARRISON LANE, CHESSINGTON

TITLE:
SITE LOCATION PLAN

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Scale:	1:1250 @ A3		Date:	Oct 20
Drawn:	CAD		DRG. No.	2719/10
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Checked:			REV.	A

APPENDIX 4: The climate change impact of burning municipal waste in Scotland (Councillor Nick Mattey)

The climate change impacts of burning municipal waste in Scotland

Technical Report

Prepared by:
Kimberley Pratt and Michael Lenaghan
Zero Waste Scotland

Date: October 2020

European Union
gov.scot
EUROPE & SCOTLAND
European Regional Development Fund
Investing in a Smart, Sustainable and Inclusive Future

Contents

Project details, disclaimer, copywrite and acknowledgements

Project name: The climate change impact of burning municipal waste in Scotland – Technical Report

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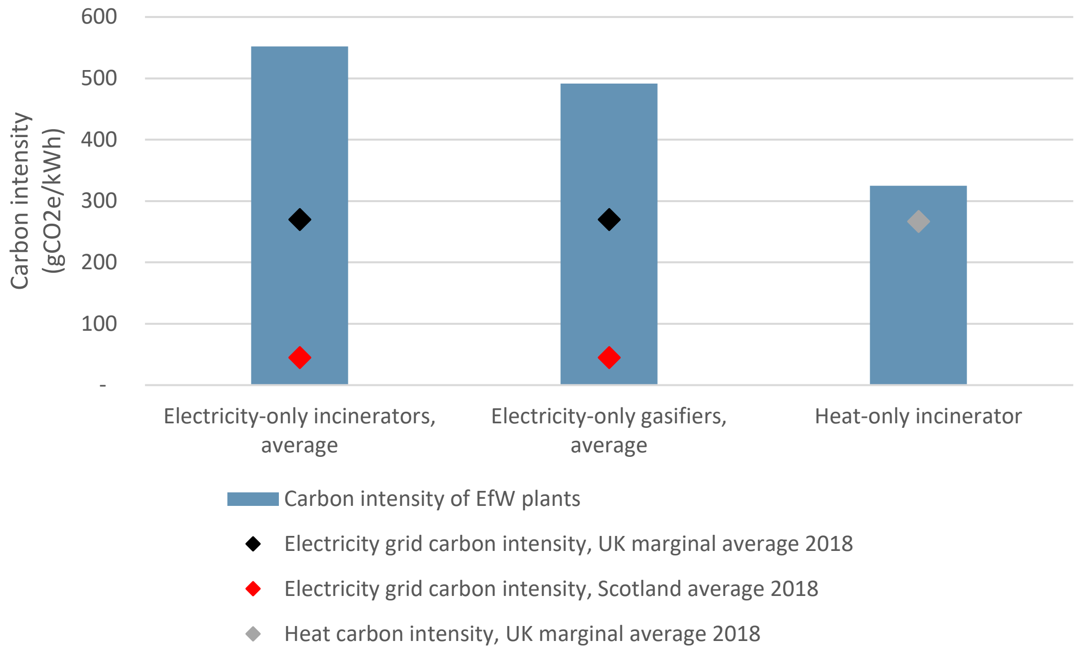
Executive Summary

This report describes the climate change impacts of burning residual municipal waste in Scotland. The **carbon intensity** and **greenhouse gas emissions** of all six Energy from Waste (EfW) plants burning residual municipal waste in Scotland in 2018 have been calculated. Measuring carbon intensity allows a comparison with other energy production technologies. Life Cycle Analysis has been used to calculate the net greenhouse gas emissions per tonne of waste input for EfW and landfill as an alternative waste management option. Incineration and landfill are reserved for residual waste once all other, less environmentally damaging options, such as prevention, reuse and recycling, have been exhausted.

Burning residual municipal waste in EfW plants in Scotland in 2018, had an average carbon intensity of 509 gCO_2/kWh. Figure 1 shows the average carbon intensity by EfW plant type. Electricity-only incinerators and gasifiers have an average carbon intensity of 524 gCO_2/kWh. This is nearly twice as high as the carbon intensity of the UK marginal electricity grid average, which was 270 gCO_2/kWh in 2018 [1]. The carbon intensity of the only heat-only incinerator operating in Scotland in 2018 was lower, at 325 gCO_2/kWh, although this was still higher than the UK marginal heat average (267 gCO_2/kWh).

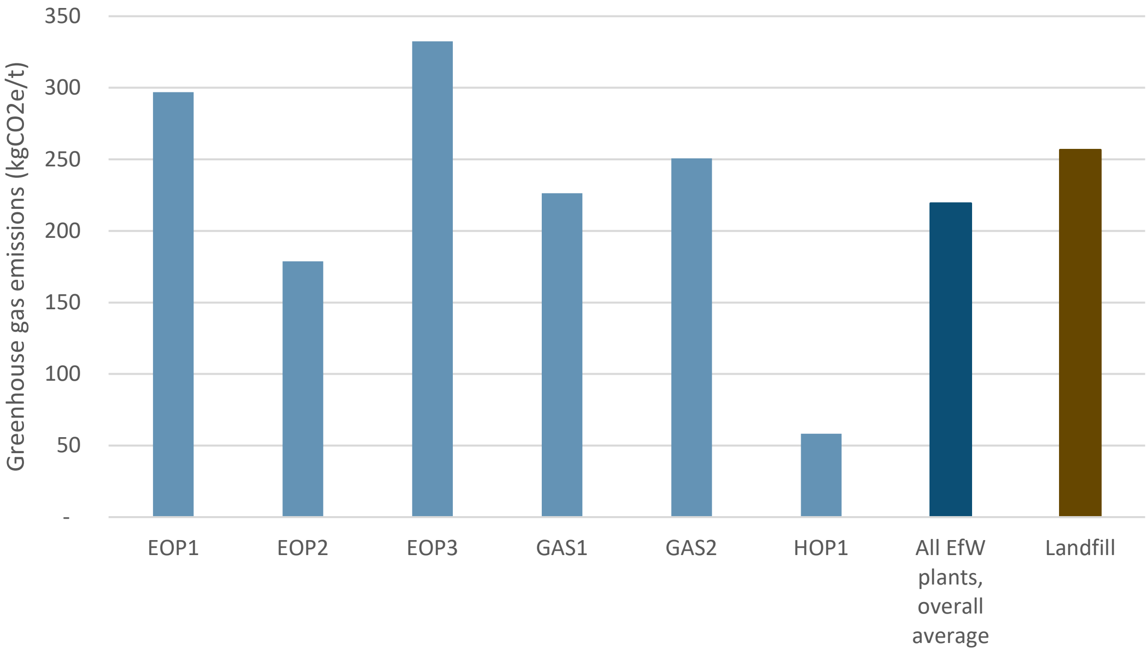
Figure 1. Average carbon intensity of EfW plant types in Scotland in 2018



[1] The carbon intensity of the Scottish marginal electricity grid average in 2018 was 44 gCO2e/kwh.

Sending one tonne of residual municipal waste to EfW in Scotland in 2018 emitted 219 kgCO_2e, which is 15% less greenhouse gas emissions per tonne than the emissions from sending the waste to landfill instead (Figure 2).

Figure 2. Greenhouse gas emissions per tonne from burning and landfilling residual municipal waste in Scotland in 2018



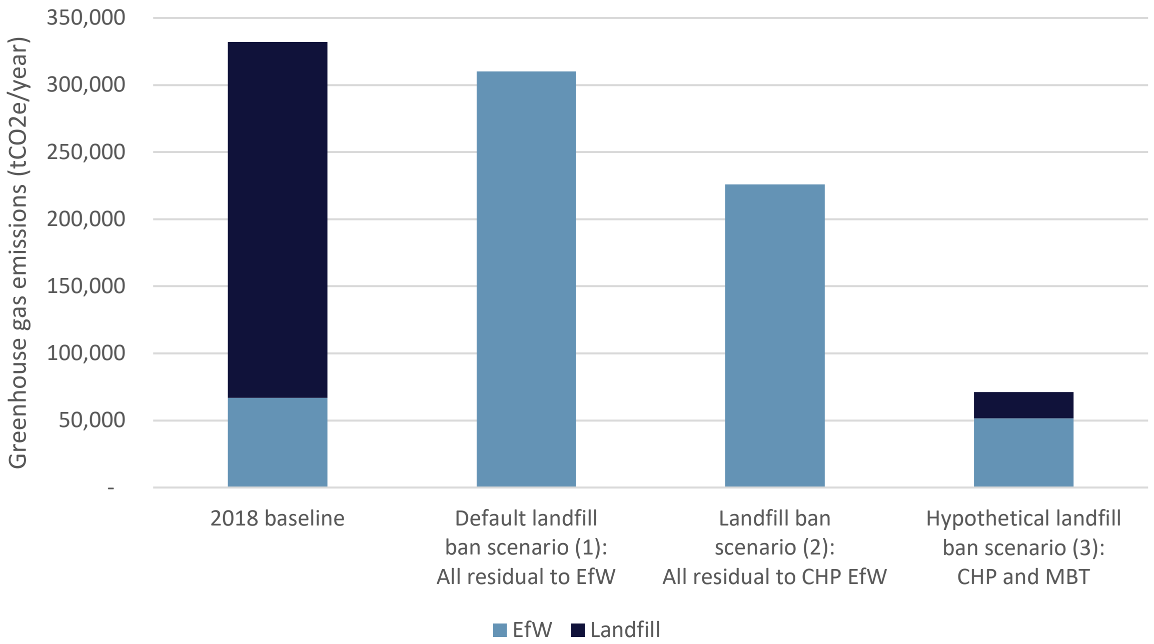
A sensitivity analysis was conducted to explore the impact of two critical variables in the model: the composition of waste and the potential of technological solutions. The results show that changes in waste composition and technology can considerably alter the climate change impacts of waste management.

Both incinerator and landfill impacts are very sensitive to the composition of the waste input. Increasing the plastic content of municipal waste increases the Net Calorific Value (NCV) but also the greenhouse gas emissions of EfW plants, as a higher proportion of fossil carbon is burnt and released into the atmosphere. If the proportion of plastic in residual municipal waste increases from 15% to 17%, greenhouse emissions per tonne for incinerators rises to the same level as landfill. Converting to CHP systems reduces the carbon intensity of EfW plants significantly but not below the UK average for marginal grid electricity.

The Scottish biodegradable municipal waste (BMW) ban is due to come into force in 2025. The aim of this ban it to reduce greenhouse gas emissions from biodegradable material sent to landfill. This study includes an assessment of the potential carbon impacts of meeting the ban in three different ways. Figure 3 shows the greenhouse gas impacts of these scenarios, which are:

- Default landfill ban scenario (1): incinerate all waste in facilities which operate 2018 efficiency levels;
- Landfill ban scenario (2): incinerate all waste in facilities which operate as CHPs; or
- Hypothetical landfill ban scenario (3): upgrade all incinerators to CHPs and pre-treat waste sent to landfill (the tonnage split between incineration and landfill remains at 2018 levels).

