Appendix VI: Technical Assumptions

Management of WCA collected material

All options assume that a number of treatment facilities will be developed to deal with the recyclable and compostable materials collected at kerbside and at bring sites. These include a Materials Recycling Facility (MRF) for kerbside collected dry recyclables, windrow composting (GWC) for green waste collected at HWRCs/ CRCs and In-vessel composting (IVC) to treat kerbside collected green and kitchen waste (which would need to be compliant with the Animal By-Products Regulations).

The following performance of the recycling and composting facilities has been assumed in the modelling. Rejected material is available for treatment in the residual waste facilities.

Note: The biodegradability of household waste was derived in a study by Parfitt (2002)[3], which was prepared for the Strategy Unit report (2002) Waste Not, Want Not.[4] In the tables *below "The proportion of household waste classified as biodegradable is 68%"* is referred to as the 'DEFRA baseline.'

Pre-Residual Waste Treatment Technologies

Source	% of input	Technology Supplier/ Source	BMW	BMW % source
MRF rejection rate	10%	O.Kay Eng.	68%	DEFRA baseline
Windrow composting rejects	3%	Biffa Waste Services	100%	Jacobs Babtie, worse case
IVC rejection rate	10%	CRS	100%	Jacobs Babtie, worse case
Household residual waste	n/a	n/a	68%	DEFRA baseline
HWRC/ CRC residual waste	n/a	n/a	68%	DEFRA baseline
Trade Waste and Fly-tipped	n/a	n/a	68%	DEFRA baseline

[3] Parfitt, J. (2002) Analysis of Household Waste Copmposition and Factors Driving Waste Increases. Page 10 concludes that "The proportion of household waste classified as biodegradable is 68%." Available at: http://www.number-10.gov.uk/su/waste/report/downloads/composition.pdf

[4] Waste Not, Want Not; A Strategy for Tackling the Waste Problem in England. Cabinet Office, London. Available at: http://www.number-10.gov.uk/su/waste/report/downloads/wastenot.pdf
The 68% figure was subsequently applied in the development of the LATS by DEFRA and disseminated in a letter to all English WDAs on 11 August 2004 from Lindsay Cornish, Head of Waste Strategy Division, on **Landfill Allowance Trading Scheme: Provisional Allocation of Landfill Allowances.** Available at: http://www.defra.gov.uk/environment/waste/localauth/lats/pdf/allocation-let.pdf

Mechanical Biological Treatment

Source	% of output	Technology Supplier/ Source	BMW	BMW % source
RDF	50%	Ecodeco	52%	High CV RDF value – Fichtner/RRF (2004) RDF Opportunities: Coal and Cement Industries.
Moisture loss	25%	Ecodeco	100%	Jacobs Babtie
Residuals for landfill	10%	Ecodeco	68%	Jacobs Babtie
Organic	7%	Ecodeco	100%	Jacobs Babtie
Glass/Grit (assumed to be landfilled)	5%	Ecodeco	0%	Jacobs Babtie

Note: The organic fraction produced by the MBT process is subsequently processed through modules in an ABPR compliant IVC facility. This waste derived compost can only count towards BVPI recycling targets i.e. 82a. Only source separated organics that are processed and produce compost can count towards BVPI 82b.

The calorific value of RDF derived through the MBT process is 15 to 18 MJ/kg.

Glass/ grit is assumed to be landfilled as bidders have not provided sufficient evidence to suggest that the quality of the material is suitable for use as an aggregate, furthermore, there has been insufficient evidence that market outlets have been agreed.

Mechanical Treatment prior to Anaerobic Digestion

Source	% of output	Technology Supplier/ Source	BMW	BMW % source
Water loss	2%	Hese Umwelt GmbH	100%	Jacobs Babtie
Organics	22%	Hese Umwelt GmbH	100%	Jacobs Babtie
Ferrous	2%	Hese Umwelt GmbH	0%	Jacobs Babtie
Non-ferrous	1%	Hese Umwelt GmbH	0%	Jacobs Babtie
RDF	38%	Hese Umwelt GmbH	52%	High CV RDF value – Fichtner (2004) RDF Opportunities: Coal and Cement Industries,
Residues	35%	Hese Umwelt GmbH	30%	Revised by Jacobs Babtie to apply conservative variance to Hese Umwelt testing [August 2004] suggesting 25%

Note: The organic fraction produced by the MT process is processed through the AD facility, as outlined below. In summary the MT and AD process are fully integrated, and thus not mutually exclusive in terms of the output specifications used in the modelling and specified above and below.

The calorific value of RDF derived through the MT process is between 13 and 18 MJ/kg. The lower end range accounts for the fact that the RDF material is significantly wetter than that derived through the bio-drying process used in the MBT facility above.

Anaerobic Digestion

Source	% of output	Technology Supplier/ Source	BMW	BMW % source
Compost for maturation (to end processor)	75%	Hese Umwelt GmbH	100%	Biffa Waste Services
Gas (to electricity)	5%	Hese Umwelt GmbH	100%	Jacobs Babtie
Sand/ grit to landfill	20%	Hese Umwelt GmbH	50%	Hese Umwelt GmbH

Note: RDF is not treated through this process. Whilst the paper content of the RDF could be digested through the AD process, the presence of plastics, and other miscellaneous materials, would contaminate the digestate produced and render it inappropriate to be used though the AD process.

