MVV Environment Services Ltd

MVV Dundee City & Angus Councils' Residual Waste Project

WRATE Technical Report

WTR01

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Contents

Abbreviations and glossary

Term	Abbreviation/meaning	Definition
APCR	Air Pollution Control Residue	By-product of flue-gas cleaning process. Typically a mixture of ash, carbon and lime. Classified as a hazardous waste.
Authority	Dundee City Council and Angus Council	Joined procurement authority for the Dundee City and Angus Councils' residual waste project
CHP	Combined Heat and Power	Cogeneration of heat and power.
CO_2	Carbon Dioxide	A green house gas, and the main form in which carbon is emitted from waste incineration. CO2 has a global warming potential of 1.
CO_2eq	Carbon Dioxide Equivalent	A standard unit for measuring carbon footprints. Used to compare emissions from various greenhouse gases based upon their global warming potential. For example, the global warming potential of methane over 100 years is 21 times that of Carbon Dioxide.
EfW	Energy from Waste	The process where waste is burnt to produce heat and/or electricity.
Eur.Person.Eq	European Person Equivalent	This is a quantification of the environmental impact caused annually by the activities of an average European person.
GHGs	Greenhouse Gases	The atmospheric gases responsible for causing global warming and climate change. The major GHGs are carbon dioxide, methane (CH_4) and nitrous oxide (N_2O). Less prevalent - but very powerful - greenhouse gases are hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6).
GWP	Global Warming Potential	An index representing the combined effect of the differing times greenhouse gases remain in the atmosphere and their relative effectiveness in absorbing outgoing infrared radiation.
GWP100a	Global Warming Potential (100 years)	GWP100a is calculated over a 100 year timeframe
IBA	Incinerator bottom ash	Non-combustible ash discharged from the burning grate at EfW incinerators. IBA typically contains ferrous and non-ferrous metals.
km	Kilometre	A unit of length, equal to 1000 metres.
LCA	Life-cycle Analysis	A process to evaluate the environmental burdens associated with a product, process or activity by identifying and quantifying energy and materials used and wastes released to the environment in order to: • assess the impact of those energy and material uses and releases to the environment; and • identify and evaluate opportunities to effect environmental improvements.
MSW	Municipal Solid Waste	Waste collected by or on behalf of a local authority and it comprises mostly household waste.
MW	Megawatt	A unit of power equal to one million watts. A watt is equivalent to one joule per second.

Term	Abbreviation/meaning	Definition
MWh	Megawatt hour	A unit of power delivered over time equal to one million watts delivered over one hour.
MW_{th}	Megawatt thermal	A unit of thermal power.
MW_e	Megawatt electric	A unit of electrical power.
NCV	Net Calorific Value	The amount of energy within the waste fuel, minus any heat lost due to moisture present in the waste.
NOx	Nitrous Oxides	A group of greenhouse gases emitted from burning waste as a fuel. Nitrous Oxides have a global warming potential of up to 300 times that of CO_2 for a 100-year timescale.
RDF	Refuse Derived Fuel	Refuse derived fuel (RDF) consists of residual waste that is subject to a contract with an end-user for use as a fuel in an energy from waste facility. The contract must include the end-user's technical specifications relating as a minimum to the calorific value, the moisture content, the form and quantity of the RDF.
tpa	Tonnes per annum	Tonnes of waste processed per year
UDP	User Defined Process	A process created in WRATE where one or more parameters or allocation rules is amended from a default process.
WRATE	Waste and Resources Assessment Tool for the Environment	WRATE (Waste and Resource Assessment Tool for the Environment) is a tool for evaluating the environmental aspects of waste management activities during their whole life.

1 Introduction

Ove Arup & Partners Ltd (Arup) has prepared this report for MVV Environmental Services Ltd (MVV) in support of their appointment as Preferred Bidder for the Dundee City Council and Angus Council ('the Authority') joined residual waste contract. Bid participants are required to submit a Waste and Resources Assessment Tool for the Environment (WRATE) model reflecting their proposed waste management solution. The WRATE model has been prepared in compliance with the guidance provided by the Authority; 'WRATE_Guidance_Notes_Part_1_CLEAN_ FINAL.DOC' ('the Authority guidance'), using WRATE version 3.0.1.5 (database version 3.0.1.9), and duplicating the base case scenario (.lca file provided by the Authority) as a starting point for the proposed waste management solution.

In the assessment year of 2025, MVV's proposed waste management solution comprises of a new moving grate Energy from Waste (EfW) facility (the ''EfW CHP facility'), co-located at the existing Dundee Energy Recycling Ltd (DERL) incinerator site, treating all of the contract waste (77,455 tonnes in 2025) and operating in combined heat and power (CHP) mode. Heat will be supplied in the form of steam via a steam network to the neighbouring Michelin tyre manufacturing plant ('the Michelin plant'). Power will be supplied to the the National Grid. There is the potential for heat export to other adjacent heat users, and to export power to the Michelin plant, but at the present time no details are confirmed. In 2025, the existing DERL incinerator will no longer be operational.

WRATE is a life-cycle analysis (LCA) tool, which assess the potential environmental impacts associated with specific integrated waste management scenarios, and is currently the foremost LCA tool for waste management in the UK. The outcomes of the WRATE analysis should be used to inform the decision making process and not used as the sole basis for waste management scenario selection.

As stipulated in the Authority guidance, only the Global Warming Potential over 100 years (GWP 100a) environmental indicator from the WRATE model is presented in this report.

The WRATE pro-forma provided by the Authority, 'WRATE Template – Part 2' has been completed and is submitted as a separate document in conjunction with this report. Part 1.3 of the WRATE pro-forma has not been completed as no bespoke processes have been created.

This report provides an overview of the WRATE model, with the detailed process choices and changes made under the User Defined Process (UDP) included within the WRATE pro-forma. A copy of the WRATE model (.lca file) for the proposed waste management solution will be provided to the Authority together with this report.

No independent peer review has been carried out of the WRATE model (or components of the model such as the UDP), as this is not required as advised by the Authority.

2 Key WRATE modelling parameters

The following key parameters have been used in the WRATE model. Heat and power output parameters have been scaled according to the total net thermal capacity of the contract waste, as the EfW CHP facility will have a larger maximum capacity of 130,000 tonnes per annum (tpa) (compared to 77,455 tpa of contract waste) and will treat waste additional non-contract waste of a higher Net Calorific Value (NCV):

- An assessment year of 2025, as specified by the Authority.
- Plant availability of 90% (7,884 hours per annum) for EfW CHP facility.
- Waste composition as specified by the Authority (see **Appendix A2**) and contract waste tonnage of 77,455 tpa as specified by the Authority.
- Electricity mix for Scotland in 2025, as specified by the Authority (see **Appendix A3**).
- A NCV of 8.8 GJ/tonne, as calculated by the WRATE model when using the specified waste composition.
- A lifespan of 25 years for the EfW CHP facility.
- A heat demand of 5.9 MW_{th} (heat efficiency of 24.54%) from the Michelin plant[1].
- A parasitic load of 0.88 MW_e (3.66% of the thermal capacity of the contract waste) for the EfW CHP facility[2].
- A gross power output of 4.8 MW_e (gross power efficiency of 19.79%) and a net power output of 3.9 MW_e (net power efficiency of 16.13%) in CHP mode with 24.53% heat extraction[3].
- An overall net energy efficiency of 40.67% for the EfW CHP facility.
- Non-ferrous and ferrous metal recovery of 12.6%[4] (of all contract waste) at the EfW CHP facility grate. This reflects the pre-treatment undertaken on the HWRC portion of the contract waste.