Figure 3. The greenhouse gas impacts of three scenarios for meeting the BMW ban



In 2018, management of residual municipal waste had a greenhouse gas impact of 332,016 tCO_2e. If all waste was sent to electricity-only incineration plants (the default scenario), the impact would be lowered slightly by 7% to 310,125 tCO_2e. If all waste was sent to CHP plants instead, the impact would fall further (27% below the 2018 baseline) to 225,910 tCO_2e. If incinerators were upgraded to CHPs and pre-treatment added to landfill (CHP and MBT scenario), much greater savings are possible. The annual impact would be reduced by 79% to 71,104 tCO_2e.

The savings from landfill pre-treatment are illustrative only and further, more detailed research is required to understand the exact savings required.

Conclusions

This study has implications for how long-term infrastructure and policy decisions are made. Whilst EfW plants have been successful, to date, in reducing greenhouse gas emissions from residual municipal waste, there is a risk that these savings will be lost if current trends and policies continue. This is due to the changing nature of waste composition and because of the successful decarbonisation of the UK and Scottish energy grids. Decarbonisation of the grid has been so successful that EfW technologies can no longer be considered low carbon solutions. Decisions on future management must be based on the most current and accurate data possible to ensure climate change impacts are minimised.

Waste policy should be adapted to take advantage of significant opportunities to reduce the climate change impacts of waste further. This study can inform policy decisions in this area.

1 Introduction

This technical report is part of a study which calculated the climate change impacts of burning municipal waste in Energy from Waste (EfW) plants in Scotland in 2018. A summary report is also available on the Zero Waste Scotland website. This report explains the methodology and describes the results, including the sensitivity analysis, in detail.

There were six EfW plants which burn municipal waste in Scotland in 2018:

- three electricity-only plants (EOP1, EOP2 and EOP3) in Dunbar, Dundee and Edinburgh;
- two gasifiers (GAS1 and GAS2) in Glasgow and West Lothian; and
- one heat-only plant (HOP1) on the Shetland Isles.

Most of these plants have only recently started operating and more are expected to be built ahead of the 2025 landfill ban on biodegradable municipal solid waste (MSW). By quantifying the climate change impacts of burning Scotland's waste, this study will support decision makers in understanding how these impacts can be minimised.

Plant specific data was used as much as possible in the model. The baseline year was chosen as 2018 as this was the most complete and up to date dataset available. Four of the plants only started operating in this year and this is reflected in the data, results and interpretation. The study also included a sensitivity analysis, to assess the likely effects of future changes in key variables, such as changes to the composition of municipal waste and converting the electricity-only plants to Combined Heat and Power (CHP) plants. The main results, sensitivity analysis results and key uncertainties and data gaps are presented in this report.

Climate change impacts are measured in two ways in this study; **carbon intensity** and **greenhouse gas emissions**. Carbon intensity is a standard approach for comparing the climate change impacts of different energy generation technologies, such as gas fired power stations. EfW plants are classified as power stations for national emissions reporting purposes and while their primary purpose is waste treatment, part of their function is to provide energy. Therefore, a comparison to other energy generating technologies is appropriate. Life Cycle Analysis (LCA) methodology is used to assess the greenhouse gas emissions and savings of sending one tonne of municipal waste to a waste disposal route. It can be used to compare the climate change impact of waste management technologies with similar boundaries. In this study, EfW is compared to landfill.

Key terms used in this study are defined in the box below.

Definitions of key terms

Climate change impacts

A measure of greenhouse gases (GHG) including carbon dioxide (CO_2) and methane (CH_4), which are produced as a result of human activities, and which influence the climate of our planet through atmospheric warming. These can be grouped and quantified into a single figure (known as a global warming potential or GWP), using estimates of the relative impact of each GHG. This figure, measured in CO_2 equivalent units (CO_2e), can be used to compare processes which emit different types of GHG (such as EfW and landfill).

The boundaries for this study are consumption based, rather than territorial. This reflects the global nature of material consumption and climate change. As nearly all the activities included in the study occur within Scottish geographic boundaries, the results would not change greatly if they were territorial based. The main difference would be an exclusion of emissions and savings associated with the export of materials for recycling.

Carbon intensity

A measure of carbon dioxide emissions relative to the energy generation for a fuel or technology, such as a power station. It is usually measured in units of gCO_2/kWh and can be used to compare the environmental efficiency of energy generating technologies. It only considers the impact of energy generation, not wider activities related to these technologies, such as transport, processing and emissions saved from energy offset.

Greenhouse Gas emissions

Life Cycle Analysis (LCA) is used as a methodology for measuring all the greenhouse gas emissions and savings from each stage of a process. The approach used in this study includes the emissions from transporting, on-site processing and burning of municipal waste, as well as the emissions saved from the energy offset and recycling for each EfW plant. This can be compared to other processes with similar boundaries, such as landfill[2]. GHG emissions are measured in $kgCO_2e$ per tonne of waste input.

Displacement of energy or virgin material production

It is assumed that energy generated from a process such as burning waste displaces an alternative form of energy generation. The emissions which would have otherwise occurred from that alternative energy generation are included as part of the savings from the EfW process. The EfW plants in this study are assumed to displace marginal UK grid electricity, reflecting the most likely scenario for these technologies.

Materials which are recycled are assumed to displace virgin material production. For example, the impacts of metal recovery include the savings from avoided extraction of metal ores, as well as the impacts of transporting and reprocessing the recyclate.

[2] Greenhouse gas emissions from landfill occur over a long period dependent on the decomposition rate of waste in landfill.

1.1 EfW plants in Scotland

As of 2019, there are fourteen operational EfW plants in Scotland. Of these, six are permitted to take municipal waste. Details of these plants are listed in Table 1. Municipal waste is defined as "waste from households as well as other waste which because of its nature or composition is similar to waste from households" by the Landfill (Scotland) Regulations 2003 (as amended)[3]. Waste from non-municipal sources is subject to separate regulations and is beyond the scope of this study.

Table 1. Operational EfW plants in Scotland in 2019 which are permitted to take residual municipal waste

Name of plant	Incinerator type	Incineration capacity (tonne/year)	Municipal waste incinerated in 2018 (tonnes)	Status and energy generation type
Dunbar Energy Recovery Facility, Oxwellmains, East Lothians	Moving grate incinerator	300,000	41,284[3]	Fully operational as of 2019[2], CHP potential but currently operating as electricity-only
MVV, Baldovie Industrial Estate, Dundee	Fluidised bed incinerator	110,000	94,624	Operational[4], CHP potential but currently operating as electricity-only
Millerhill Energy Recovery Centre, Edinburgh	Moving grate incinerator	195,000	16,459[3]	Fully operational as of 2019[5], CHP potential but currently operating as electricity-only
Glasgow Recycling and Renewable Energy Centre (GRREC), Glasgow	MRF[6], AD[7] and gasifier	154,000	66,504[3]	Begun operations in 2018, producing SRF[6] and electricity (CHP potential but currently operating as electricity-only)
Levenseat Thermal Waste Treatment Plant, West Lothian	MRF[4], AD[5] and gasifier	200,000	63,355[3]	Begun operations in 2018, producing SRF[6] and electricity (CHP potential but currently operating as electricity-only)
Lerwick Energy Recovery Plant, Lerwick, Shetland Islands	Moving grate incinerator	24,000	23,053	Operational, built and operating as heat-only
Total (tonnes)		**983,000**	**305,280**	

[3] SEPA Guidance (2018) Biodegradable Municipal Waste Landfill Ban https://www.sepa.org.uk/media/352595/sepa_bmw_landfill_ban_guidance_note.pdf

[4] Fires at the Dundee plant in 2018 meant that it was not able to operate for part of the year.

[5] The Dunbar, Millerhill, GRREC and Levenseat facilities all begun operating in 2018 and their operations were scaled up over this year, which is why inputs in 2018 were well below capacity. They are mostly expected to be running close to capacity from 2019.

[6] Materials Recovery Facility (MRF) are partially mechanised approaches to removing materials with recycling value from municipal waste before the remained is burnt for energy generation.

[7] Anaerobic Digestion (AD) is the treatment of organic feedstock for energy or heat recovery.

HOP1 is the only heat-only plant on this list. The other plants, including the gasifiers, have been constructed to be Combined Heat and Power (CHP) plants. However, they currently operate as electricity-only plants.

Of the remaining eight operational EfW plants in Scotland in 2018:

- Five are small scale commercial or industrial incinerators with a combined capacity of 66,000 tonnes per year;
- Three are large scale co-incinerators which mainly take biomass as a fuel but are supplemented with waste from commercial and/or industrial sources. They have a combined capacity of 1.4 million tonnes per year and waste makes up about 19% of their total inputs (275,000 tonnes per year).

A further two small scale commercial incinerators were not operational in 2018.

Future developments include:

- Three EfW plants, which plan to take municipal waste are currently in construction. These are all expected to be operational by 2022, assuming they pass their commissioning stages as planned, and will add 708,000 tonnes per year capacity to create a total potential capacity of 2.14 million tonnes per year of municipal waste by 2025.
- Plans for a further eighteen incinerators are held by SEPA. Half of these plants have been given planning permission, but none have permits or begun construction as of June 2020.

2 Methodology

This section details the methodology used to calculate the carbon intensity and greenhouse gas emissions of the six municipal waste burning EfW facilities operating in Scotland in 2018. The methodology is split into five sections:

1. Estimate the biogenic and fossil carbon content of municipal waste in Scotland in 2018;
2. Calculate the carbon intensity of the EfW plants;
3. Calculate the greenhouse gas emissions of EfW plants using LCA;
4. Calculate the greenhouse gas emissions of landfill using LCA; and
5. Description of how the sensitivity analysis was conducted.

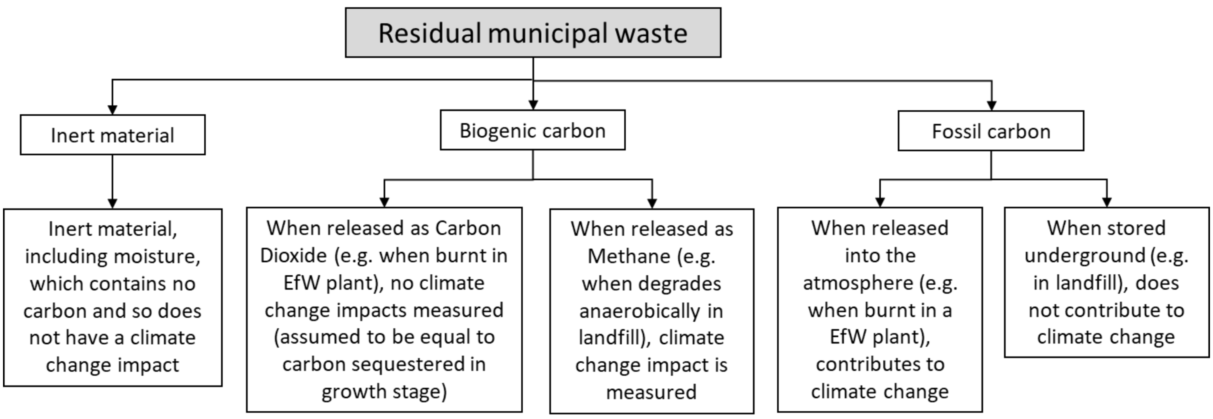
2.1 The carbon content of waste

A typical tonne of municipal residual waste will contain many different waste materials, some of which will contain carbon. This carbon can be divided into two categories: **biogenic carbon,** which is derived from biological sources such as plants; and **fossil carbon** which is derived from fossil fuels. Carbon in waste can be either completely biogenic (such as food waste) completely fossil-based (such as plastic) or a mix of biogenic and fossil (such as cotton and polyester mixed clothing). Some wastes do not contain any carbon (such as metal) are said to be inert or non-combustible.