Advanced Thermal Treatment

Source	% of input	Technology Supplier/ Source	BMW	BMW % source
RDF rejects	4%	EA*, WasteGen	50%	Jacobs Babtie
Metals	9%	EA*, WasteGen	0%	Jacobs Babtie
RDF	87%	EA*, WasteGen	68%	Baseline
Output - Carbon residues for aggregate	15%	EA*, WasteGen	0%	Jacobs Babtie

*Environment Agency Waste Technologies Data Centre

Energy from Waste

Source	% of input	Technology Supplier/ Source	BMW	BMW % source
Residues for landfill	1%	Jacobs Babtie	68%	DEFRA baseline
Feedstock	99%	Jacobs Babtie	68%	DEFRA baseline
Output - Bottom Ash - recycled	22%	CIWM*	0%	Inert
Output - Metals	2%	Jacobs Babtie	0%	Inert
Output Residues – Fly Ash	6%	CIWM*	0%	Hazardous

*CIWM EfW Good practice Guide (2003)

Autoclave

Source	% of output	Technology Supplier/ Source	BMW	BMW % source
Estimated proportion ending up as fibre	68%	EEL Davis Brothers	68%	Jacobs Babtie
Glass	6%	EEL Davis Brothers	0%	Jacobs Babtie
Ferrous metal	3%	EEL Davis Brothers	0%	Jacobs Babtie
Non-ferrous	2%	EEL Davis Brothers	0%	Jacobs Babtie
Plastics	4%	EEL Davis Brothers	0%	Jacobs Babtie
Remaining material for disposal	17%	EEL Davis Brothers	68%	Jacobs Babtie

Tables 13 to 18 in Section 4 of the main report illustrate that waste throughput varies both between and within the Meet Targets and Exceed Targets options. As presented in the tables below there is a maximum percentage throughput of residuals that any one technology arrangement can cope with, based on the processing capabilities and material input specifications needed, hence under the Exceed Targets options 3, 4 and 5 it is assumed that these technologies cannot cope with (bulky) HWRC/ CRC residues.

The variations in the Meet Targets options are attributable to the fact that different quantities of waste would have to be processed through each technology arrangement in order to meet the LATS target + 10%. This is because different technologies have different output specifications, as described in the tables above.

The following table shows the maximum percentage of each stream that is able to be processed each technology:

Technology Option	**1a,1b,1c,1d,2a,2b,2c**	
Residual input	**% used**	**What is not processed?**
Household	98%	2% bulky/ oversize/ unusual household waste excluded
Fly-tipped and Trade	60%	40% bulky/ oversize/ unusual waste excluded
Residues from HWRC/ CRC	50%	Approximately 50% can be processed through system, because of the bulky/ oversize nature of these type of residues. Methods to separate potentially usable HWRC/ CRC residue fractions from unusable/ unsuitable fractions have been proposed by bidders, and these include providing two separate bins on site and providing an operative or suitable guidance for users, to try and 'keep' organic materials for example.
Residues from Windrow	100%	
Residues from IVC	100%	
Residues from MRF	100%	

Technology Option	**3, 4, 5a, 5b**	
Residual input	**% used**	**What is not processed?**
Household	98%	2% bulky/ oversize/ unusual household waste excluded
Fly-tipped and Trade	60%	40% bulky/ oversize/ unusual waste excluded
Residues from HWRC/ CRC	0%	Due to the nature of HWRC/ CRC residues and the screening/ sorting processes used, a conservative assumption that 0% of HWRC CRC residues can be processed through these systems
Residues from IVC	100%	
Residues from MRF	100%	
Residues from Windrow	100%	

Appendix VII: Technical Performance

The following pages show the diversion achieved when technology options are added to the system.