[1] The total heat demand from the Michelin plant in 2025 is forecasted to be 9.79 MW_{th} and has been scaled down to reflect only contract waste treatment at the EfW CHP facility.
[2] In Power only mode gross power output for the EfW CHP facility in 2025 is 10.16 MW_e, with a 1.46 MW_e parasitic load. Power output has been scaled down to reflect only contract waste treatment at the EfW CHP facility.
[3] In CHP mode gross power output for the EfW CHP facility in 2025 is 7.90 MW_e, with a 1.46 MW_e parasitic load. Heat output to Michelin is 9.79 MW_{th}. Power and heat output have been scaled down to reflect only contract waste treatment at the EfW CHP facility.
[4] Pre-treatment comprising metal extraction is a statutory requirement and technically only required on the bulky waste fraction (i.e. HWRC waste) of the contract waste, as commercial waste and household waste will not have a technical requirement for pre-treatment due to source segregation requirements for recyclables. The waste forecast spreadsheet provided by the Authority indicates an average of 50.04% of all non-household contract waste is HWRC waste, and non-household waste is delivered via RCV 1 (15.30% of all contract waste) and RCV 4 (20.57% of all contract waste) – representing 35.87% of all contract waste as defined in the base case WRATE model supplied by the Authority. Therefore, 12.56% of ferrous and non-ferrous

- Selective non-catalytic reduction (SNCR) Nitrous Oxides (NO_x) abatement and a dry flue gas cleaning system for the new EfW CHP facility.

A full list of detailed WRATE modelling parameters is provided in **Appendix A**.

metals will be extracted, assuming a 70% metal recovery rate (i.e. 50.04% * 35.87% * 70% = 12.56%).

3 Methodology

The WRATE project file 'WRATE Template.lca' provided by the Authority and containing the base case scenario was duplicated and modified to develop MVV's proposed waste management solution.

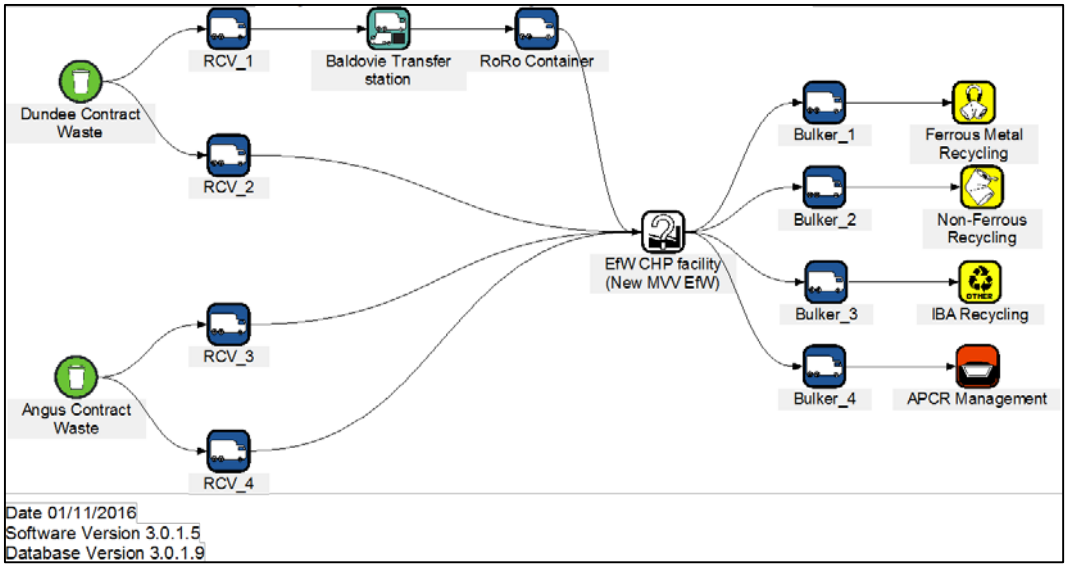

Figure 1: Schematic of proposed waste management solution in WRATE

Figure 1 shows the proposed waste management solution. The key changes to the base case scenario include:

- Directing all waste (15,934.98 tonnes) from RCV_4 to the EfW CHP facility, as opposed to Restenneth Landfill (the transport distance has been amended accordingly). This reflects the increased capacity and plant availability of the EfW CHP facility.
- The existing DERL incinerator has been replaced with the EfW CHP facility, operating in CHP mode.

A UDP was created to model the new MVV EfW, using the default WRATE process 'Flexible Energy from Waste v3, process #21849' as a template. The 'Flexible Energy from Waste Process v3' (FEfWPv3) was chosen as a template to base the MVV EfW UDP on as both have similar waste throughput capacities (94,972 tpa capacity for the FEfWPv3 process and 130,000 tpa capacity for the EfW CHP facility), and both use moving grate technology and operate in CHP mode. In addition, the FEfWPv3 also allows the selection of SNCR for NO_x abatement and the selection of a dry flue gas cleaning system.

Key quantities and allocation rules for process energy production (heat and power), process outputs (metal recovery), construction inputs, maintenance material inputs and outputs, operational fuel inputs, operational material inputs, operational water inputs, waste outputs, energy inputs, and process emissions were altered. This was done in order to reflect the increased energy recovery of the EfW CHP facility as well as other parameters. Where data was not available, quantities were pro-rated to reflect the increased capacity.

Ferrous and non-ferrous recycling at the EfW CHP facility grate was set at 12.6%. This translates to 293 tpa of ferrous metal and 196 tpa of non-ferrous metal that is then transported to off-site recycling via Bulker 1 and Bulker 2. The remainder of the ferrous and non-ferrous metal in the contract waste passes through the EfW CHP facility, subject to process loss of 5% in the flue for non-ferrous metal, and is extracted off-site as part of the incinerator bottom ash (IBA) recycling process.

Amended construction quantities include concrete and steel associated with the steam connection (and condensate return) to the Michelin plant. This comprises steel pipe, steel pipe bridge and foundations. All the full amendments made are detailed in the completed WRATE pro-forma, and the detailed modelling parameters are provided in **Appendix A1.1**.

Management of process waste outputs; IBA and air pollution control residue (APCR), are unchanged from the base case scenario. Therefore, IBA undergoes ferrous and non-ferrous metal extraction, before being recycled for use as aggregate[5], and APCR is sent to landfill.

[5] It is understood that at the present time IBA is sent to landfill after metal extraction, even though in the Authority's base case scenario it is sent for aggregate recycling. However, this has not been altered, as MVV will be actively looking to secure agreement to sell the remaining IBA to market and recycle it (e.g. use as aggregate).

4 Results

As specified by the Authority, global warming potential is the only environmental indicator used for evaluation. The GWP100a results for the proposed waste management solution are presented in categorised form in **Figure 2** and normalised form in **Figure 3** respectively.

Negative results represent an avoided (or displaced) impact, and therefore a benefit, whereas positive results represent a created impact, and therefore a dis-benefit. Therefore, negative results represent a net improved environmental performance, and positive results represent a net reduced environmental performance.

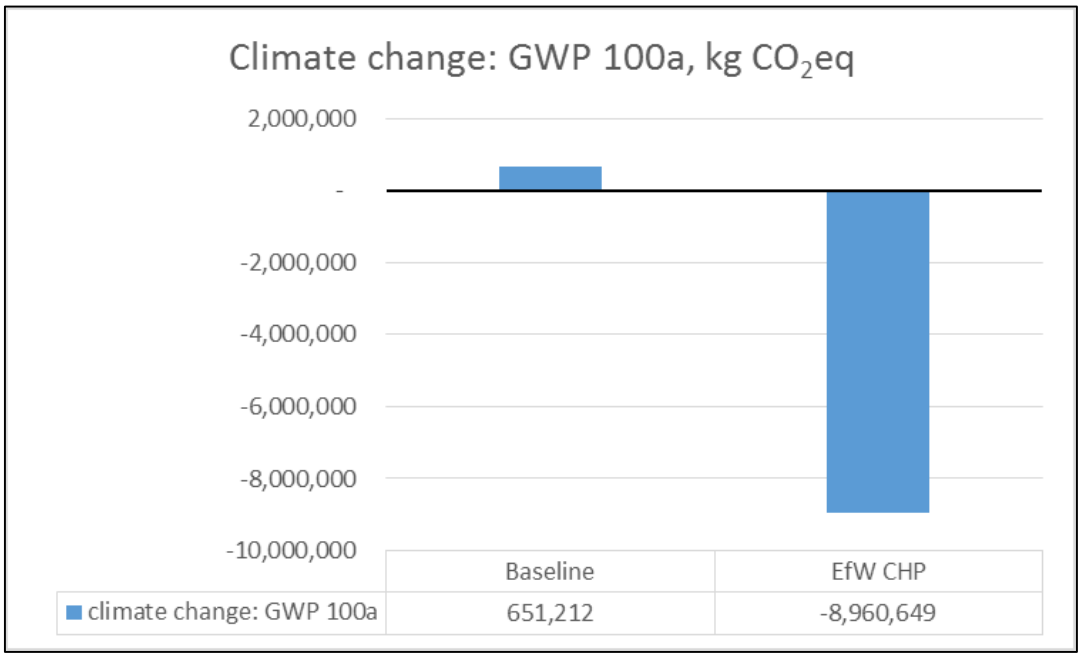

Figure 2: Categorised results

The categorised results in **Figure 2** show that MVV's proposed waste management solution has a negative GWP100a potential impact of -8,960,649 $kgCO_2eq$. Relative to the base case impact of 651,212 $kgCO_2eq$, MVV's proposed waste management solution represents an avoided impact and benefit of -9,661,861 $kgCO_2eq$.