From a climate change perspective, biogenic and fossil carbon are counted differently. The IPCC methodology for reporting national greenhouse gas emissions only includes biogenic carbon when it is released into the atmosphere as methane. This can happen when biogenic waste degrades anaerobically in landfill, for example. Biogenic carbon released as carbon dioxide is assumed to be equal to the carbon sequestered when the biogenic material was grown. In contrast, fossil carbon released into the atmosphere by human activities contributes to climate change. If it is placed in long term storage instead, the climate change impacts of fossil carbon can be mitigated.

When waste is burnt in an EfW plant, nearly all[8] the biogenic and fossil carbon is released into the atmosphere immediately: the fossil carbon will contribute to climate change. When waste is landfilled, all of the fossil carbon and about half of the biogenic carbon will be stored in the landfill for many years without degrading. The rest of the biogenic carbon will be converted to landfill gas (a mixture of 50% carbon dioxide and 50% methane) some of which will escape into the atmosphere and contribute to climate change. The different possible fates of biogenic and fossil carbon in waste and their contributions to climate change have been summarised in Figure 4.

Figure 4. The climate change impact of inert, biogenic and fossil carbon material in waste



[8] Less than 3% of carbon remains in the ash (DEFRA, 2014 Energy recovery for residual waste).

Therefore, the climate change impacts of EfW are largely determined by the amount of fossil carbon in residual municipal waste, whilst the impacts of landfill are largely determined by the proportion of biogenic carbon in waste which is released into the atmosphere as methane. So, the biogenic and fossil carbon content of residual municipal waste is a critical parameter in this study.

To calculate the biogenic and fossil carbon content of waste, two pieces of information were required:

1. An up to date composition of municipal residual waste sent to landfill and EfW in Scotland; and
2. An estimation of the biogenic and fossil carbon content of each waste material type in residual municipal waste.

The composition of waste used in this study is based on the ZWS (2017)[9] waste composition analysis. This study estimated a national composition of municipal residual waste collected at kerbside in Scotland in 2014-15. An annual update is made to this composition analysis by SEPA to reflect expected changes in the proportion of food waste in residual waste as food waste collection schemes are introduced across the country. The 2018 composition, as calculated by SEPA, was used in this study.

The biogenic and fossil content of each waste material was based on the assumptions used in a DEFRA (2014) EfW and landfill comparison study[10]. The composition and carbon content of waste estimates used in this study is shown in Table 2.

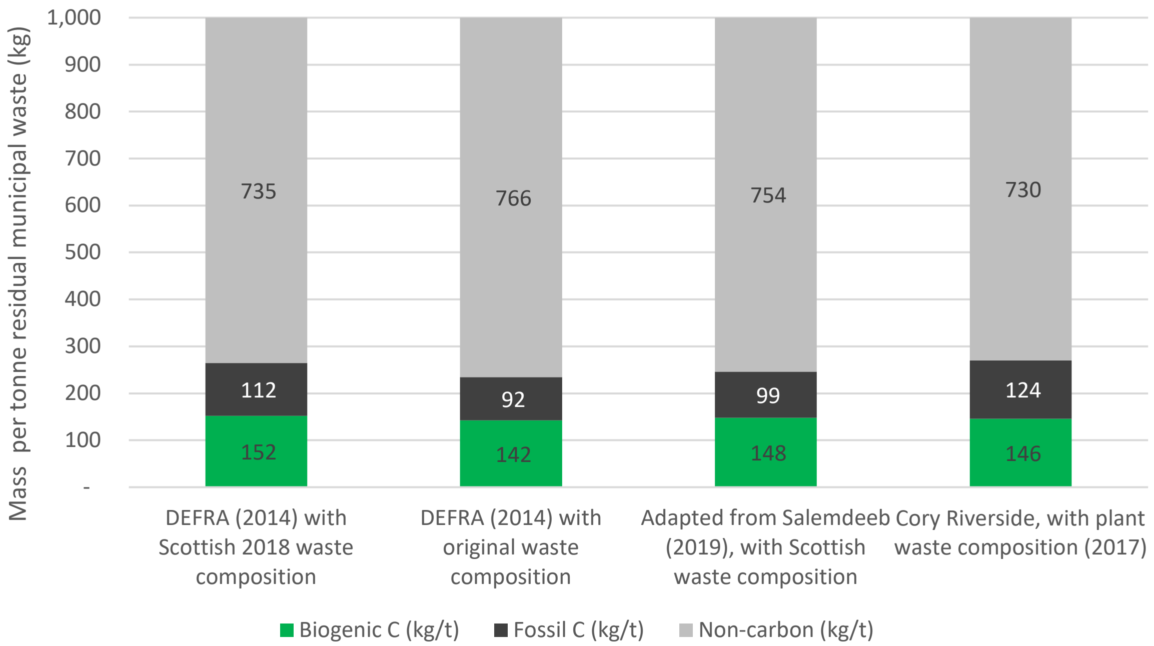
[9] Zero Waste Scotland (2017) The composition of household waste at the kerbside in 2014-15
[10] DEFRA (2014) Energy recovery for residual waste

Table 2. The estimated composition and carbon content of municipal waste in Scotland in 2018

Waste material type	Proportion of waste	Proportion of waste which contains carbon (%)	Proportion of carbon which is biogenic (%)	Proportion of carbon which is fossil (%)
Animal and mixed food waste	26%	14%	100%	0%
Discarded equipment (excluding discarded vehicles, batteries and accumulators wastes)	2%	0%	0%	0%
Glass wastes	6%	0%	0%	0%
Health care and biological wastes	9%	19%	79%	21%
Household and similar wastes (refuse and furniture)	6%	45%	50%	50%
Metallic wastes, mixed ferrous and non-ferrous	4%	0%	0%	0%
Mineral waste from construction and demolition	3%	7%	50%	50%
Paper and cardboard wastes	14%	32%	100%	0%
Plastic wastes	15%	52%	0%	100%
Rubber wastes	0%	0%	0%	100%
Textile wastes	6%	40%	50%	50%
Vegetal wastes	5%	24%	100%	0%
Wood wastes	3%	44%	100%	0%
Total	**100%**	**25.6%**	**14.7%**	**10.9%**

The lack of published information on composition and carbon content of waste, along with the natural variability of waste itself means that there is a high degree of uncertainty surround these parameters. Figure 5 compares the carbon content of waste used in this study with three alternative sources: the original DEFRA (2014) study; the results of a 2017 UK metastudy of waste composition[11]; and a review by the Carbon Trust of the Cory Riverside EfW plant in England which estimated the carbon content of its waste in 2015[12].

Figure 5. A comparison of the carbon content of one tonne of residual municipal waste



Whilst Figure 5 indicates the parameters used in this study are consistent with alternative sources, the study analysis indicates that the model is highly sensitive to the proportions of certain materials in municipal waste. This issue is explored further in the sensitivity analysis results.

2.2 The carbon intensity of EfW plants

Carbon intensity measures the greenhouse gas (GHG) emissions generated per unit of power generated. It is often reported in units of “grams of carbon dioxide emissions per kilowatt hour” or (gCO_2/kWh). It is possible to estimate the carbon intensity of individual EfW plants using three key pieces of information:

- the emissions from the fossil carbon content of waste;
- the net calorific value (NCV) of the waste input and;
- the plant efficiency.

The carbon intensity of each of the EfW plants taking residual municipal waste was calculated using the information above and Equation 1 and Equation 2.

[11] Salemdeeb R (2019) Beyond the food waste hierarchy: a quantitative assessment of embodied environmental impacts using a hybrid approach. PhD thesis. University of Cambridge (UK).
[12] Carbon Trust (2017) Cory Riverside Energy: A Carbon Case

Equation 1. Efficiency of fuel

$$\frac{\text{GHG emissions from fossil carbon content of waste}}{\text{Net calorific value of waste}} = \text{Efficiency of fuel}$$

Where:

GHG emissions from the fossil carbon content of waste is based on the fossil carbon content of waste (Table 2) converted into carbon dioxide emissions using the molecular mass for carbon and oxygen. This was calculated for each plant based on the municipal waste inputs for 2018.

The **net calorific value (NCV) of waste** is based on estimates stated in the Heat and Power Plans for individual plants[13]. The average NCV was 9.5 GJ/t for electricity-only incinerators and 12.1 GJ/t for the gasifiers. The average NCV for UK municipal waste in 2018 was 8.9 MJ/kg[14].

Equation 2. Carbon intensity of EfW plants

$$\frac{\text{Efficiency of fuel}}{\text{Plant efficiency}} = \text{Carbon intensity of EfW plant}$$

Where:

The efficiency of the fuel is calculated from Equation 1.

Plant efficiency is based on the best available data for the plant[11]. Plant efficiency averaged 25% for the electric-only plants and 50% for the heat-only plant.

This allowed the carbon intensity of each EfW plants producing municipal waste in Scotland in 2018 to be calculated. This could then be compared to other energy generating technologies.

2.3 Greenhouse gas emissions of EfW plants

The methodology for estimating the net carbon emissions generated per tonne of waste burnt for each facility is based on a Life Cycle Analysis (LCA). LCA is an internationally recognised approach to measuring and comparing environmental impacts by calculating the emissions and savings of each stages of a process.

In this study, a disposal to cradle boundary is used. All emissions and savings from activities from transport to the incinerator gate to final disposal or recycling of materials are included in the assessment. Where there are emissions savings from avoided production due to recycling, these have been included. The system boundaries for the incinerators, gasifiers (which have more complex pre-

[13] Dunbar: Viridor (2008) Heat Plan, Facility: Oxwellmains, Viridor Waste Management Ltd
Dundee: ARUP (2017) Pollution Prevention and Control Permit – Non-Technical Summary
Millerhill: FCC Environment (2015) Heat and Power Plan
GRREC: Viridor (2017) Heat and Power Plan
Levenseat: Fichtner Consulting Engineers Limited (2014) Heat and Power plan and supporting information
Lerwick: Shetland Islands Council Environmental Service (2009) PCC Permit

[14] Tolvik (2019) UK Energy from Waste Statistics for 2018

treatment stages) and landfill (as an alternative disposal route for municipal waste) are shown in Figure 6, Figure 7 and Figure 8.