The diversion graph is split into

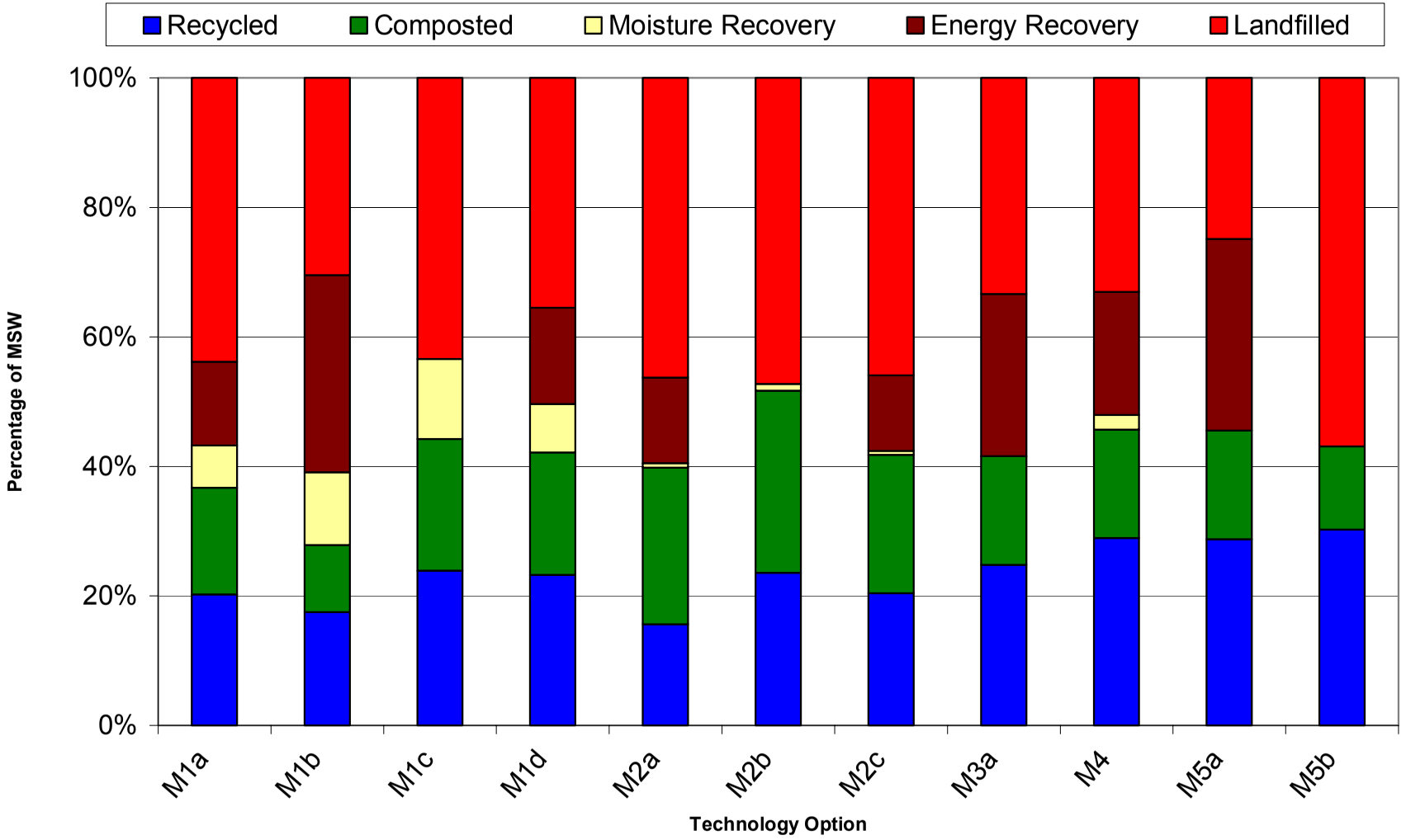
- Landfilled;
- Moisture Recovery;
- Energy Recovery;
- Composed; and,
- Recycled.

Note: Energy Recovery accounts only for thermal treatment of RDF only, it excludes energy recovery from biogas produced from the anaerobic digestion of waste derived organics in Option 2a, 2b and 2c.This is because under BVPI definitions the waste derived organics is already counted under the Recycling 82a BVPI, as the primary purpose of the AD process is to produce a usable compost-like product and not to produce biogas for energy recovery.