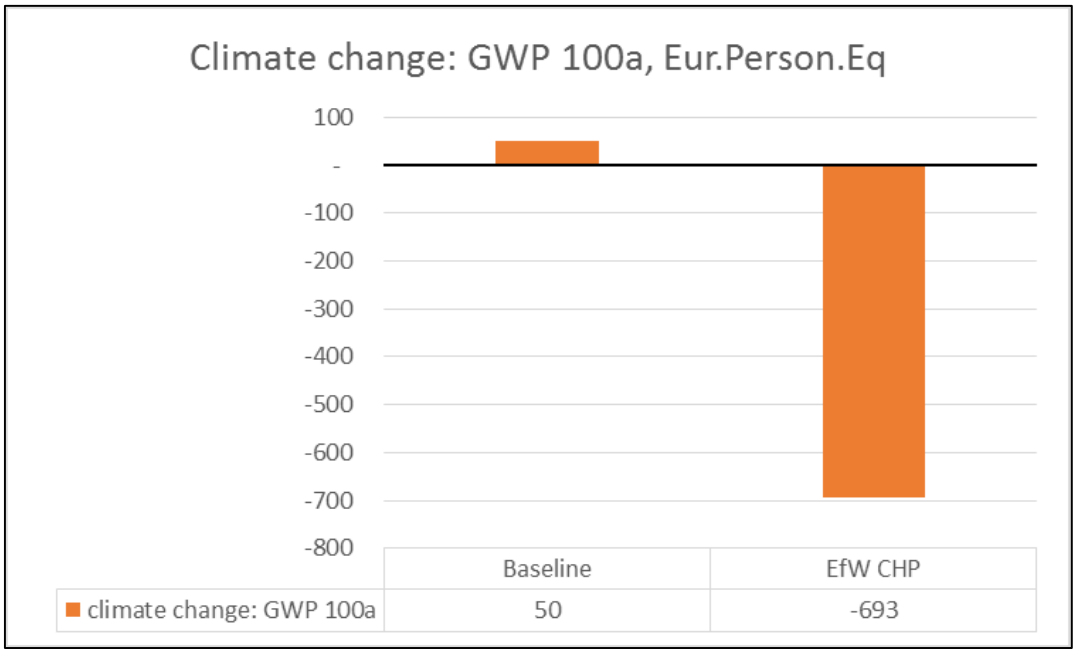

Figure 3: Normalised results

Figure 3 shows the GWP100a impact normalised so that it represents the same unit of a European Person Equivalent (Eur.Person.Eq), the functional unit being the GWP100a impact one 'European Person' would have over the course of a year. It can be seen that MVV's proposed solution has an avoided GWP100a impact and benefit of -693 Eur.Person.Eq, or relative to the base case an avoided GWP100a impact of -743 Eur.Person.Eq.

Figure 4 and **Figure 5** present the characterised and normalised WRATE modelling results broken down by waste management activity. It can be seen from the figures that the avoided GWP100a impact and therefore improved environmental performance of MVV's proposed waste management solution over the base case is primarily from improved treatment and recovery and avoided landfill disposal (e.g. less bulky waste being landfilled).

The primary treatment and recovery in MVV's proposed waste management solution is the EfW CHP facility, and the avoided impact arises from displacing natural gas use for heat and national grid generation (including some fossil fuel use) for power. In addition, there is avoided GWP100a impact from recycling and landfill activity, this reflects the avoided resource use through displacement of virgin materials through recycling as well as avoided emissions from significantly less use of landfill.

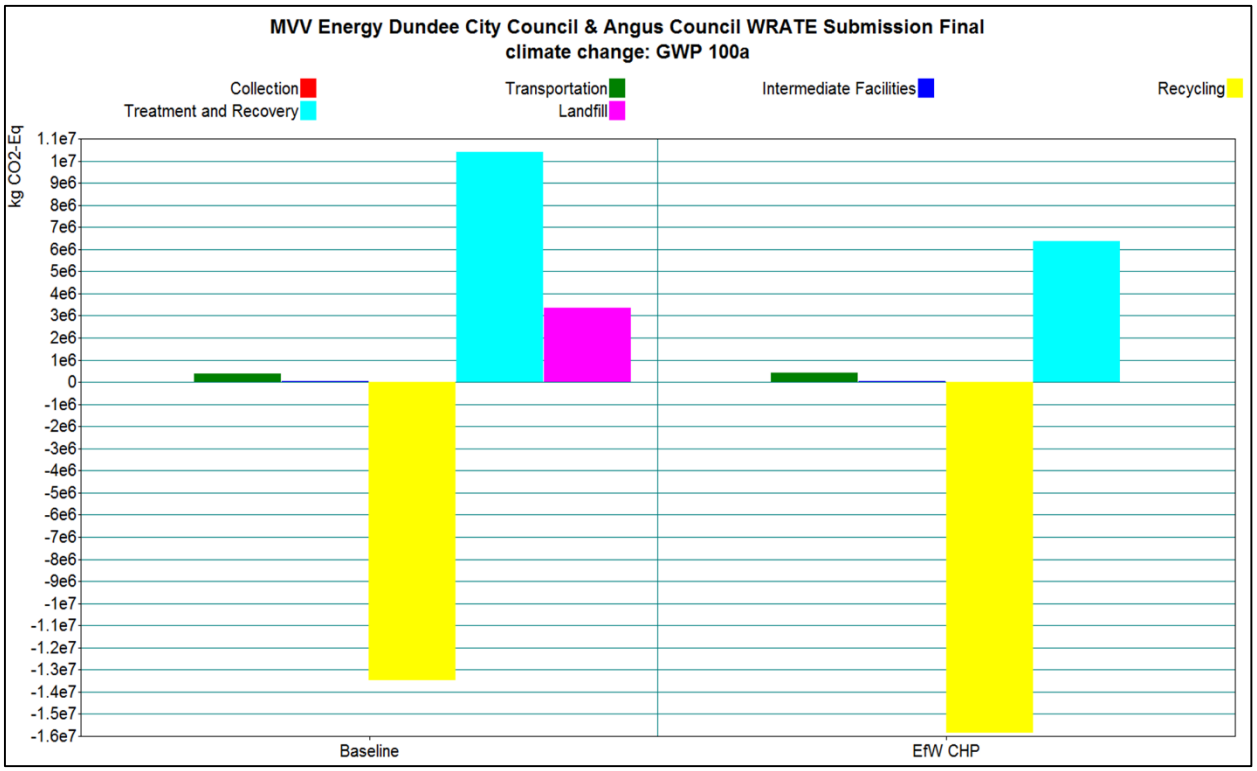

Figure 4: Detailed characterised results[6]