Figure 6. System boundaries for sending one tonne of waste to an incinerator

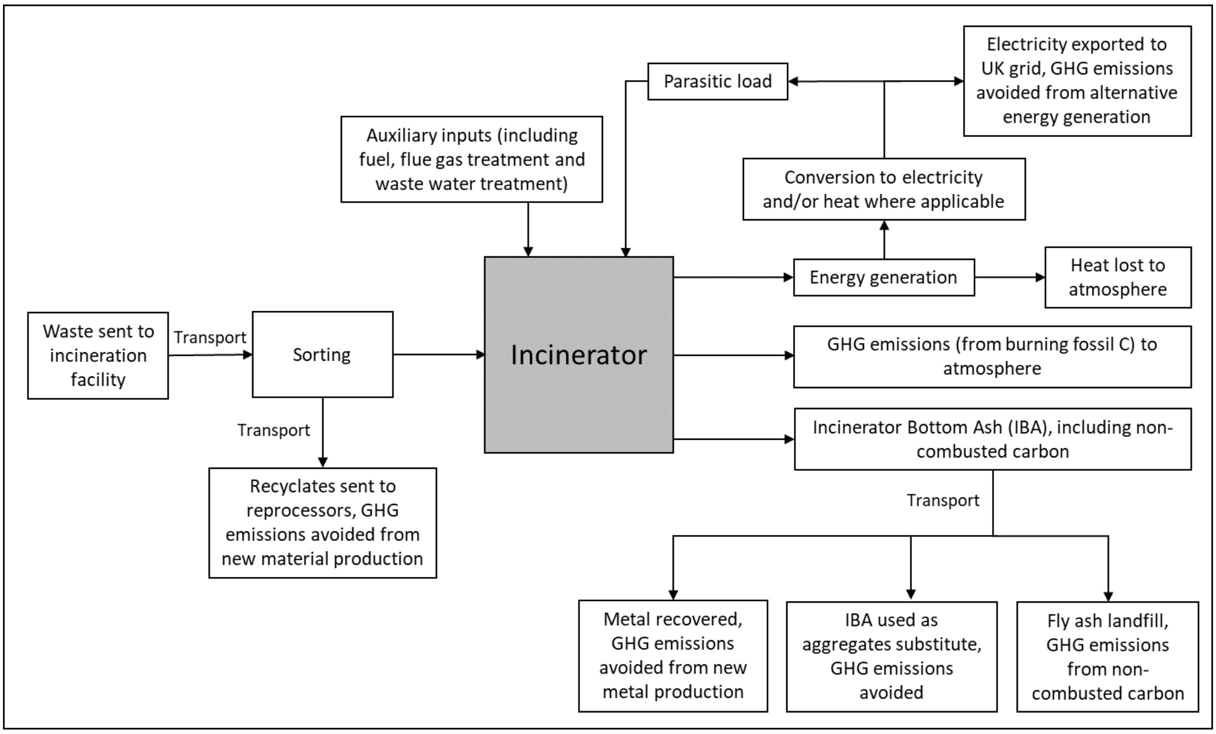


Figure 7. System boundaries for sending one tonne of waste to a gasifier

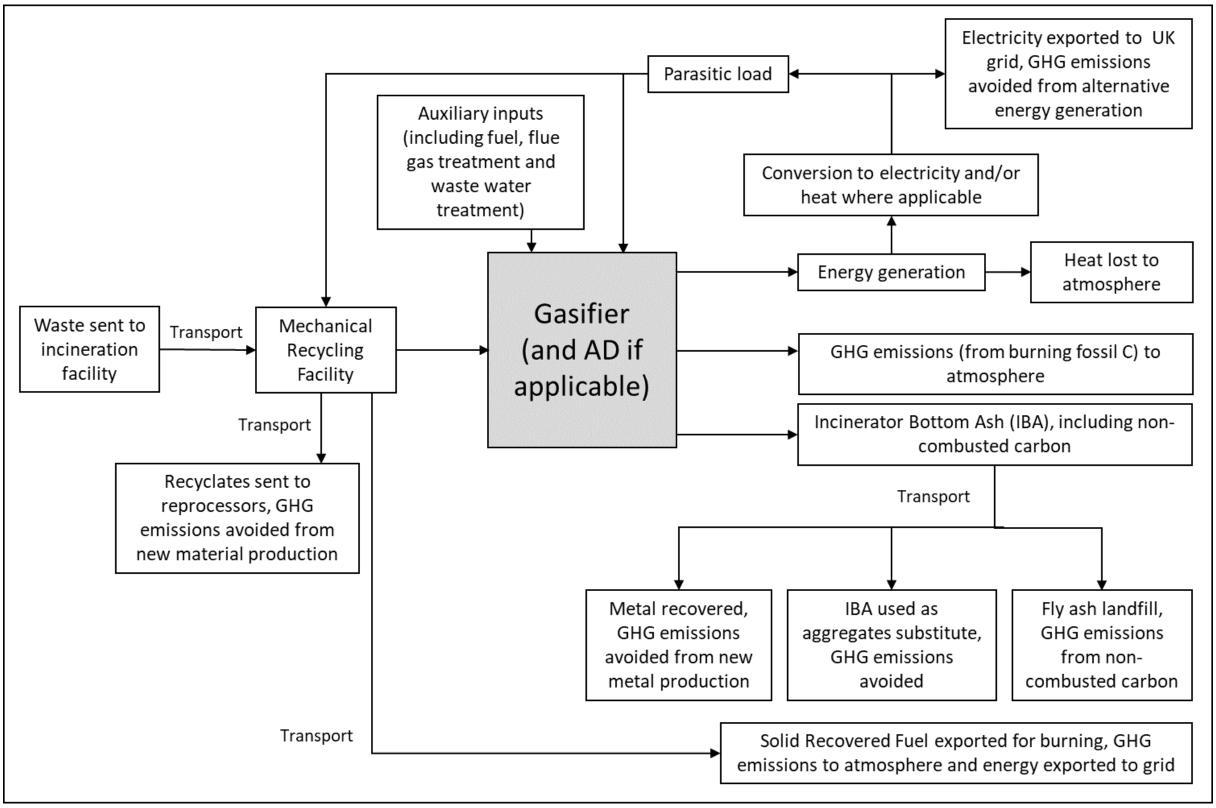
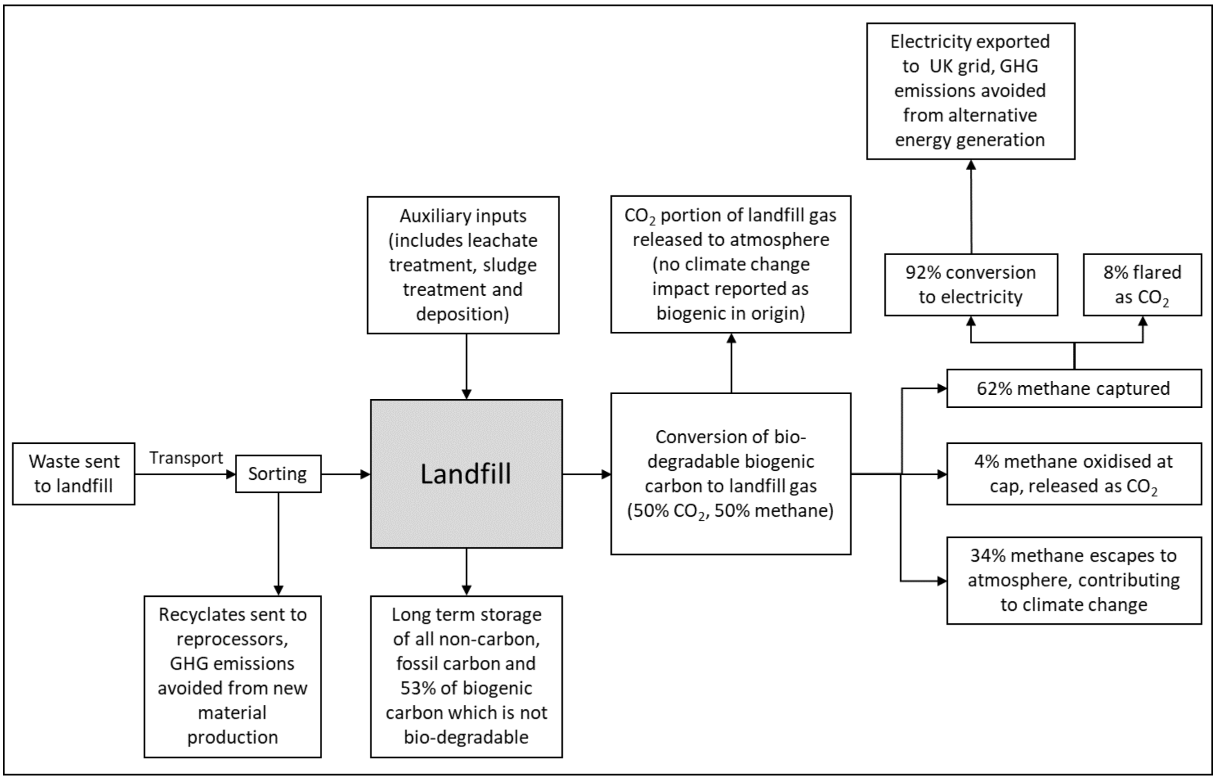


Figure 8. System boundaries for sending one tonne of waste to landfill



The EfW plant model has been divided into six life cycle stages:

1. Emissions from the fossil carbon embedded in the waste burnt;
2. Process emissions (transport, sorting and auxiliary inputs to the incinerator);
3. Emissions avoided from energy displacement;
4. Emissions from incinerator wastes;
5. Emissions avoided from pre-treatment recycling and metal recovery; and
6. Emissions from SRF export (gasifiers only).

The rest of Section 2.3 details the method used to calculate the emissions and savings for each of these stages.

The **emissions from fossil carbon embedded in waste burnt** is based on the fossil carbon content of waste (Table 2) converted into carbon dioxide emissions using the atomic mass for carbon and oxygen. The tonnages and type of waste sent to each EfW are published by SEPA annually[15]. The amount of waste burnt is calculated from this data, minus any recyclate removed pre-treatment. For the gasifiers, the tonnages converted to SRF are also excluded from the tonnages burnt.

The **process emission** stage includes:

- Transport of waste to facility (based on BEIS carbon conversion factors for 2018[16] and Zero Waste Scotland Carbon Metric distances for transporting municipal waste[17]);
- Sorting of waste (Zero Waste Scotland Carbon Metric assumption[15]); and
- Auxiliary inputs to the incinerator (adapted from Ecoinvent[18]).

The **emissions avoided from energy displacement** was estimated using the annual electrical and heat power output estimates for the plant; the load factor for the plant (assumed to be 80% unless plant specific data is available) and the running hours (assumed to be 8,000 hours per year unless plant specific data is available); and the parasitic load (from the Heat and Power Plans of individual plants). These parameters can be used to estimate the power generated from burning one tonne of waste for each EfW plant. This figure is multiplied by the UK carbon factors for marginal electricity[19] and heat[20] generation to calculate the emissions avoided from alternative energy generation. Marginal factors are used rather than the grid average, as EfW generated energy would most likely displace marginal technologies (such as natural gas and renewables).