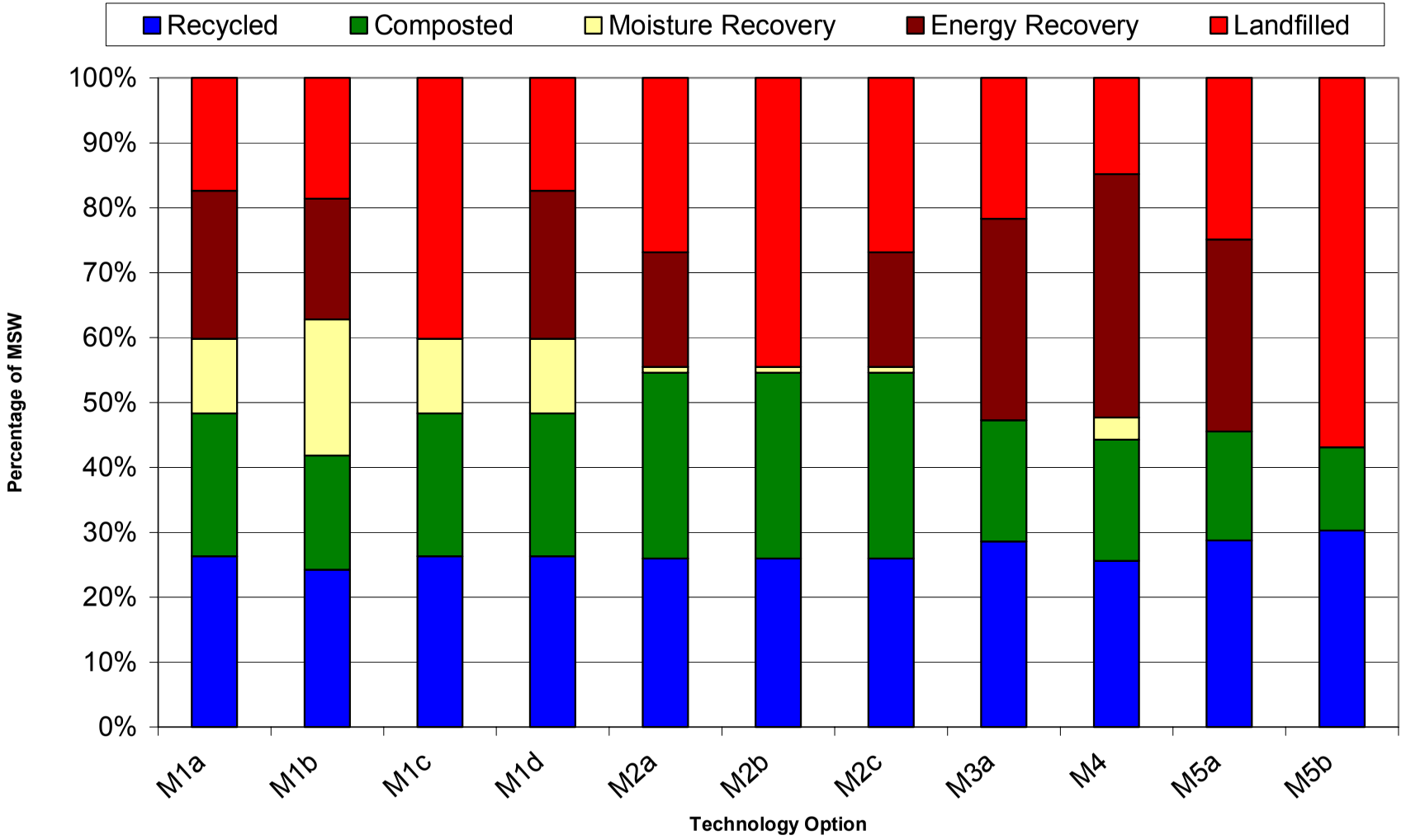
The amount landfilled is an understatement in absolute terms as it excludes residual materials landfilled after being processed for recycling or composting, for example it excludes residues from the GWC and MRF processes. Under the BVPI definitions the total input to a composting process is counted towards 82b, no matter how large the quantity of residues. Residues from the recycling processes, for example, MRFs, are not counted towards the BVPI 82a target.[5]

[5] Referenced from Newsletter 22 Revised (England) Best Value Performance Indicators ODPM.

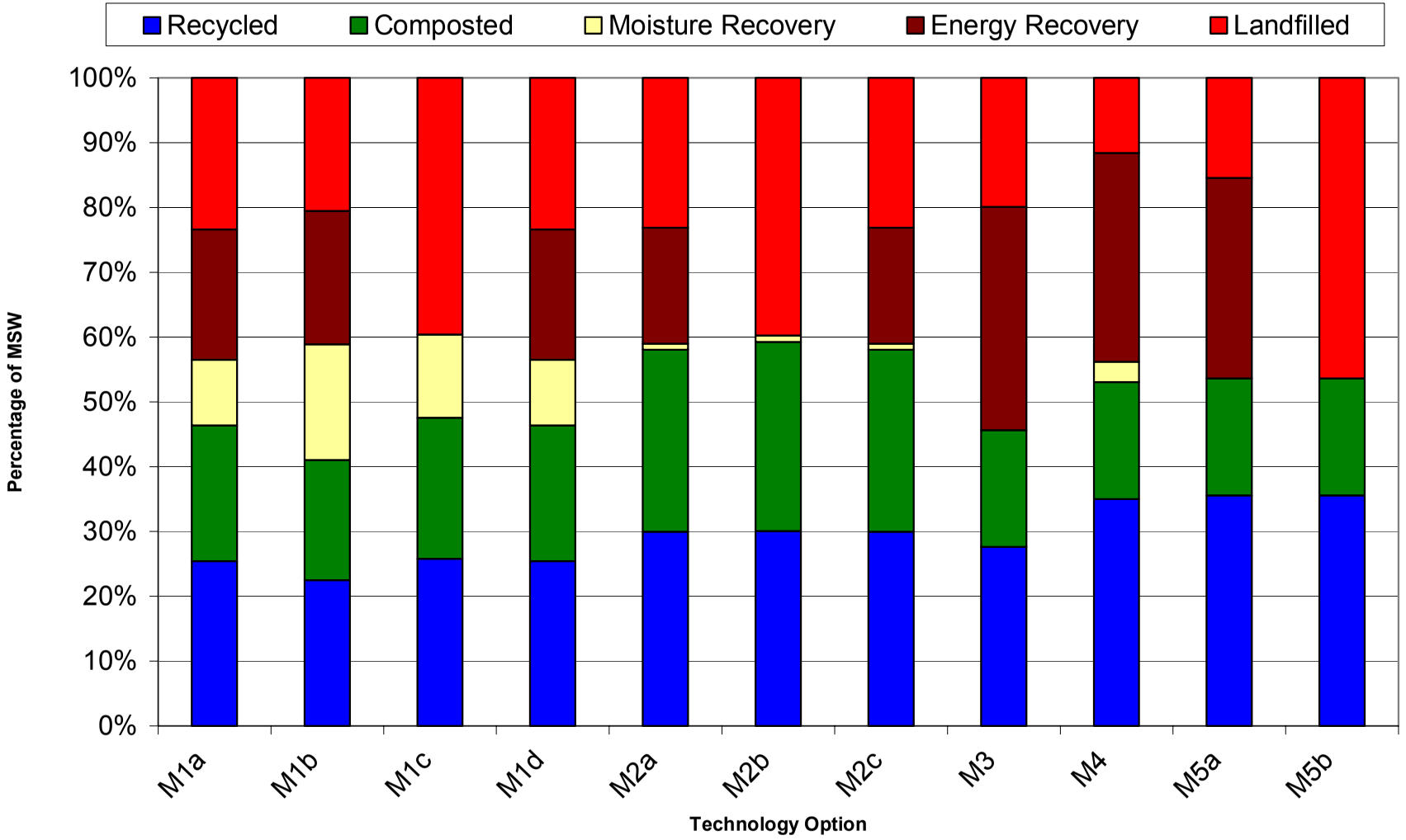
Graph A60: BCC – Meet Targets – Diversion Graph