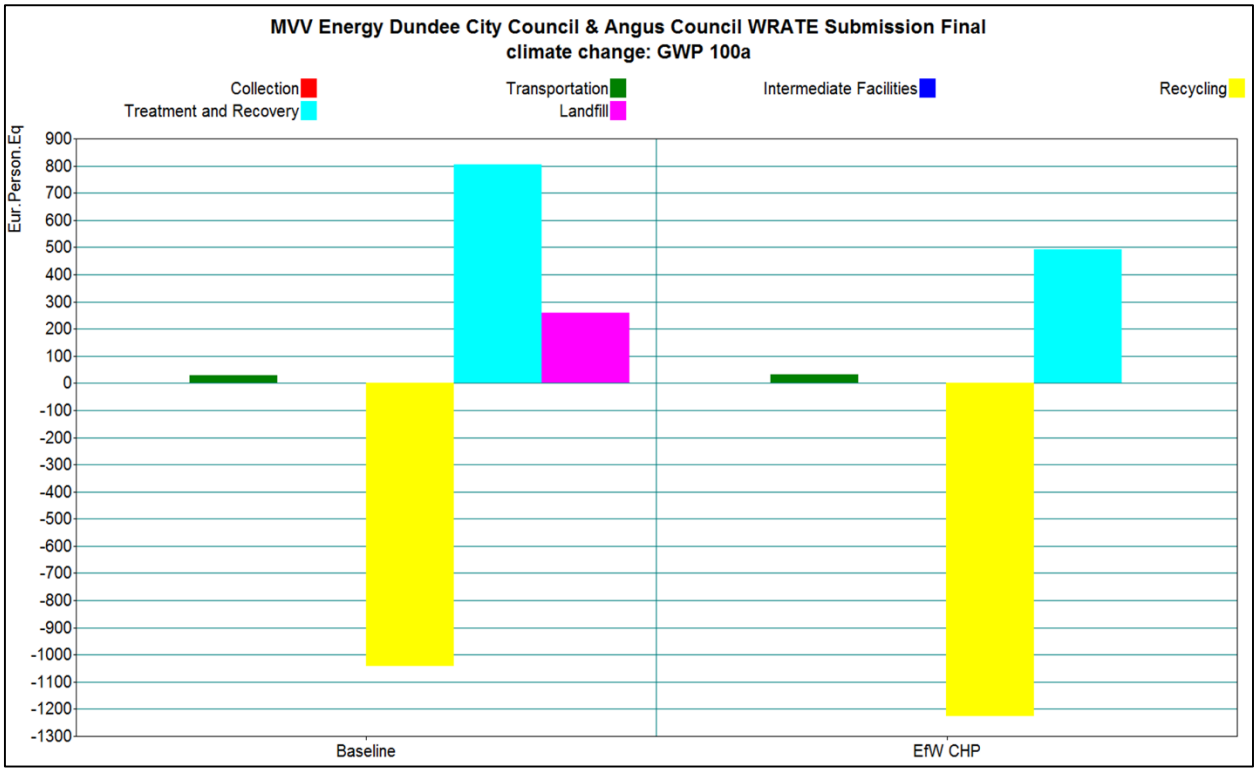

Figure 5: Detailed normalised results[6]

[6] 'Baseline' is the Authority base case, and 'EfW CHP' is MVV's proposed waste management solution.

5 Conclusion

In summary, in terms of global warming potential, operation of MVV's proposed waste management solution would result in an avoided GWP100a impact and benefit of -9,661,861 kgCO_2eq, or -743 Eur.Person.Eq relative to the base case in the assessment year of 2025. This is an improved environmental performance and would be equivalent to avoiding the carbon emissions of an average petrol car driving around the circumference of the earth over 1,169 times[7].

[7] Assuming 0.2 kgCO_2eq/km (Source: DCF Carbon factors for passenger vehicles, available at: http://www.ukconversionfactorscarbonsmart.co.uk/; accessed 11 December 2015) for an 'average' petrol car, and a circumference of the earth of 40,075 km.

Appendix A

WRATE modelling parameters

A1 Detailed WRATE modelling parameters

Table A1.1 Detailed WRATE modelling parameters

Bold values indicate key parameters used in the WRATE model.

CONFIDENTIAL MVV Dundee City & Angus Council		
Modelling year: 2025		Scenario
Modelling Parameters	Units	Proposed waste management solution
WRATE Modelling Parameters		
Electricity Mix	year	2025
Electricity Mix	Name	Scotland (as set by the Authority)
Project Name	-	MVV Dundee
Waste compostion	-	As set by the Authority - contract waste
EfW CHP (in CHP mode)		
Original process name (from default process)		Flexible energy from waste process v3
Original process ID (from default process)	-	21849
Process Name	-	CHP EfW
Process ID for MVV EfW	-	11410
Energy recovery type	-	Combined Heat and Power (CHP)
Process Max Capacity	tonnes per year	130,000
User Entered Capacity	tonnes per year	130,000
Waste processed	tonnes per year	77,455
Waste throughput	tonnes per hour	9.82
Net Calorific Value	GJ/tonne	8.83
Plant availability	%	90.00
Lifespan	years	25.0
Availability	hours per year	7,884
Thermal capacity (energy in waste fuel)	MW_{th}	24.09
Boiler thermal efficiency	%	87.9%
Energy converted to steam	MW_{th}	21.2
Steam for process use (Michelin plant)	MW_{th}	5.91
Steam for heating (Michelin plant)	MW_{th}	0.00
Gross power output	MW_e	4.77
Gross power efficiency	%	19.8%
Parasitic load	%	3.7%
Parasitic load	MW_e	0.88
Net power output	MW_e	3.89
Net power output	kWh/tonne	235.7
Net power efficiency	**%**	**16.1%**
Overall net energy efficiency	%	40.7%
Heat efficiency	**%**	**24.5%**
Total Net Power	MJ	110,321,356
Total Net Heat	MJ	167,826,893
Total energy recovered from waste	MJ	278,148,249
Inputs and outputs in WRATE		
Fe metal in waste input at EfW	tonnes per year	2,324
Fe metal extraction prior to EfW grate, to recycling	tonnes per year	292
Fe metal extraction prior to EfW grate, to recycling	**%**	**12.56%**
Non-Fe metal in waste input at EfW	tonnes per year	1,549
Non-Fe metal extraction prior to EfW grate, to recycling	tonnes per year	195
Non-Fe metal extraction prior to EfW grate, to recycling	**%**	**12.56%**
Contract waste direct to Landfill	tonnes per year	0
Net IBA (minus Fe and Non-Fe) to IBA recycling	tonnes per year	15,987
Fe within IBA to IBA recycling	tonnes per year	1,750
Non-Fe within IBA to recycling	tonnes per year	1,521
Non-Fe loss to the flue	%	5.0%
APCR residue to APCR management	tonnes per year	3,852
Construction burdens: steam connection pipeline construction		
Length	m	450.00
Foundation interval	m	8.00
Number of foundations	No	57.00
Concrete foundations		
Foundation length	m	1.50
Foundation width	m	1.50
Foundation depth	m	1.50
Foundation volume	m^3	3.38
Total concrete volume	m^3	192
Total steel reinforcement volume	m^3	19
Density of steel	kg/m^3	7,700
Density of concrete	kg/m^3	2,400
Weight of concrete	kg	**461,700**
Weight of concrete per linear metre	kg/m	1,026
Weight of steel rebar	kg	**148,129**
Weight of steel rebar per linear metre	kg/m	329
Steel pipe and steel pipe bridge		
Unit weight of two pipes and pipe bridge	kg/m	100.00
Total weight of two pipes and pipe bridge	kg	**45,000**

A2 Waste composition

The WRATE project waste composition is as set by the Authority, as shown in Table A2.1.

Table A2.1 project waste composition

Material type	Composition (%)
Paper & Card	10
Plastic Film	5
Dense Plastic	7
Textiles	5
Other Combustibles	18
Glass	4
Other Non-Combustibles	9
Food & Kitchen Waste	27
Garden Waste	0
Other Organics	1
Ferrous Metals	3
Non-ferrous Metals	2
Hazardous	1
WEEE	4
Fines	4

A3 Electricity mix

The Scotland 2025 electricity mix, as specified by the Authority, was used as the WRATE project waste shown in Table A3.1 below.

Table A3.1 Scotland 2025 electricity mix

Energy mix	Baseline fuel mix (%)	Generating efficiencies (%)	Marginal fuel mix (%)
Coal	0.97	33.92	8.06
Oil	0.43	26.49	0.00
Gas	0.42	41.19	0.00
Gas CCGT	5.75	46.84	91.94
Nuclear	4.76	35.71	0.00
Waste	0.00	19.38	0.00
Thermal other	0.10	22.64	0.00
Renewables thermal	0.00	27.47	0.00
Solar PV	0.00	15.52	0.00
Wind	77.54	25.00	0.00
Tidal	3.48	82.00	0.00
Wave	0.00	82.00	0.00
Hydro	5.23	82.00	0.00
Geothermal	0.00	82.00	0.00
Renewable other	1.31	82.00	0.00

WRATE TEMPLATE – PART 2
WRATE PRO-FORMA

1.1 Transport Assumptions Table

Please complete the following Table, providing justification where applicable.

Enter the corresponding name within the Participant's completed WRATE model under 'Transportation Assumption'.