The **emissions from incinerator wastes** included: transportation of Incinerator Bottom Ash (IBA); displacement of aggregates; transport of fly ash to landfill; and the release of uncombusted carbon from fly ash in landfill.

The **emissions avoided from recycling and metals recovery** is based on the tonnages reported as outputs by each EfW plant and the Zero Waste Scotland Carbon Metric factors for substitution and recycling for each material.

Both gasifier plants began operations in 2018. Their operations and tonnage throughput for this year are not representative of their future expected performance. In 2018, both gasifiers mainly processed their waste by producing Solid Recovered Fuel (SRF) for export, rather than burning it. In GAS1, 70% of waste sent to the plant was converted to SRF, at GAS2 this figure was 82%. The model boundaries were expanded to include the **emissions from the transport and burning of SRF**. Transport distances were based on the proportion of RDF tonnages sent to Scottish, UK and European

[15] SEPA (2019) Site Returns Data
[16] BEIS (2019) Greenhouse gas reporting: conversion factors 2019
[17] Zero Waste Scotland (2020) Carbon Metric 2018
[18] Ecoinvent Version 3, "Municipal solid waste {GB}|treatment of, incineration | Cut-off, U" adapted to include only impacts from auxiliary processes including materials for DE NOx stage, cement required for solidification of landfill material, auxiliary inputs for the waste water treatment stage and flue gas treatment.
[19] BEIS (2019) Valuation of energy use and greenhouse gas
[20] Ecoinvent Version 3, "Heat, central or small-scale, natural gas {Europe without Switzerland}| market for heat, central or small-scale, natural gas | Cut-off, U", year of calculation is 2018, method is IPCC GWP 2013 100a

locations, as recorded by SEPA. The SRF was assumed to be burnt in EfW plants to produce electricity, for which UK marginal grid factors were used.

The results for both the carbon intensity and greenhouse gas emissions for EfW plants were anonymised to ensure the focus of the results remains on the national picture, rather at the level of individual plants.

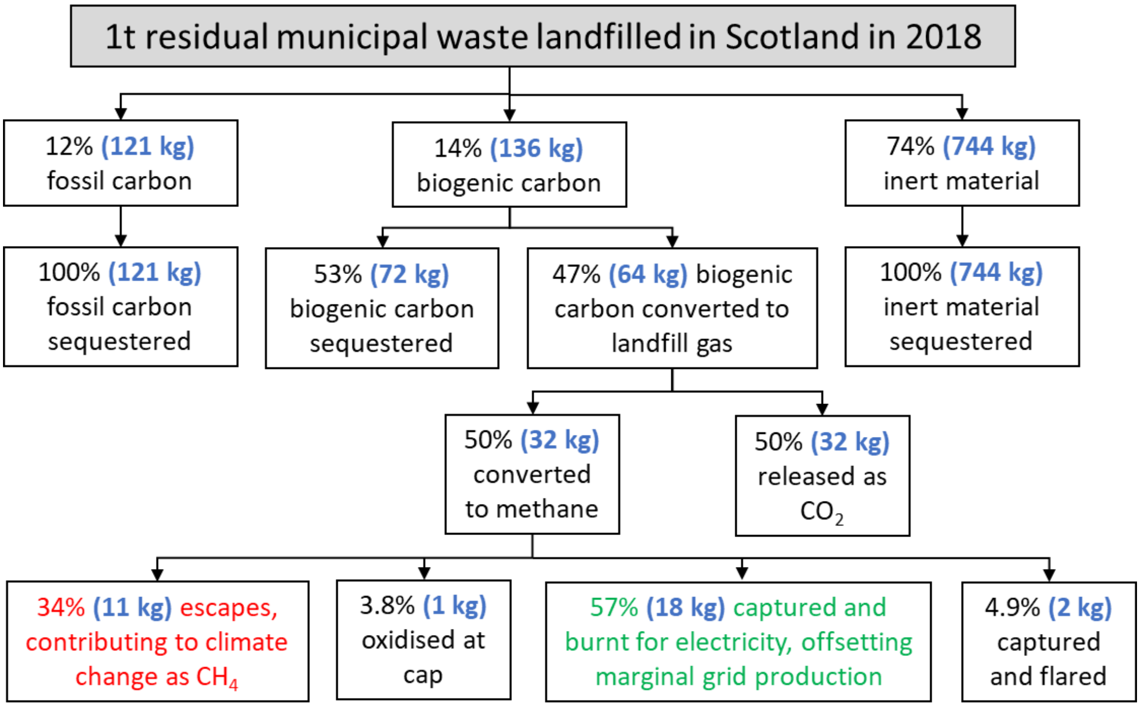
2.4 Greenhouse gas emissions for landfill

The greenhouse gas emissions of sending one tonne of residual municipal waste to landfill in Scotland in 2018 was estimated using LCA. There were four stages to this:

1. Calculating the proportion of biogenic carbon embedded in waste which escapes as methane;
2. Sorting and recycling of waste, including avoided production;
3. Process emissions (transport and auxiliary inputs to landfill); and
4. Emissions avoided from energy displacement.

The fate of carbon sent to landfill is shown in Figure 9. Estimates for the amount of **carbon escaping as methane** is shown in red and the amount of carbon burnt for energy is shown in green. The composition of waste figures are the same as those used for the EfW model and set out in Table 2. The proportion of biogenic carbon which bio-degrades (47%) is based on material specific estimates used in the DEFRA (2014) study and MelMod (a UK and Scottish Government model created to measure the impacts of landfill for the purposes of national carbon reporting[21]).

Figure 9. The fate of carbon in one tonne of residual municipal waste landfilled in Scotland in 2018



The amount of biogenic carbon escaping as methane is calculated from the mass of the carbon given above (11 kg/t) and using the molecular mass of methane. This is then multiplied by the global warming potential of methane[22] to give the greenhouse gas emissions.

[21] Ricardo (2018) MelMod 2018 Inventory Scotland (model version V01-10) and Ricardo (2018) National Atmospheric Emissions Inventory

[22] For methane, this is 28, excluding feedback mechanisms based on the IPPC 4th Assessment Report. This is consistent with Scottish Government climate change reporting.

About 10% of waste sent to landfill is **sorted for recycling** (mainly glass, metals, plastics and wood). The amount and type of materials recycled are estimated from 2018 site returns data from a representative landfill site. The carbon factors for recycled materials in the Scottish Carbon Metric were used to calculate the carbon savings from recycled materials and the remaining waste was assumed to be sent to landfill.

To ensure the EfW and landfill models are comparable, the boundaries of the system must be the same. So, the relevant **process emissions** for activities including transport and leachate treatment are also included in the landfill calculations.

The GHG emissions of the methane captured and **burnt for energy generation** can be estimated by calculating Equation 3 (using standard figures for the density and NCV of methane). It is assumed that this methane goes on to be released into the atmosphere as CO_2.

Equation 3. Power generated per tonne of waste landfilled

Volume of methane captured and burnt	x	Density of gas	x	NCV of gas	=	Power generated per tonne of waste landfilled

The power generated from landfill gas is assumed to displace marginal UK grid electricity. The standard 2018 emissions factor for marginal UK grid electricity production is used to estimate this.

2.5 Sensitivity Analysis methodology

A sensitivity analysis was conducted to explore the importance of two key parameters in the model: the net calorific value (NCV) of residual municipal waste and the conversion of EfW plants to combined Heat and Power (CHP) systems. The method used for this sensitivity analysis is described in this section.

Changing the waste composition

The model in this study is built on assumptions about the carbon content of residual municipal waste. The carbon content of waste can be expressed in terms of net calorific value (NCV), as it is carbon which is burnt to produce energy: the more carbon present in a fuel, the higher it's NCV. The NCV of fuel is a key consideration of EfW operators because it affects the efficiency of their plants.

The main model was altered to vary the proportion of plastic waste in residual municipal waste. Plastic waste contains high amounts of fossil carbon, so increasing the proportion of plastic waste would increase the carbon content and NCV of waste.

In the sensitivity analysis, plastic waste was varied by 10 percentage points. Other materials were adjusted accordingly. The results are presented in terms of changes to NCV and greenhouse gas emissions.

Climate change impacts of technological solutions to residual waste management

Combined Heat and Power (CHP) systems are power plants which convert energy into both electricity and heat. They are more efficient than electricity-only power plants. In alignment with PPC

Regulations, incineration of waste can only be permitted when “conditions necessary to ensure the recovery of energy takes place with a high level of energy efficiency”[23].

All the electricity-only and gasifier plants burning residual municipal waste in Scotland in 2018 operate as electricity-only plants. They were all designed as CHP plants, as required by planning regulations, to maximise their efficiency. The main model was adjusted to show how converting to CHP systems may change their carbon intensity. This was done using electricity and heat efficiency scenarios for each plant, published as part of their Heat and Power Plans. These plans calculated the electricity and heat efficiencies required to meet the standards of high performing CHPs. Plant efficiency increased from an average of 25% in the main model, to 34%.

This is compared to the potential savings of reducing biodegradable material sent to landfill. This could be done using Mechanical Biological Pre-treatment (MBT) technologies. This is modelled with an assumption that biogenic carbon content is reduced from 15% to 5% of municipal residual waste content[24].

Reducing the biodegradable content of waste

Scotland is introducing a ban on biodegradable municipal waste sent to landfill in 2025. The primary purpose of this ban is to reduce greenhouse gas emissions from landfill by removing biodegradable content[25].

The greenhouse gas impacts of residual municipal waste management were calculated for 2018 based on the model outputs. This was compared to three scenarios for the landfill ban:

- Default landfill ban scenario (1): the 77% of residual municipal waste landfilled in 2018 is sent to incineration instead. In this scenario, the incinerators reflect 2018 average practice.
- Landfill ban scenario (2): as in the default scenario, all residual municipal waste is sent to incineration. However, in this scenario, the incinerators are modelled on CHP systems.
- Hypothetical landfill ban scenario (3): all waste currently incinerated is sent to incinerators which are upgraded to CHPs. The remaining residual municipal waste is sent to landfill with pre-treatment, such as MBT, to reduce biodegradability.

The savings from pre-treatment are illustrative only and further, more detailed research is required to understand the exact savings required.

[23] SEPA (2014) Thermal treatment of waste guidelines

[24] Effective MBT pre-treatment can significantly reduce the biodegradable content of landfilled waste in compliance with the Landfill Ban regulations, resulting in significant emissions savings. While a growing number of studies have shown the emissions savings potential of MBT pre-treatment, the figures here are indicative and are not based on a thorough lifecycle analysis of MBT technology.

[25] SEPA (2018) Biodegradable Municipal Waste landfill ban, legislative context

3 Main Results

3.1 The carbon intensity of burning residual municipal waste

The weighted average[26] carbon intensity of EfW plants burning municipal residual waste in Scotland in 2018 was 509 gCO_2/kWh. Table 3 shows the carbon intensity for each EfW plant and the average for each plant type.