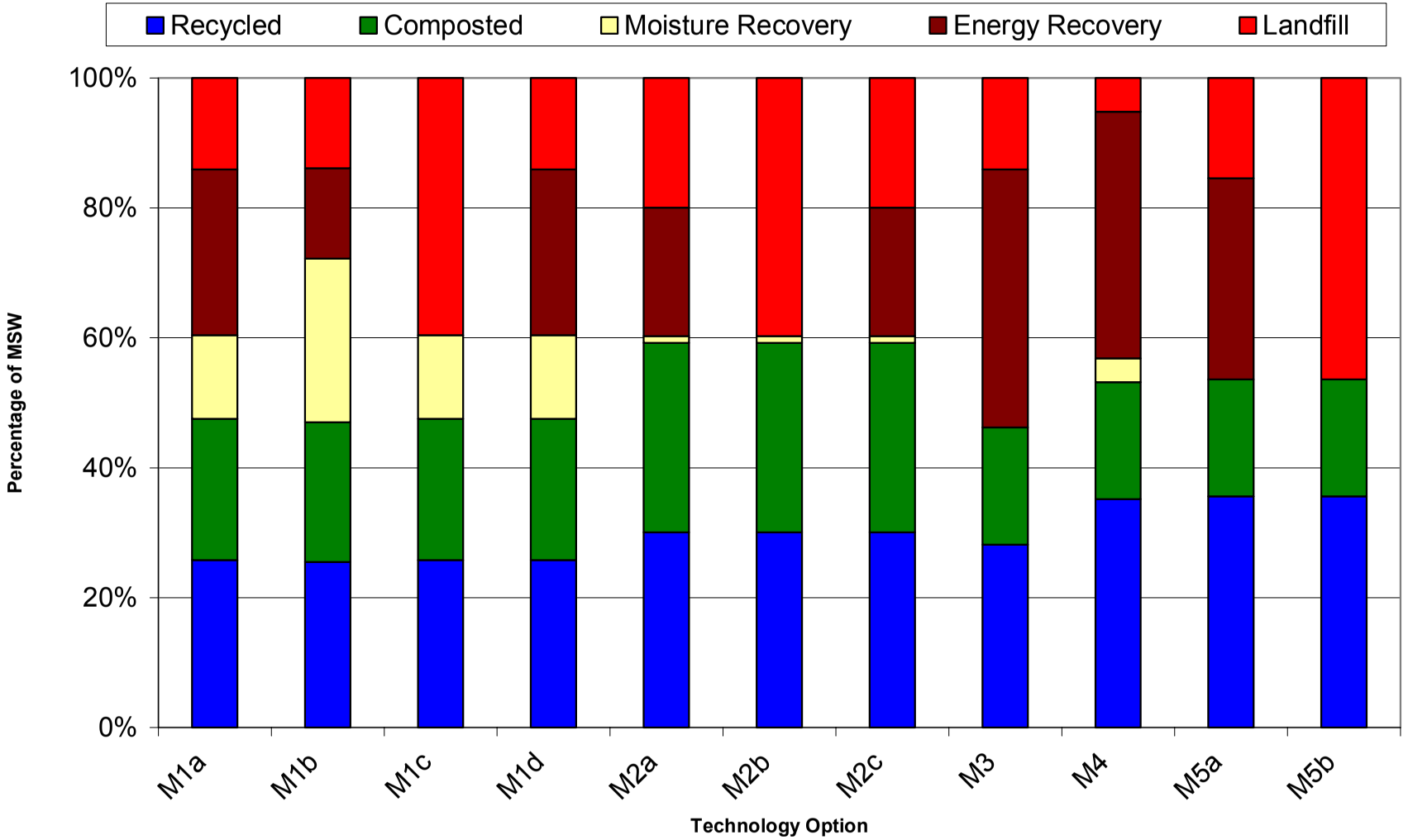
Graph A61: BCC – Exceed Targets – Diversion Graph