All transport assumptions have been kept as per the base case scenario provided by the Authority, with the exception of RCV_4 detailed in the table below.

Transportation Assumption	WRATE Process Name and Number	Destinations (Post Code)		Distance (km)	Road Mix (%)		
		From	To	A to B	Urban	Rural	M'way
RCV_4 distance amended	RCV_4 (process name: 6X4 RCV Fleet – Diesel v2, process #:12165)	DD11 4DS	DD4 0NS	24.9	10	25	65

1.2 Waste Transfer, Recycling, Treatment and Disposal Assumptions Table

WHERE WRATE DEFAULT PROCESSES OR USER DEFINED PROCESSES HAVE BEEN INCLUDED WITHIN THE PARTICIPANT'S MODEL, DETAILS SHOULD BE INCLUDED IN THE TABLE BELOW.

Please complete the following Table with justifications for the chosen processes. Details of any amendments to default WRATE processes should be noted, along with associated justifications. Also enter post codes for all transfer, recycling, treatment and disposal locations.

Enter the corresponding name within the Participant's completed WRATE model under 'Process Assumption'.

Process Assumption	Post Code	WRATE Process Name and Number	Justification for Process Choice	Amendment to Process (if required)	Justification for Process Amendment (if required)
Restenneth Landfill (process #121151) removed.	N/A	Restenneth Landfill (process name: Landfill (HDPE Liner, Clay Cap) process #: 121151) removed.	Process as per Authority base case model.	Process removed, and waste tonnage of 15,934.98 tonnes per annum now routed direct to the new EfW CHP	All contract waste will be processed at the new EfW CHP.
RCV_4 distance amended.	N/A	RCV_4 (process name: 6X4	Process as per Authority base case	Distance A to B amended from 22.9km to 24.9km. Urban (%), Rural (%) and Motorway (%) split unchanged.	All contract waste will be processed at the new EfW CHP (same site location as

Process Assumption	Post Code	WRATE Process Name and Number	Justification for Process Choice	Amendment to Process (if required)	Justification for Process Amendment (if required)
		RCV Fleet – Diesel v2, process #:12165).	model.		existing DERL Incinerator, postcode: DD4 0NS).
EfW CHP (process # 11398) added.	DD4 0NS	EfW CHP (process name: Flexible Energy From Waste Process V3, process # 11398).	The 'Flexible Energy from Waste Process V3' was chosen as a template to base the new EfW CHP UDP on as both have similar capacities, and both use moving grate technology, Combined Heat and Power, SNCR NOx abatement and dry flue	**Process Parameters:** Lifespan amended from 20 to 25 years. Process annual capacity amended from 94,972 tonnes per annum to 130,000 tonnes per annum. This is a 36.882% increase in annual capacity. Maximum process capacity amended from 95,000 tonnes per annum to 130,000 tonnes per annum. This is a 36.842% increase in maximum capacity.	Lifespan amended to reflect design life of the new EfW CHP. Annual capacity amended to reflect design capacity of the new EfW CHP. Maximum process capacity amended to reflect maximum capacity of the new EfW CHP.

Process Assumption	Post Code	WRATE Process Name and Number	Justification for Process Choice	Amendment to Process (if required)	Justification for Process Amendment (if required)
			gas cleaning.		
EfW CHP (process # 11398) added	DD40NS	EfW CHP (process name: Flexible Energy From Waste Process V3, process # 11398).	The 'Flexible Energy from Waste Process V3' was chosen as a template to base the new EfW CHP UDP on as both have similar capacities, and both use moving grate technology, Combined Heat and Power, SNCR NOx abatement and dry flue gas cleaning.	**Headline Values:** Energy recovered allocation rule amended from: =[USER_ENERGY_PRODUCTION.ELECTRICITY] +[USER_TOTAL.NET_CV]* [USER_PROCESS_PARAM.HEAT_EFFICIENCY] To =([USER_TOTAL.NET_CV]*0.161304) +([USER_TOTAL.NET_CV]*0.245384)	Allocation rule amended to reflect heat and net power efficiencies (24.54% and 16.13% respectively) of the new EfW CHP, as provided by MVV. The gross power efficiency is 19.79% and the parasitic load is 3.66%.

Process Assumption	Post Code	WRATE Process Name and Number	Justification for Process Choice	Amendment to Process (if required)	Justification for Process Amendment (if required)
EfW CHP (process # 11398) added.	DD4 0NS	EfW CHP (process name: Flexible Energy From Waste Process V3, process # 11398).	The 'Flexible Energy from Waste Process V3' was chosen as a template to base the new EfW CHP UDP on as both have similar capacities, and both use moving grate technology, Combined Heat and Power, SNCR NOx abatement and dry flue gas cleaning.	**Construction Material Inputs:** Construction quantities have been changed from default values (in brackets) to amended values. Cement, 21,210.53 kg, (15,500 kg) Concrete, 18,256,647 kg, (13,004,000 kg) Bricks, 754,000 kg (551,000 kg) Hardcore, 3,147,368 kg (2,300,000 kg) Copper, 40,163 kg (29,350 kg) Insulation Materials, 121,789 kg (89,000 kg) Refractory (Al, Si), 12,453 kg (9,100 kg) Refractory (metals), 34,211 kg (25,000 kg) Refractory (SiC), 11,974 kg (8,750 kg) Tar, 1,322,579 kg (966,500 kg) Brass, 3,763 kg, (2,750 kg) Steel (virgin), 4,760,234.01 kg (3,337,500 kg) Cast Iron, 119,737 kg (87,500 kg) Aluminium (virgin), 46,458 kg (33,950 kg) Paint, 33,526 kg (24,500 kg) Polyethelene (PE) 38,179 kg, (27,900 kg) Allocation rules have not been amended.	The construction quantities have been scaled up by 36.842%, in relation to the default process max capacity being 95,000 tonnes per annum and the new EfW CHP max capacity of 130,000 tonnes per annum. This is because there is no data available for construction materials inputs at this time. Concrete includes an extra 461,700 kg (estimated) for construction of foundations for the steam link infrastructure. Steel (virgin) includes an extra 45,000 kg (estimated) for the construction of the steam link infrastructure (steam pipe, condensate return pipe and pipe bridge). This is based on a conservative assumption of a

Process Assumption	Post Code	WRATE Process Name and Number	Justification for Process Choice	Amendment to Process (if required)	Justification for Process Amendment (if required)
					total of 100 kg of steel per m. Steel (virgin) also includes an extra 148,129 kg (estimated) for steel reinforcement for the concrete foundations for the steam link infrastructure.
EfW CHP (process # 11398) added	DD40NS	EfW CHP (process name: Flexible Energy From Waste Process V3, process # 11398)	The 'Flexible Energy from Waste Process V3' was chosen as a template to base the new EfW CHP UDP on as both have similar capacities, and both use moving grate technology, Combined Heat and Power, SNCR NOx	**Maintenance material inputs:** Maintenance material input quantities have been changed from default values (in brackets) to amended values. Rubber, 13,684 kg (10,000 kg) Rubber, 109 kg (80 kg) Ion Exchange Resin, 684 kg (500 kg) Ion Exchange Resin, 684 kg (500 kg) Activated Carbon, 684 kg (500 kg) Helium, 68 kg (50 kg) Refractory (Al, Si), 6,842 kg (5,000 kg) Steel (virgin), 2,737 (2,000 kg) Oxygen, 68 kg (50 kg) Acetylene, 34 kg (25 kg) Hydrogen, 68 kg (50 kg) Polyphenylene Sulfide, 120 kg (88 kg) Lubricants, 3,421 kg (2,500 kg) Allocation rules have not been amended.	The maintenance material input quantities have been scaled up by 36.842% in order to reflect the maximum capacity of the new EfW CHP. This is because there is no data available for maintenance material inputs at this time. These values are considered to be conservative as maintenance requirements in a modern facility would be less.