Electricity-only incinerators and gasifiers have an average carbon intensity of 524 gCO_2/kWh. This is nearly twice as high as the carbon intensity of the UK marginal electricity grid average, which was 270 gCO_2/kWh in 2018 [27]. The carbon intensity of the only heat-only incinerator operating in Scotland in 2018 was 325 gCO_2/kWh. The carbon intensity is lower because heat-only plants operate at higher plant efficiencies (around 50%) compared to electricity-only (25%). However, even this plant operated at higher carbon intensities than the UK marginal heat average (267 gCO_2/kWh).

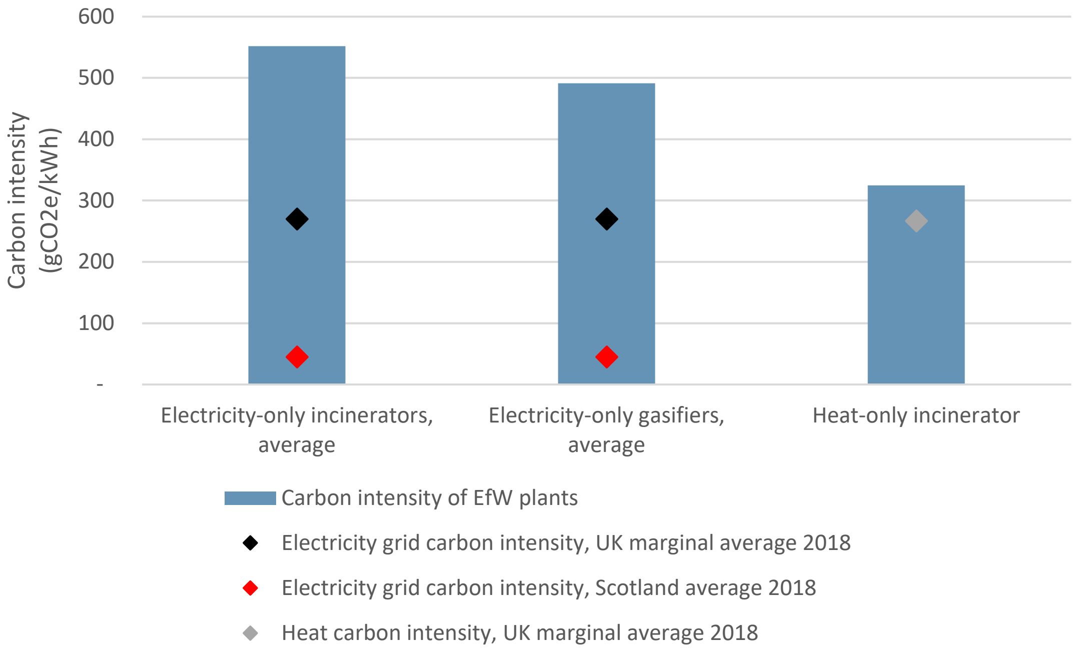
Table 3. Carbon intensity of EfW plants burning municipal waste in Scotland in 2018

Plant	Carbon intensity (gCO_2/kWh)
Electricity-only plant 1 (EOP1)	565
Electricity-only plant 2 (EOP2)	513
Electricity-only plant 3 (EOP3)	744
Gasifier plant 1 (GAS1)	563
Gasifier plant 2 (GAS2)	417
Heat-only plant 1(HOP1)	325
Electricity only incinerators, weighted average	**552**
Electricity-only gasifiers, weighted average	**492**
All EfW plants, overall weighted average	**509**

[26] A weighted average was used for this calculation based on the waste tonnage input into each plant.
[27] The carbon intensity of the Scottish marginal electricity grid average in 2018 was 44 gCO2e/kwh. Taken from Scottish Government (2020) Scottish Energy Statistics Hub, Average greenhouse gas emissions per kilowatt hour of electricity.

Figure 10 shows the carbon intensity of the plants compared to the carbon intensity of the marginal grid average. All plant types have a higher carbon intensity than the grid average, which means they produce more greenhouse gas emissions per unit of power produced than alternative technologies.

Figure 10. The carbon intensity of EfW plants taking municipal waste in Scotland in 2018



3.2 Greenhouse gas emissions from burning and landfilling municipal waste

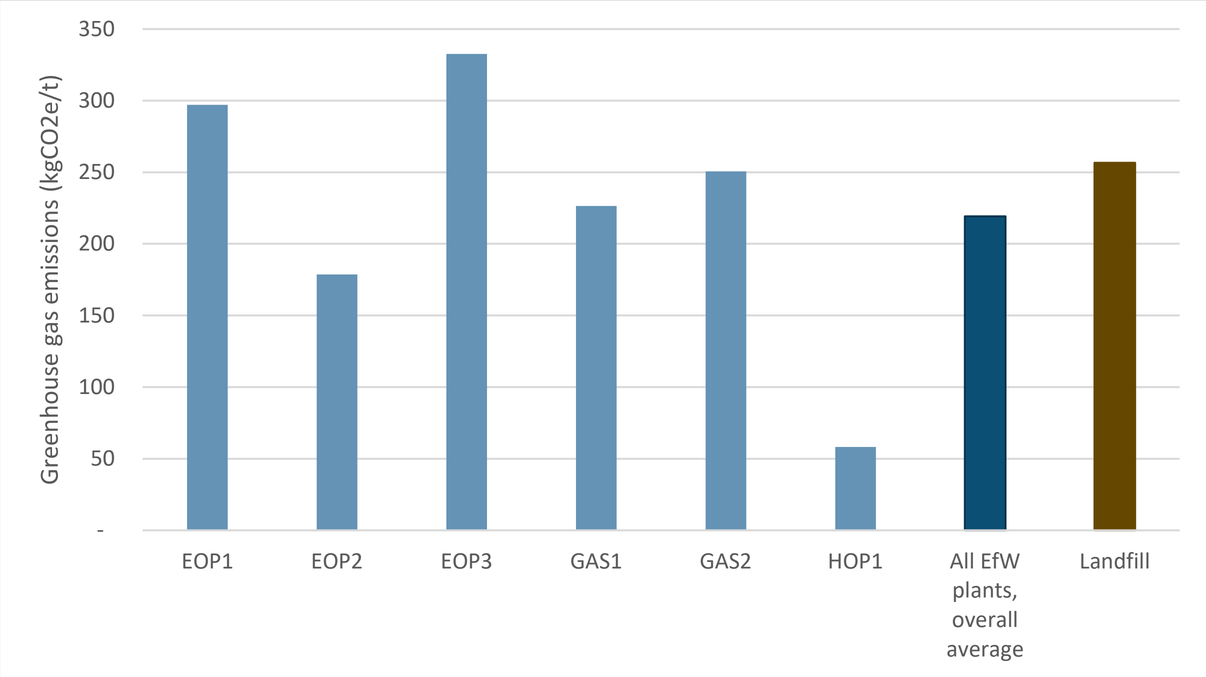
The average greenhouse gas emissions for one tonne of waste sent to incineration in Scotland in 2018 was 219 kgCO2e/t. This is 15% less than sending the same tonne of waste to landfill. Table 4 and Figure 11 show the greenhouse gas emissions of sending one tonne of waste to waste management facilities (EfW plants and landfill) in Scotland in 2018.

Table 4. The greenhouse gas emissions of sending one tonne of municipal waste to waste management facilities in Scotland in 2018

Plant	Greenhouse gas emissions per tonne ($kgCO_2e/t$)
Electricity-only plant 1 (EOP1)	297
Electricity-only plant 2 (EOP2)	179
Electricity-only plant 3 (EOP3)	333
Gasifier plant 1 (GAS1)	226
Gasifier plant 2 (GAS2)	251
Heat-only plant 1 (HOP1)	58
Electricity only incinerators, weighted average	**227**
Electricity-only gasifiers, weighted average	**238**
All EfW plants, weighted average	**219** [28]
Landfill	**257**

[28] This rises to 306 kgCO2e/t if the Scottish electricity grid factor is used instead of the UK marginal grid factor.

Figure 11. The greenhouse gas emissions of sending one tonne of municipal waste to waste management facilities in Scotland in 2018



The heat-only plant has lower greenhouse gas emissions per tonne than the other plants because heat-only plants run at a higher efficiency. This means much more energy generation can be displaced by this plant – reducing the greenhouse gas emissions overall.

Two of the plants in this study, EOP1 and EOP3, have considerably higher GHG emissions per tonne than the other plants (and landfill). These were the only plants not to record any pre-treatment recycling in 2018. At EOP2, 11% of waste brought on site was sorted for pre-treatment recycling. If pre-treatment recycling had been conducted at EOP1 and EOP3, at similar levels to this, their net greenhouse gas emissions per tonne would have been more in line with the other electricity only incinerators and gasifiers.

Table 5, Table 6 and Figure 12 show the more detailed results for the carbon factors for each waste facility, broken down by life cycle stage.

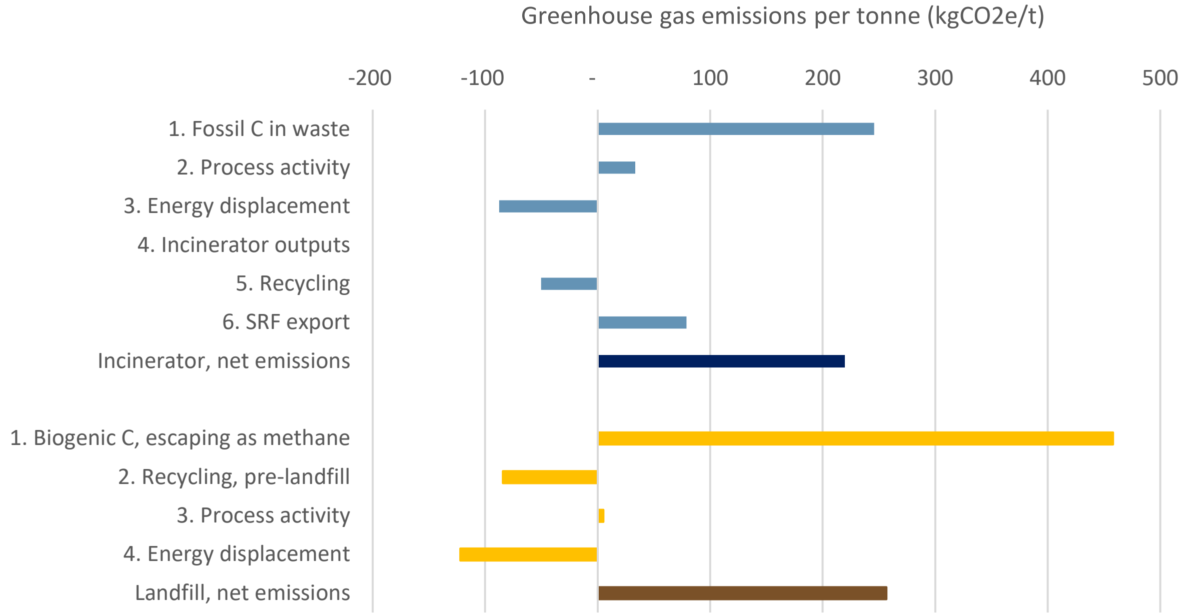
Table 5. Greenhouse gas emissions of sending one tonne of waste to EfW plants in Scotland in 2018, by life cycle stage