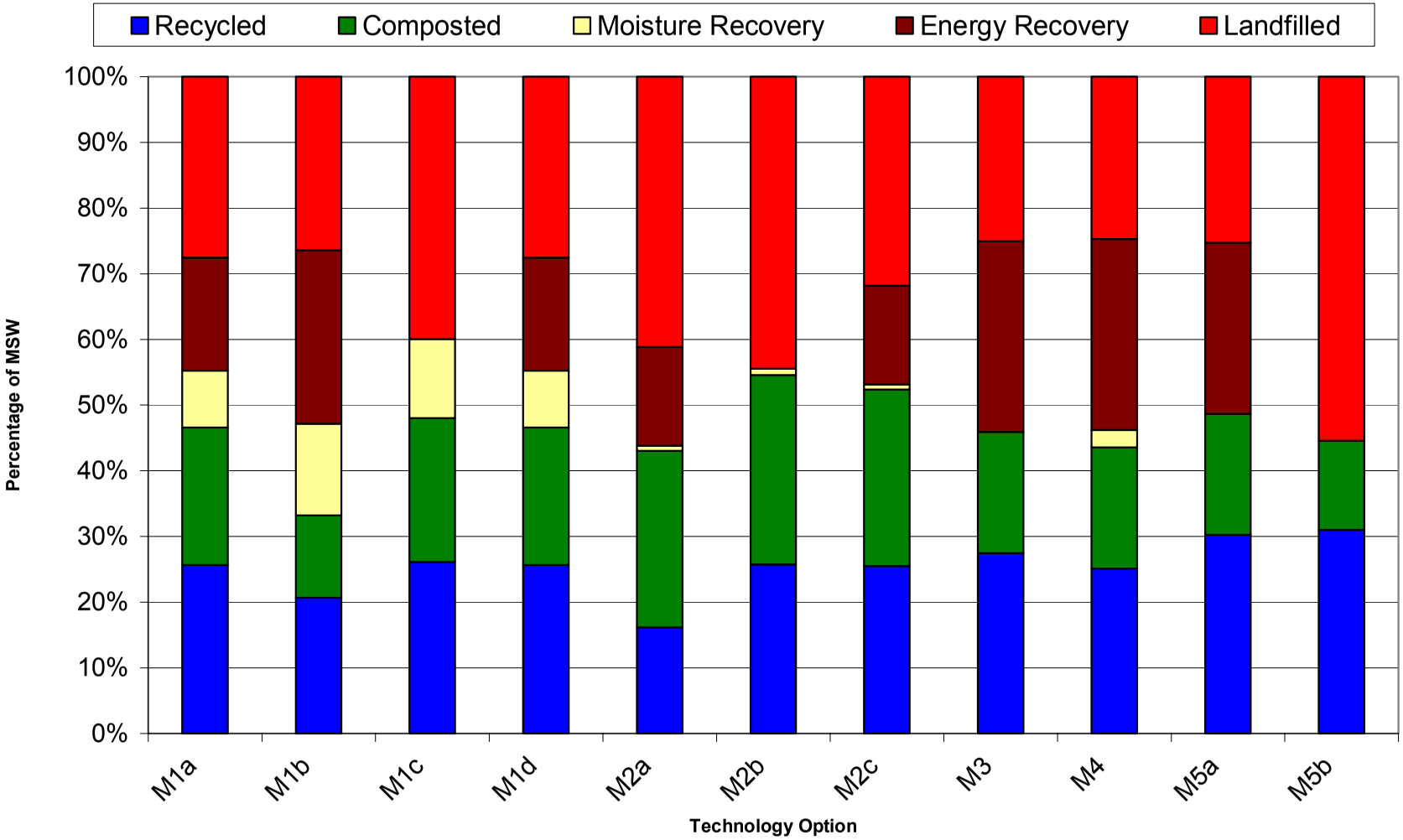
Graph A61: MKC – Meet Targets– Diversion Graph