Process Assumption	Post Code	WRATE Process Name and Number	Justification for Process Choice	Amendment to Process (if required)	Justification for Process Amendment (if required)
			abatement and dry flue gas cleaning.		
EfW CHP (process # 11398) added	DD40NS	EfW CHP (process name: Flexible Energy From Waste Process V3, process # 11398)	The 'Flexible Energy from Waste Process V3' was chosen as a template to base the new EfW CHP UDP on as both have similar capacities, and both use moving grate technology, Combined Heat and Power, SNCR NOx abatement and dry flue	**Maintenance material outputs:** Maintenance material input quantities have been changed from default values (in brackets) to amended values. Lubricants, 2,737 kg (2,000 kg) Ion Exchange Resin, 684 kg (500 kg) Ion Exchange Resin, 684 kg (500 kg) Activated Carbon, 684 kg (500 kg) Helium, 68 kg (50 kg) Rubber, 13,684 kg (10,000 kg) Refractory (Al, Si), 6,842 kg (5,000 kg) Steel (virgin), 2,737 kg (2,000 kg) Rubber, 99 kg (72 kg) Hydrogen, 68 kg (50 kg) Polyphenylene Sulfide, 120 kg (88 kg) Allocation rules have not been amended.	The maintenance material output quantities have been scaled up by 36.842% in order to reflect the maximum capacity of the new EfW CHP. This is because there is no data available for maintenance material outputs at this time. These values are considered to be conservative as maintenance requirements in a modern facility would be less.

Process Assumption	Post Code	WRATE Process Name and Number	Justification for Process Choice	Amendment to Process (if required)	Justification for Process Amendment (if required)
			gas cleaning.		
EfW CHP (process # 11398) added	DD40NS	EfW CHP (process name: Flexible Energy From Waste Process V3, process # 11398)	The 'Flexible Energy from Waste Process V3' was chosen as a template to base the new EfW CHP UDP on as both have similar capacities, and both use moving grate technology, Combined Heat and Power, SNCR NOx abatement and dry flue gas cleaning.	**Typical Waste Fraction Composition:** No amendments made.	No amendment has been made to the Typical Waste Fraction Composition. This is because the Typical Waste Fraction Composition is used to allocate some Process Emissions, and no data is available on Process Emissions at this time. Therefore the default quantities and allocations have been kept in place so that Process Emissions are scaled appropriately.

Process Assumption	Post Code	WRATE Process Name and Number	Justification for Process Choice	Amendment to Process (if required)	Justification for Process Amendment (if required)
EfW CHP (process # 11398) added.	DD40NS	EfW CHP (process name: Flexible Energy From Waste Process V3, process # 11398).	The 'Flexible Energy from Waste Process V3' was chosen as a template to base the new EfW CHP UDP on as both have similar capacities, and both use moving grate technology, Combined Heat and Power, SNCR NOx abatement and dry flue gas cleaning.	**Operational Fuel Inputs:** Operational fuel input quantities have been changed from default values (in brackets) to amended values. Off-road gasoil (ULS diesel) for Burner Start up: 144,368.421 kg (105,500 kg) Off-road gasoil (ULS diesel) for vehicles: 30,105 kg (22,000 kg) Allocation rules have not been amended.	The operational fuel input quantities have been scaled up by 36.842% in order to reflect the maximum capacity of the new EfW CHP. This is because there is no data available for operational fuel inputs at this time. These values are considered to be conservative as operational fuel input requirements in a modern facility would be less.
EfW CHP	DD4	EfW CHP	The 'Flexible	**Operational Material Inputs:**	The operational material input

Process Assumption	Post Code	WRATE Process Name and Number	Justification for Process Choice	Amendment to Process (if required)	Justification for Process Amendment (if required)
(process # 11398) added	0NS	(process name: Flexible Energy From Waste Process V3, process # 11398)	Energy from Waste Process V3' was chosen as a template to base the new EfW CHP UDP on as both have similar capacities, and both use moving grate technology, Combined Heat and Power, SNCR NOx abatement and dry flue gas cleaning.	Operational material inputs quantities have been changed from default values (in brackets) to amended values. Boiler water treatment, inorganic chemicals at plant: 82.1 kg (60 kg) Condenser water treatment, inorganic chemicals at plant: 410.6 kg (300 kg) Boiler water treatment, sodium hydroxide (50% in H2O) at plant: 24,700.4 kg (18,045 kg) Gas cleaning, ammonium nitrate: 129,938.4 kg (94,227 kg) Gas cleaning, carbon black at plant: 23,270.0 kg (17,000 kg) Boiler water treatment, hydrochloric acid (30% in H2O) at plant: 25,467.0 kg (18,605 kg) Gas cleaning, lime at plant: 1,299,384.0 kg (949,270 kg) Allocation rules relating to the above quantities have not been amended. Anhydrous Ammonia quantity and allocation for SCR systems have been deleted for clarity, as the system used for the new EfW CHP will be SNCR. Lime and Sodium Hydroxide quantities and allocations for wet scrubbing systems have deleted for clarity, as a dry scrubbing system will be used for the new EfW CHP.	quantities have been scaled up by 36.842% in order to reflect the maximum capacity of the new EfW CHP. This is because there is no data available for operational material inputs at this time. These values are considered to be conservative as operational fuel input requirements in a modern facility would be less.

Process Assumption	Post Code	WRATE Process Name and Number	Justification for Process Choice	Amendment to Process (if required)	Justification for Process Amendment (if required)
EfW CHP (process # 11398) added	DD4 0NS	EfW CHP (process name: Flexible Energy From Waste Process V3, process # 11398)	The 'Flexible Energy from Waste Process V3' was chosen as a template to base the new EfW CHP UDP on as both have similar capacities, and both use moving grate technology, Combined Heat and Power, SNCR NOx abatement and dry flue gas cleaning.	**Operational Water Inputs:** The operational water input quantity has been changed from the default value (in brackets) to an amended value. Mains water, process water: 36,079,476.06 kg (26,358,000 kg) Allocation rules have not been amended.	The operational water input quantities have been scaled up by 36.842% in order to reflect the maximum capacity of the new EfW CHP. This is because there is no data available for operational water inputs at this time. These values are considered to be conservative as water input requirements in a modern facility would be less.

Process Assumption	Post Code	WRATE Process Name and Number	Justification for Process Choice	Amendment to Process (if required)	Justification for Process Amendment (if required)
EfW CHP (process # 11398) added	DD40NS	EfW CHP (process name: Flexible Energy From Waste Process V3, process # 11398)	The 'Flexible Energy from Waste Process V3' was chosen as a template to base the new EfW CHP UDP on as both have similar capacities, and both use moving grate technology, Combined Heat and Power, SNCR NOx abatement and dry flue gas cleaning.	**Energy Inputs:** No amendments made.	The operational energy input is scaled according to the incoming waste divided by the '[TYPICAL_WASTE_TOTAL]'. The typical waste total represents 94,972 tpa in the original Flexible Energy from Waste process V3 # 11398 and cannot be changed. Therefore, in the absence of any available operational data at this time, the process quantity has not been changed to reflect the maximum capacity of the EfW CHP (130,000 tpa) as has been done for other process quantities, however the default allocation will still scale appropriately. The default value is considered to be conservative as energy input requirements in a modern facility would be less.

Process Assumption	Post Code	WRATE Process Name and Number	Justification for Process Choice	Amendment to Process (if required)	Justification for Process Amendment (if required)
EfW CHP (process # 11398) added.	DD4 0NS	EfW CHP (process name: Flexible Energy From Waste Process V3, process # 11398).	The 'Flexible Energy from Waste Process V3' was chosen as a template to base the new EfW CHP UDP on as both have similar capacities, and both use moving grate technology, Combined Heat and Power, SNCR NOx abatement and dry flue gas cleaning.	**Process Output:** Ferrous metal recovery rate set to 12.6% using the slider under 'further process properties'. Non-ferrous metal recovery rate set to 12.6% using the slider under 'further process properties'. Allocation rules have not been amended.	12.6% capture rate for both ferrous and non-ferrous metal is based on 50.04% of all non-household waste from RCV 1 and RCV 4 requiring metal extraction, i.e. all HWRC waste, all waste from RCV 1 and RCV 4 representing 35.87% of all contract waste and a 70% metal recovery rate at the new EfW CHP grate (50.04% * 35.87% * 70% = 12.56%)
EfW CHP	DD4	EfW CHP	The 'Flexible	**Process Energy Production:**	The electricity to the grid and