Life cycle stage	Greenhouse Gas Emissions per tonne ($kgCO_2$/tonne of waste input)					
	EOP1	EOP2	EOP3	GAS1	GAS2	HOP1
1. Fossil carbon embedded in waste	412	322	412	109	67	401
2. Process activities	35	35	35	30	30	35
3. Energy displacement	-127	-101	-97	-28	-11	-334
4. Disposal of incinerator wastes	-3	0	-4	-0	0	-3
5. Recycling, including metal recovery	-20	-78	-14	-37	-57	-41
6. SRF export and burning	-	-	-	152	221	-
Net GHG emissions per tonne	**297**	**179**	**333**	**226**	**251**	**58**

Table 6. Greenhouse Gas emissions of sending one tonne of waste to landfill in Scotland in 2018, by life cycle stage

Life cycle stage	GHG Emissions per tonne ($kgCO_2e$/tonne)
1. Biogenic carbon embedded in waste, which escapes as methane	458
2. Materials removed for recycling, pre-landfill	- 84
3. Process Activity	5
4. Energy displacement	- 122
Net GHG emissions per tonne	**257**

Figure 12. GHG emissions of sending one tonne of waste to incineration and landfill in Scotland in 2018



These results, along with the total tonnages sent to each waste management facility in 2018, can be used to estimate the total greenhouse gas emissions in 2018 for each facility. This is shown in Table 7. An estimated 305 kt of municipal waste was burnt in Scotland in 2018, resulting in 67 ktCO_2e. In addition, 1,031 kt of municipal waste was landfilled resulting in 265 ktCO_2e.

Table 7. The impact of disposal of municipal waste in Scotland in 2018

Facility	Tonnes sent to waste management facility (t)	Greenhouse gas emissions per tonne ($kgCO_2e/t$)	Total greenhouse gas emissions in 2018 (tCO_2e)
EOP1	41,284	297	12,263
EOP2	94,624	179	16,915
EOP3	16,459	333	5,473
GAS1	66,504	226	15,058
GAS2	63,355	251	15,877
HOP1	23,053	58	1,342
All EfW plants	**305,280**	**219**	**66,928**
Landfill	**1,031,467**	**257**	**264,691**

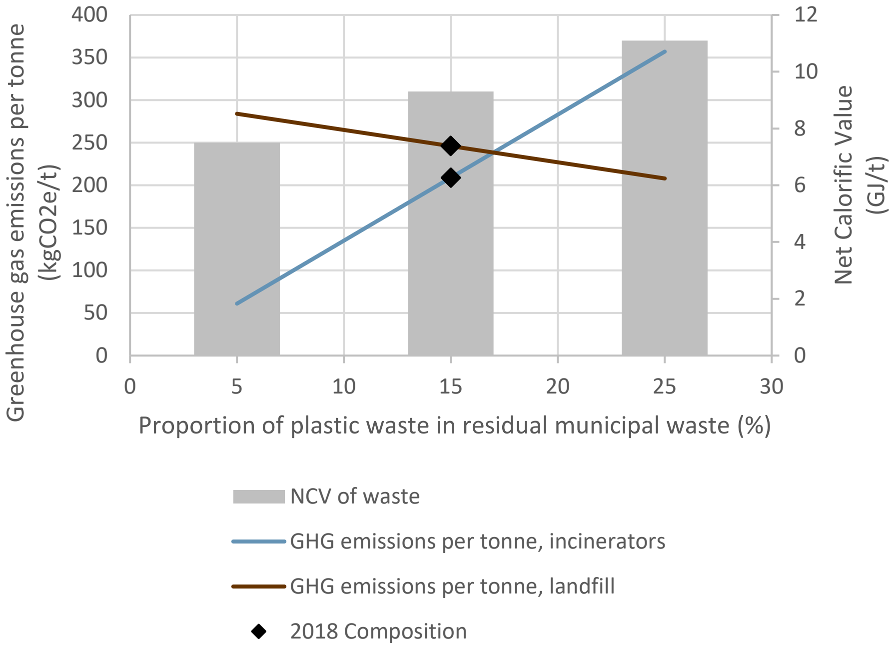
4 Sensitivity Analysis Results

4.1 Changing the Net Calorific Value of waste

Varying the proportion of plastic waste in residual municipal waste changed the NCV and GHG emissions for EfW plants. In the main study, plastic wastes comprised 15% of residual municipal waste which has an NCV of 9.3 GJ/t. The GHG emissions for EfW plants was 219 $kgCO_2e/t$.

As shown in Figure 13, if the proportion of plastic is increased to 25% of residual municipal waste, NCV rises to 11.1 GJ/t but the greenhouse gas emissions also rises by 70% to 357 $kgCO_2e/t$. The same variation in composition would have the opposite effect on landfill emissions (as all fossil carbon is stored in landfill), reducing the impacts of landfill to 208 $kgCO_2e/t$. EfW and landfill impacts are equal when the proportion of plastic in residual municipal waste is increased to 17%.

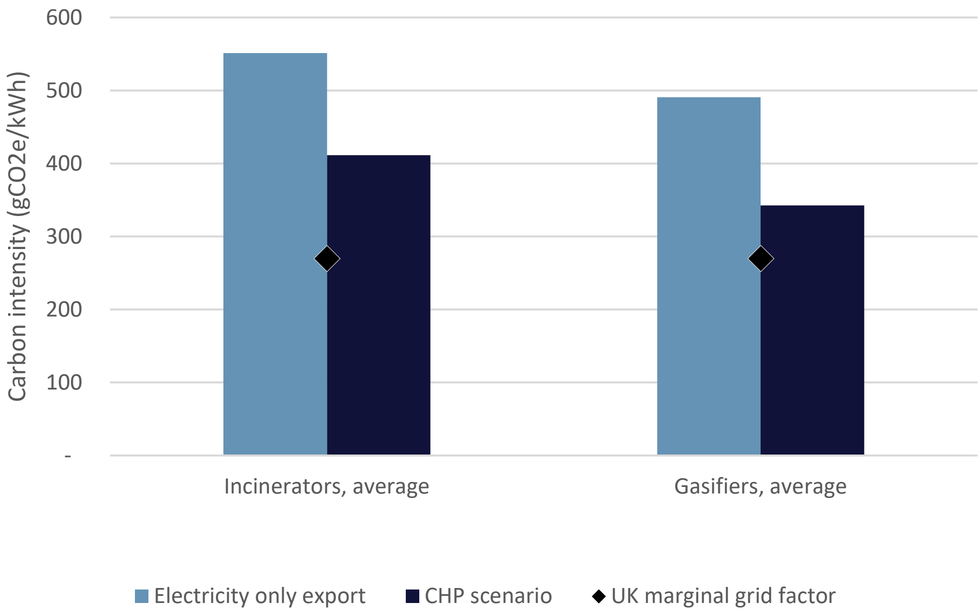
Figure 13. Varying the proportion of plastic in residual municipal waste composition changes the NCV and GHG emissions of EfW and landfill



4.2 Converting plants to CHP facilities

The carbon intensity of electricity-only incinerators and gasifiers was modified to understand how conversion to CHP plants would affect their climate change impacts. Figure 14 shows the results of this analysis. The carbon intensity of both types of plants is reduced but not below the UK marginal grid average.

Figure 144. Converting to CHP systems lowers the carbon intensity of EfW plants

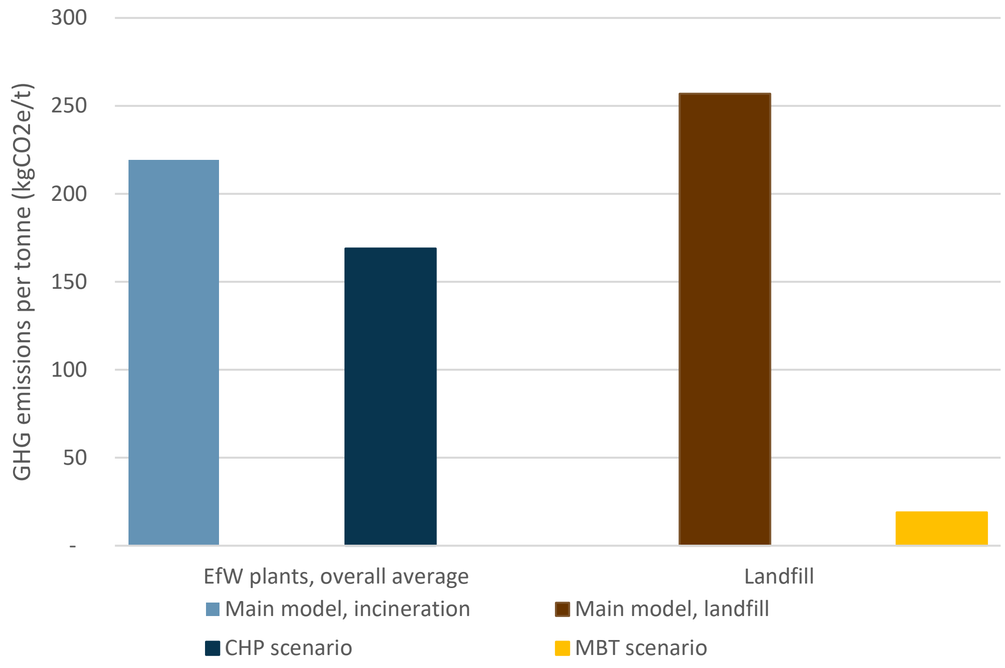


HOP1, the only heat-only incinerator taking municipal waste in Scotland, is not considered in this sensitivity analysis. The carbon intensity of HOP1 is 325 gCO_2/kWh. This is higher than the marginal heat factor for the UK, which is 267 gCO_2/kWh[29].

Changing to a CHP scenario reduces the net greenhouse gas emissions of EfW plants, as well as it's carbon intensity. The net emissions of the plants fall slightly as more energy displaces marginal energy generation. This is shown in Figure 15. This figure also shows a comparison to the potential savings from reducing biodegradable material to landfill. This could be achieved using a Mechanical Biological Pre-treatment (MBT) technology. If levels of biogenic carbon can be reduced from 15% to 5% of municipal residual waste, landfill impacts would fall from 257 $kgCO_2e/t$ to 19 $kgCO_2e/t$.