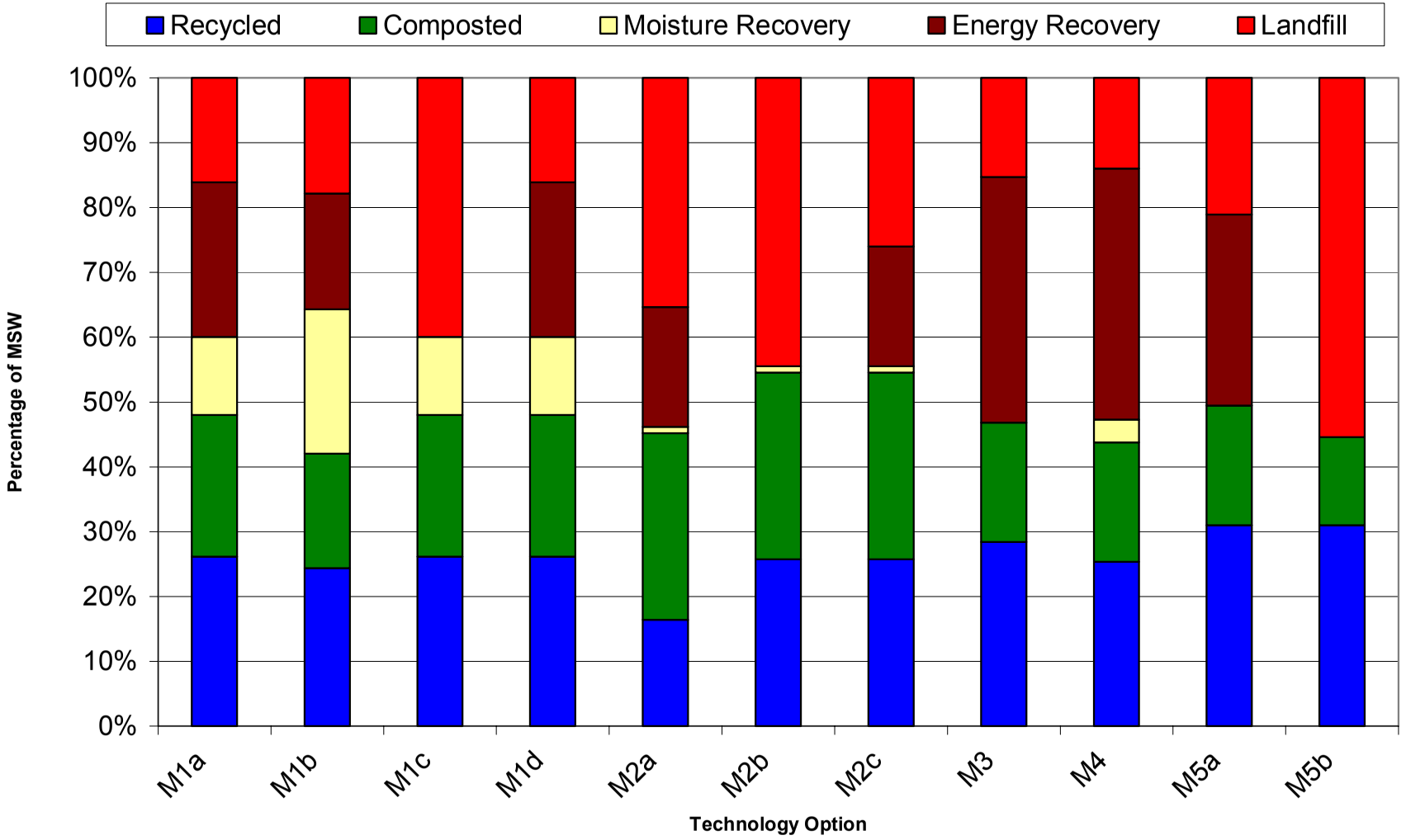
Graph A62: Milton Keynes – Exceed Targets– Diversion Graph