Process Assumption	Post Code	WRATE Process Name and Number	Justification for Process Choice	Amendment to Process (if required)	Justification for Process Amendment (if required)
(process # 11398) added.	0NS	(process name: Flexible Energy From Waste Process V3, process # 11398).	Energy from Waste Process V3' was chosen as a template to base the new EfW CHP UDP on as both have similar capacities, and both use moving grate technology, Combined Heat and Power, SNCR NOx abatement and dry flue gas cleaning.	All default allocation rules and quantities deleted, and two new allocation rules added for heat and power: Electricity to grid: =[USER_TOTAL.NET_CV]*0.161304 External heat: =[USER_TOTAL.NET_CV]*0.245384 Heating offset for Heat amended to 'Large Industrial Heat User, Gas'.	heat output allocations have been amended to reflect the proposed net electrical efficiency of 16.13% and heat efficiency of 24.54%.The gross power efficiency is 19.79% and the parasitic load is 3.66%.All the heat and approx. All power will be exported to the National Grid.
EfW CHP (process # 11398)	DD4 0NS	EfW CHP (process name:	The 'Flexible Energy from Waste	**Process Waste Output:** The process waste outputs allocation rules have been	Allocation rules have been amended to reflect operational data from MVV

Process Assumption	Post Code	WRATE Process Name and Number	Justification for Process Choice	Amendment to Process (if required)	Justification for Process Amendment (if required)
added		Flexible Energy From Waste Process V3, process # 11398)	Process V3' was chosen as a template to base the new EfW CHP UDP on as both have similar capacities, and both use moving grate technology, Combined Heat and Power, SNCR NOx abatement and dry flue gas cleaning.	amended from: IBA =([USER_TOTAL.ASH]*0.91+ ([USER_WASTE_FRACTIONS.NON_FERROUS]+ [USER_WASTE_FRACTIONS.RDF_1_12])*0.05+ 0.2*((([USER_WASTE_FRACTIONS.FERROUS_METAL]+ [USER_WASTE_FRACTIONS.RDF_1_11])*(1- [USER_PROCESS_PARAM.FE_RECOVERY]))+ ([USER_TOTAL.ASH]*0.91)+ (([USER_WASTE_FRACTIONS.NON_FERROUS]+ [USER_WASTE_FRACTIONS.RDF_1_12])*(1- [USER_PROCESS_PARAM.NON_FE_RECOVERY]))) IBA ferrous =([USER_WASTE_FRACTIONS.FERROUS_METAL]+ [USER_WASTE_FRACTIONS.RDF_1_11])* (1-[USER_PROCESS_PARAM.FE_RECOVERY]) IBA non-ferrous =([USER_WASTE_FRACTIONS.NON_FERROUS] +[USER_WASTE_FRACTIONS.RDF_1_12])*(0.95- [USER_PROCESS_PARAM.NON_FE_RECOVERY]) APCr =ifequal([USER_PROCESS_PARAM.SCRUBBER_TYPE], [SCRUBBER_TYPE.DRY],([USER_TOTAL.ASH]*0.09)	whereby total IBA represents 25% of incoming waste by weight, and APCr represents 5% of incoming waste by weight. Proportions of IBA, IBA ferrous and IBA non-ferrous are 20.64%, 2.26% and 1.96% of incoming waste respectively. These proportions have been derived from the MVV Waste Flow Model.

Process Assumption	Post Code	WRATE Process Name and Number	Justification for Process Choice	Amendment to Process (if required)	Justification for Process Amendment (if required)
				+([USER_WASTE_FRACTIONS_TOTAL]*0.02875), ([USER_TOTAL.ASH]*0.09)+ ([USER_WASTE_FRACTIONS_TOTAL]*0.025)) To: IBA [USER_WASTE_FRACTIONS_TOTAL]*0.2064 IBA ferrous =[USER_WASTE_FRACTIONS_TOTAL]*0.0226 IBA non-ferrous =[USER_WASTE_FRACTIONS_TOTAL]*0.01963 APCr =[USER_WASTE_FRACTIONS_TOTAL]*0.04973	
EfW CHP (process # 11398) added.	DD40NS	EfW CHP (process name: Flexible Energy From Waste Process	The 'Flexible Energy from Waste Process V3' was chosen as a template to base the	**Process Emissions:** The process emissions have been changed from the default value (in brackets) to an amended value. Ammonia, to air (from process): 473.61 kg (346 kg) Antimony, to air (from process): 1.00 kg (0.73 kg) Arsenic, to air (from process): 0.999 kg (0.73 kg)	The process emission quantities have been scaled up by 36.842% in order to reflect the maximum capacity of the new EfW CHP. This is because there is no data available for Process Emissions at this time.

Process Assumption	Post Code	WRATE Process Name and Number	Justification for Process Choice	Amendment to Process (if required)	Justification for Process Amendment (if required)
		V3, process # 11398).	new EfW CHP UDP on as both have similar capacities, and both use moving grate technology, Combined Heat and Power, SNCR NOx abatement and dry flue gas cleaning.	Cadmium, to air (from process): 0.096 kg (0.07 kg) Cadmium, to sewer (from process): 0.015 kg (0.011 kg) Carbon dioxide – fossil, to air (from vehicles): 72,292 kg (52,813 kg) Carbon dioxide – fossil, to air (from Burner start up): 425,555 kg (310,891 kg) Carbon monoxide – biogenic, to air (from process): 1,721.02 kg (1,257 kg) Carbon monoxide – fossil, to air (from process): 886.59 kg (648 kg) Carbon monoxide – fossil, to air (from vehicles): 405.58 kg (296 kg) Chromium, to air (from process): 0.23 kg (0.17 kg) Cobalt, to air (from process): 0.93 kg (0.68 kg) Copper, to air (from process): 0.99 kg (0.72 kg) Dioxin/Furan I-TEQ (Total) to air (from process): 4.13E-06 kg (3.02E-06 kg) Dioxin/Furan I-TEQ (Total) to air (from vehicles): 7.20E-10 kg (5.26E-10 kg) Hydrogen chloride, to air (from process): 4,388.45 kg (3,206 kg) Hydrogen fluoride, to air (from process): 36.96 kg (27 kg) Lead, to air (from process): 0.59 kg (0.43 kg) Manganese, to air (from process): 3.20 kg (2.34 kg) Mercury, to air (from process): 2.90 kg (2.12 kg) Mercury, to sewer (from process): 0.0014 kg (0.001 kg) Nickel, to air (from process): 0.67 kg (0.49kg)	These values are considered to be conservative as process emissions at a modern facility would be less.

Process Assumption	Post Code	WRATE Process Name and Number	Justification for Process Choice	Amendment to Process (if required)	Justification for Process Amendment (if required)
				Nitrogen oxides, to air (from vehicles): 687.15 kg (502 kg) Nitrogen oxides, NO and NO2 as NO2 (from process), to air: 120,668.72 kg (88,155 kg) Nitrous oxide (from process), to air: 5,452.03 kg (3,983 kg) Non-methane volatile organic compounds (NMVOCs), to air (from vehicles): 138.25 kg (101 kg) Particulate matter – PM10, to air (from vehicles): 78.84 kg (57.6 kg) Particulate matter – total, to air (from process): 2,210.65 kg (1,615 kg) PCBs, to air (from process): 2.34E-07 kg (1.71E-07 kg) Sulphur Dioxide, to air (from process): 4,395.30 kg (3,211 kg) Sulphur Dioxide, to air (from vehicles): 46.01 kg (34 kg) Thallium, to air (from process): 0.096 kg (0.07 kg) Vanadium, to air (from process): 0.51 kg (0.37 kg) VOCs, to air (from process): 199.85 kg (146 kg) Water, to sewer (from process): 763,804.07 kg (558,000 kg) Allocation rules relating to the above quantities have not been amended. Quantities and allocations relating to: Carbon dioxide – biogenic, to air (from process),	

Process Assumption	Post Code	WRATE Process Name and Number	Justification for Process Choice	Amendment to Process (if required)	Justification for Process Amendment (if required)
				Carbon dioxide – fossil, to air (from process), and Water, to air (from process). Have not been altered as the default allocation rule does not use a fixed quantity related to the default process capacity, but instead uses parameters calculated from the waste composition/characteristics. Quantities and allocations relating to the use of SCR and/or a wet abatement system for the following have been deleted for clarity, as the system used for the new EfW CHP will be dry SNCR: Ammonia, to Air (from process) Arsenic, to sewer (from process) Cadmium, to sewer (from process) Chromium, to sewer (from process) Copper, to sewer (from process) Dioxin/Furan I-TEQ (Total), to air (from process) Hydrogen chloride, to air (from process) Lead, to sewer (from process) Mercury, to sewer (from process) Nickel, to sewer (from process) Nitrogen oxides, NO and NO2 as NO2 (from process), to air Particulate matter – total, to air (from process) Sulphur Dioxide, to air (from process)	

Process Assumption	Post Code	WRATE Process Name and Number	Justification for Process Choice	Amendment to Process (if required)	Justification for Process Amendment (if required)
				Thallium, to sewer (from process) Water, to sewer (from process) Zinc, to sewer (from process)	

1.3 Bespoke Process Assumptions Table

WHERE A WRATE PROCESS HAS BEEN DEVELOPED FROM FIRST PRINCIPLES (A BESPOKE PROCESS) PARTICIPANTS SHOULD COMPLETE THE FOLLOWING TABLES. TABLES SHOULD BE DUPLICATED IF MORE THAN ONE BESPOKE PROCESS HAS BEEN DEVELOPED.