[29] From Ecoinvent V3, "Heat, central or small-scale, natural gas {Europe without Switzerland}| market for heat, central or small-scale, natural gas | Cut-off, U", year of calculation is 2018, method is IPCC GWP 2013 100a

Figure 15. Converting to CHP or MBT systems lowers the GHG emissions of waste management facilities

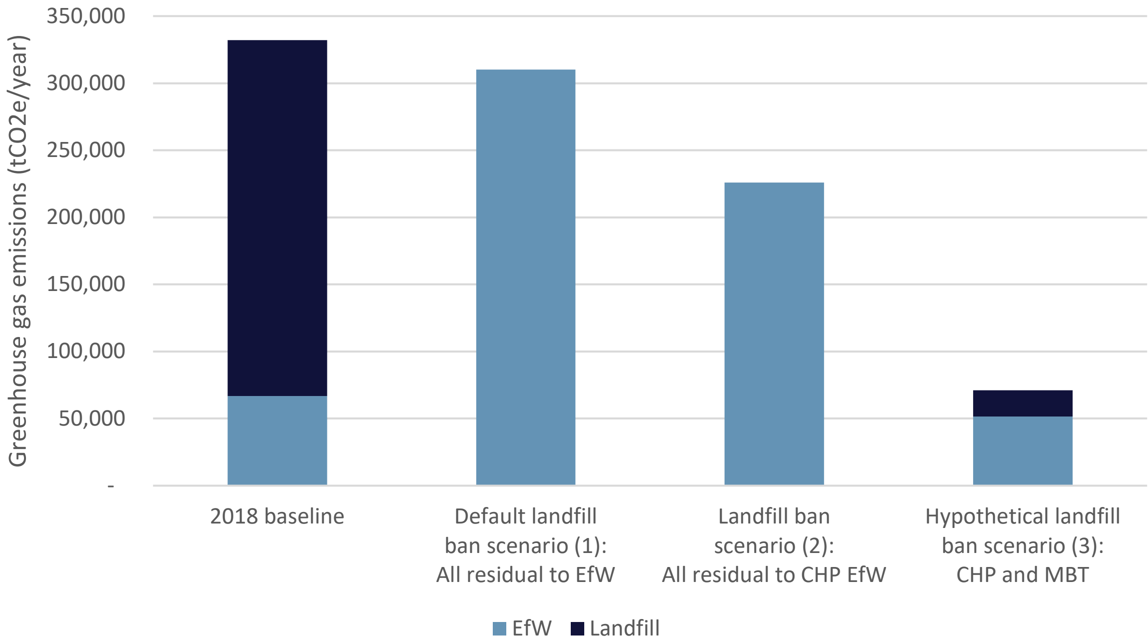


4.3 Meeting the BMW landfill ban

The Scottish biodegradable municipal waste (BMW) ban is due to come into force in 2025. Figure 16 below shows the greenhouse gas impacts of three ways in which this ban could be met:

- Default landfill ban scenario (1): incinerate all waste in facilities which operate 2018 efficiency levels;
- Landfill ban scenario (2): incinerate all waste in facilities which operate as CHPs; or
- Hypothetical landfill ban scenario (3): upgrade all incinerators to CHPs and pre-treat waste sent to landfill (the tonnage split between incineration and landfill remains at 2018 levels).

Figure 16. The greenhouse gas impacts of two scenarios for meeting the BMW ban



In 2018, management of residual municipal waste had a greenhouse gas impact of 332,016 tCO_2e. If all waste was sent to electricity-only incineration plants (the default scenario), the impact would be lowered slightly by 7% to 310,125 tCO_2e. If all waste was sent to CHP plants instead, the impact would fall further (27% below the 2018 baseline) to 225,910 tCO_2e. If incinerators were upgraded to CHPs and pre-treatment added to landfill (CHP and MBT scenario), much greater savings are possible. The annual impact would be reduced by 79% to 71,104 tCO_2e.

The savings from pre-treatment are illustrative only and further, more detailed research is required to understand the exact savings required.

5 Data gaps

There are several gaps in the data and analysis for this study which should be highlighted. The areas of greatest uncertainty are listed below:

1. The **composition of residual municipal waste** is variable and changing. Scottish residual municipal waste composition is estimated annually based on a composition analysis by Zero Waste Scotland of household waste at the kerbside in 2014-15[30]. The composition of waste will change year to year as consumption habits, waste policies and waste management practices evolve. All these factors contribute to gaps in our understanding of the composition of waste. The significance of this has been partly explored in the sensitivity analysis above. An update to the waste composition analysis study, tailored to the requirements of this study, would reduce uncertainty.

2. The **destination of the waste** entering the EfW site is also a source of uncertainty. Waste that enters an EfW site may be sorted for recycling, incinerated or rejected from both sorting and incineration, in which case it is landfilled. Most of the waste is burnt but exact volumes are not known. The fate of waste items which are difficult to recycle or incinerate, such as mattresses, is unknown. Using a basic industry assumption that bottom ash weight is 25% of the weight of waste input[31], suggests that most material (about 90%) entering sites (excluding gasifiers) is incinerated. SEPA is in discussions with plant operators about collecting more detailed data in the future. This uncertainty around sorting means there is also a lack of transparency on the exact composition of waste being incinerated.

3. Data on the **energy outputs of EfW plants** are based on PPC permits, rather than annualised energy data. These permits state the theoretical maximum energy outputs the plants would achieve, operating at maximum capacity. These energy outputs have been scaled down to the waste input levels given for 2018. However, this assumes a linear relationship between waste inputs and energy outputs. Measurements of actual energy outputs would give a more accurate understanding of the inputs and outputs of EfWs in Scotland.

The amount and type of material recycled from residual municipal waste sent to landfill is estimated from site returns data from a representative landfill site. This is the best resource available. SEPA are planning updates to their waste publications in 2021 which could be used to improve this.

There are some simplifications in the model. For example, nitrous oxide (N_2O) is a powerful greenhouse gas but emissions from modern EfW plants have been reduced to almost nothing, so this was also excluded from the analysis.

Whilst there are several areas of uncertainty, the existing model is generally robust. It has been reviewed by the Waste Data Strategy Group, which includes waste data experts from the Scottish Government, SEPA and Zero Waste Scotland. The model and results of the sensitivity analysis allows users to assess the importance of the main variables. There are planned improvements to the underlying datasets. It is therefore concluded that this study is a strong evidence base for considering the position of EfW in the waste hierarchy.

[30] Zero Waste Scotland (2017) The composition of household waste at the kerbside in 2014-15
[31] Tolvik (2019) UK Energy from Waste Statistics for 2018

6 Conclusion

This study quantifies the climate change impacts of burning residual municipal waste in EfW plants in Scotland in 2018. It focuses on two measures: carbon intensity and greenhouse gas emissions. The results show that the carbon intensity of burning waste in EfW plants is 509 gCO_2e/kWh. This is nearly twice the carbon intensity of marginal UK electricity generation, which has fallen considerably in recent years due to successful decarbonisation practices. Converting existing electricity-only plants to CHP systems would result in lowering the carbon intensity and greenhouse gas emissions of electricity-only incinerators and gasifiers. However, even if these plants were operating as CHP systems, their carbon intensities would still be higher than the marginal average. Therefore, EfW can no longer be considered a low carbon technology.

EfW greenhouse gas emissions per tonne of waste averaged 219 $kgCO_2e/t$, which is 15% less than landfill. The only heat-only plant in Scotland has considerably lower impacts than the other EfW plants because it operates at a higher energy efficiency. Pre-treatment removal of recyclate has a significant carbon saving, where it is conducted.

The sensitivity analysis indicates that these results are dependent on the exact composition of residual municipal waste. If the proportion of plastic waste in residual municipal waste is increased from 15% to 17%, EfW emissions rise to the same level as landfill. As the composition of residual municipal waste changes over time, there is a risk that the greenhouse gas emissions per tonne of waste sent to EfWs will increase above those landfilled, leading to unnecessary climate change impacts.

The CHP and MBT pre-treatment scenario for meeting the BMW landfill ban suggests there are a range of technology solutions which could be used together to minimise climate change impacts from waste. To ensure this opportunity is realised, strategic decisions about residual waste treatment and infrastructure are required.

The significance and variability of key parameters such as the composition of waste and the decarbonisation of the grid, illustrate the importance of regularly updating the evidence base on which decisions are made. Whilst there are uncertainties in the approach taken in this study, it is robust enough to guide policy development. Long-term infrastructure and policy decisions must be based on the most current and accurate data possible to ensure climate change impacts are minimised. Waste policy should be adapted in the future to take advantage of significant opportunities to reduce the climate change impacts of waste further.

Climate change is not the only considerations when assessing the environmental impacts of waste management. Land use management and land, air and water pollution other than those contributing to climate change must also be considered when comparing EfW and landfill. However, given the global scale and urgency of the climate emergency we face, the impact of our waste management choices on climate change are a priority issue. The model and report produced by this study can be used to guide future Scottish waste policy in how best to take advantage of significant opportunities to further reduce the climate change impacts of waste.

APPENDIX 5: How councils can improve their recycling rates (South West London Air Quality Monitoring Group)

Part of the Bin the Burners Briefing Series

How councils can improve their recycling rates

There is a significant gap between the councils with the highest recycling rates and those that lag behind. South Oxfordshire District sent 67% of their household waste for recycling, reuse or composting in 2015. In just one year Richmondshire District increased their recycling and composting rates by 14.7 percentage points, from 37.7% in 2014/15 to 52.4% in 2015/16. Lessons can be learnt from higher performing and rapidly improving areas.

Invest to save: Good quality recycling and composting may require short-term investment to yield long-term cost savings.

Council Waste Officers, Environment Portfolio Holders, Council Leaders, Chief Executives and Mayors are all able to work for their Council to achieve higher levels of waste reduction, reuse and recycling. There is also a great opportunity for councils to work together, especially where one council is responsible for collecting waste and another is responsible for treatment.

Ways councils can improve recycling rates

- **Provide a weekly food waste collection for composting or anaerobic digestion**
- **Ensure waste contracts reward reductions in residual waste by avoiding or exiting long-term waste incineration contracts**
- **Invest in waste education to save money that would otherwise be spent on disposal**
- **Introduce a re-use scheme for local bring sites (HWRCs)**
- **Promote re-use networks such as Freegle and Freecycle, including to those seeking bulky waste collection**
- **Enhance commitment to green procurement and give preference to buying items that can be (or that have been) recycled**
- **Provide a free garden waste service for grass cuttings and hedge trimmings**
- **Introduce kerbside glass collection**

Councils with the greatest improvement in recycling (2015/16)

↗ 14.7% — Richmondshire

↗ 8.6% — East Riding of Yorkshire

↗ 7.8% — Tameside

What some of the higher-recycling councils collect

	South Oxfordshire District (household recycling rate of 67% in 2015/16)	**North Somerset** (household recycling rate of 59% in 2015/16)	**South Cambridgeshire** (household recycling rate of 57% in 2015/16)
Food Waste Collection	Kerbside	Kerbside	Kerbside
Glass Jars & Bottles	Kerbside	Kerbside	Kerbside
Cartons (e.g. Tetra Paks)	Kerbside	HWRCs	Kerbside
Batteries	Kerbside	HWRCs	Kerbside
Textiles (clothes)	Kerbside	Kerbside	Recycling points
Food Trays	Kerbside	Not Yet	Kerbside
Plastic Bottle Tops	Kerbside	Not Yet	Kerbside