It was not necessary to create a bespoke process for the proposed waste management solution, therefore Section 1.3 is left blank.

Corresponding name within WRATE model	N/A
Post Code	N/A

All data in this form should be entered for one year of operation. For new, pilot or recently-commissioned processes, data should be pro-rated to a year.

Data type	Parameter	Unit	Value	Participant Notes & Justification	Environment Agency Notes
Process information:	Process name	Text			
	Company name	Text			
	Contact name	Text			
	Telephone	Number			
	E-mail Address	Text			
	Operational life span of plant	Years			
	Operational status of process	Text	Operational /in-commissioning/ pilot/in design		
	Process annual capacity (annual)	t			
	Maximum process capacity (annual)	t			
MSW waste composition:	Paper and card	t			
	Plastic film	t			
	Dense plastic	t			
	Textiles	t			
	Absorbent hygiene products	t			
	Wood	t			
	Combustibles	t			
	Non-combustibles	t			
	Glass	t			
	Organic - Food waste	t			
	Organic - Garden waste	t			
	Ferrous metal	t			
	Non-ferrous metal	t			
	Fine material <10mm	t			
	Waste Electrical and Electronic Equipment	t			
	Specific Hazardous	t			

Data type	Parameter	Unit	Value	Participant Notes & Justification	Environment Agency Notes
	Household				
Non MSW waste composition:	Paper and card	t			
	Plastic film	t			
	Dense plastic	t			
	Textiles	t			
	Absorbent hygiene products	t			
	Wood	t			
	Combustibles	t			
	Non-combustibles	t			
	Glass	t			
	Organic - Food waste	t			
	Organic - Garden waste	t			
	Ferrous metal	t			
	Non-ferrous metal	t			
	Fine material <10mm	t			
	Waste Electrical and Electronic Equipment	t			
	Specific Hazardous Household	t			
Other feedstock:	Other feedstock 1 (please describe)	t			
	Other feedstock 2 (please describe)	t			
	Other feedstock 3 (please describe)	t			
Site inputs:	Electricity purchased for site	KWh			Key sensitive parameters. Data that is provided should be double checked.
	Heat purchased for site	KWh			
	Natural gas used as fuel	M3			
	Diesel oil as fuel	Litres			
	Other fuel 1 (please specify)	Litres			
	Other fuel 2 (please specify)	Litres			
	Mains water use	M3			Key sensitive parameters. Data that is provided should be double checked.
	Other water use	M3			
	Activated carbon	t			
	Urea	t			
	Ammonia	t			
	Lime	t			
	Wood for biofilter	t			
	Other pollution abatement material 1 (please describe)	t			

Data type	Parameter	Unit	Value	Participant Notes & Justification	Environment Agency Notes
	Other pollution abatement material 2 (please describe)	t			
	Sodium hydroxide	t			
	Hydrochloric acid	t			
	Other water treatment chemicals 1 (please describe) Trisodium phosphate	t			
	Other water treatment chemicals 2 (please describe)	t			
Materials recycling:	Non-ferrous metal	t			Key sensitive parameters. Data that is provided should be double checked.
	Ferrous metal	t			Key sensitive parameters. Data that is provided should be double checked.
	Mixed glass	t			
	Plastic film	t			
	Mixed dense plastic	t			
	RDF	t			Key sensitive parameters. Data that is provided should be double checked.
	Autoclave fibre	t			
	Standard grade compost or digestate)	t			Key sensitive parameters. Data that is provided should be double checked. PAS 100 or equivalent standard for soil conditioner/horticultural use.
	Non-standard grade compost or digestate)	t			
	Incinerator bottom ash for recycling	t			
	Other recovered material 1 (please describe)	t			
	Other recovered material 2 (please describe)	t			
Energy recovery:	Electricity sold to grid	KWh			Key sensitive parameters. Data that is provided should be double checked. As a rule in the UK this would be the gross

Data type	Parameter	Unit	Value	Participant Notes & Justification	Environment Agency Notes
					electricity (assuming all electricity is sold for ROCs). If electricity is used in the site before export then enter the net value.
	Heat exported for sale	KWh			Key sensitive parameters. Data that is provided should be double checked. As a rule in the UK this would be the gross electricity (assuming all electricity is sold for ROCs). If electricity is used in the site before export then enter the net value.
Process wastes:	Incinerator bottom ash for Landfill disposal	t			
	APC residues	t			
	Other inert waste (please describe)	t			
	Other biodegradable waste (please describe)	t			
	Other mixed waste (please describe)	t			
Emissions to air:	Total CO2 total, of which:	kg			Key sensitive parameters. Data that is provided should be double checked. Enter data where emissions from monitoring. Provide estimates if these are available.
	CO2 fossil	kg			Fossil carbon dioxide is attributable to the carbon dioxide produced when wastes composed of materials that are derived from fossil fuels are burnt (e.g. plastic). Biogenic CO2 is produced when biomass carbon in waste materials matter is burnt (e.g. trees, wood, paper etc). Where no data is available typically the combustion of MSW would produce 36% fossil carbon and 64% biogenic carbon.

Data type	Parameter	Unit	Value	Participant Notes & Justification	Environment Agency Notes
					Enter data where emissions from monitoring. Provide estimates if these are available.
	CO2 biogenic	kg			Enter data where emissions from monitoring. Provide estimates if these are available.
	Water vapour	kg			Enter data where emissions from monitoring. Provide estimates if these are available.
	Total CO, of which:	kg			Enter data where emissions from monitoring. Provide estimates if these are available.
	CO fossil	kg			Enter data where emissions from monitoring. Provide estimates if these are available.
	CO biogenic	kg			Enter data where emissions from monitoring. Provide estimates if these are available.
	SOx	kg			Enter data where emissions from monitoring. Provide estimates if these are available.
	NOx	kg			Enter data where emissions from monitoring. Provide estimates if these are available.
	N20	kg			Enter data where emissions from monitoring. Provide estimates if these are available.
	NH3	kg			Enter data where emissions from monitoring. Provide estimates if these are available.
	HCL	kg			Enter data where emissions from monitoring. Provide estimates if these are available.
	CH4	kg			Enter data where emissions from monitoring. Provide

Data type	Parameter	Unit	Value	Participant Notes & Justification	Environment Agency Notes
					estimates if these are available.
	Dioxins, Furans – ITEQ	ng			Enter data where emissions from monitoring. Provide estimates if these are available.
	Cadmium	kg			Enter data where emissions from monitoring. Provide estimates if these are available.
	Chromium VI	kg			Enter data where emissions from monitoring. Provide estimates if these are available.
	Mercury	kg			Enter data where emissions from monitoring. Provide estimates if these are available.
	Thallium	kg			Enter data where emissions from monitoring. Provide estimates if these are available.
	Benzo[a]pyrene	kg			Enter data where emissions from monitoring. Provide estimates if these are available.
	PCB's	kg			Enter data where emissions from monitoring. Provide estimates if these are available.
	PM10	kg			Enter data where emissions from monitoring. Provide estimates if these are available.
Emissions to water:	Water discharge (please specify)	M3			open water/sewer/groundwater
	Phosphate	kg			
	Nitrogen	kg			
	NH3	kg			
	Barium	kg			
	Cadmium	kg			
	Copper	kg			
	Molybdenum	kg			
	Other emission to water 1 (please specify)	kg			
	Other emission to water 2 (please specify)	kg			