Graph A63: Joint – Meet Targets– Diversion Graph

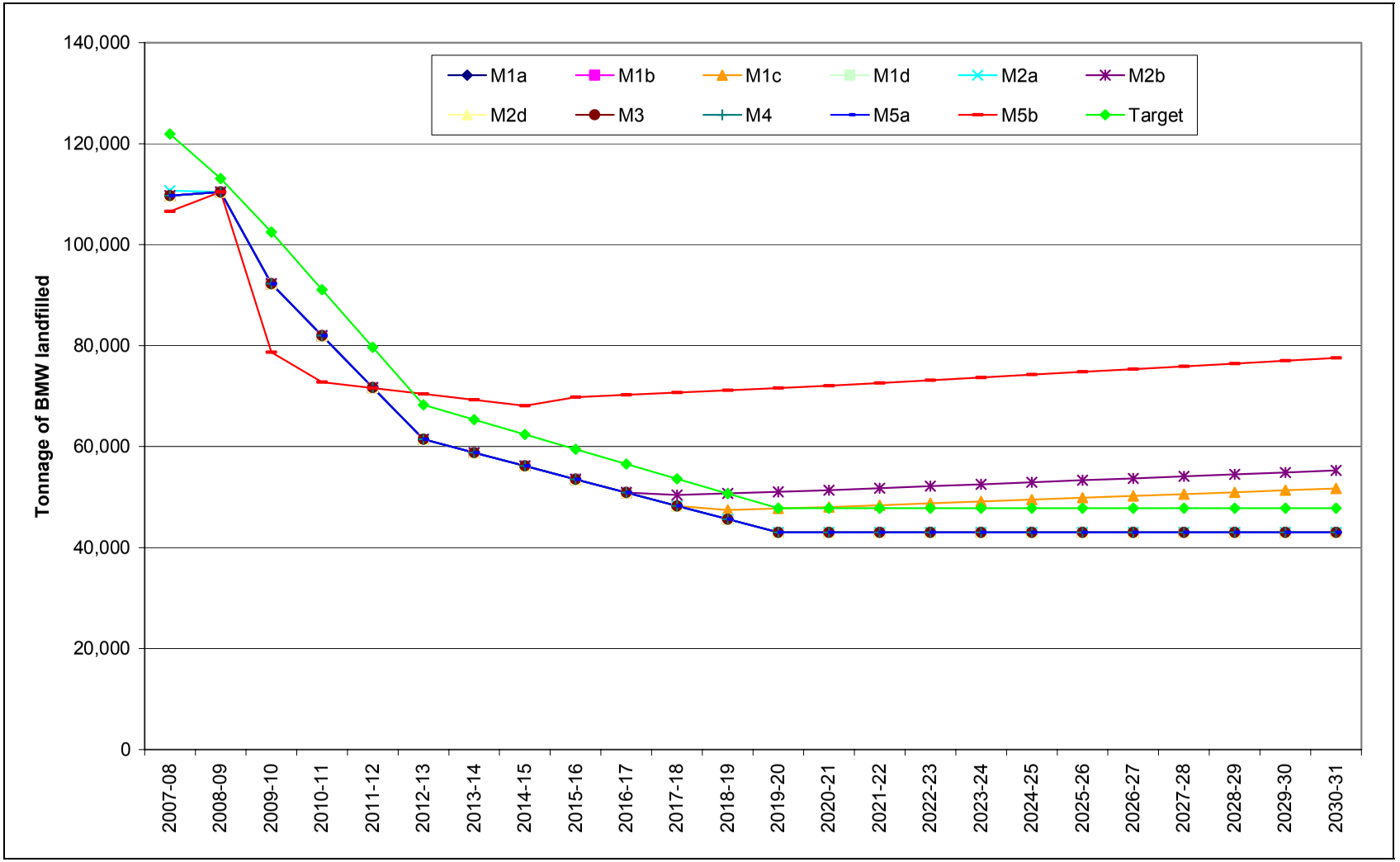


Graph A64: Joint – Exceed Targets – Diversion Graph

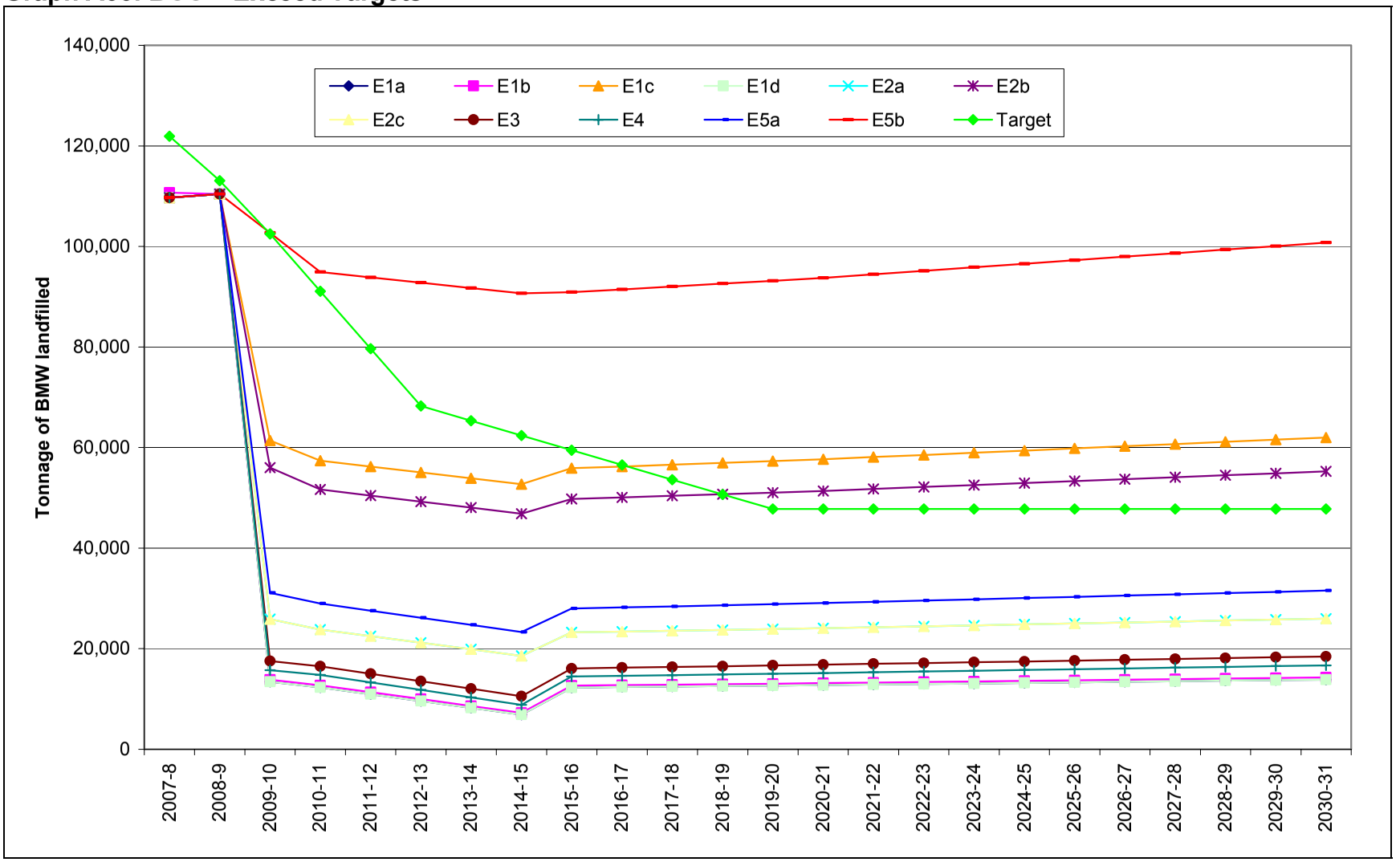


The following graphs show the LATS when the different technologies are used

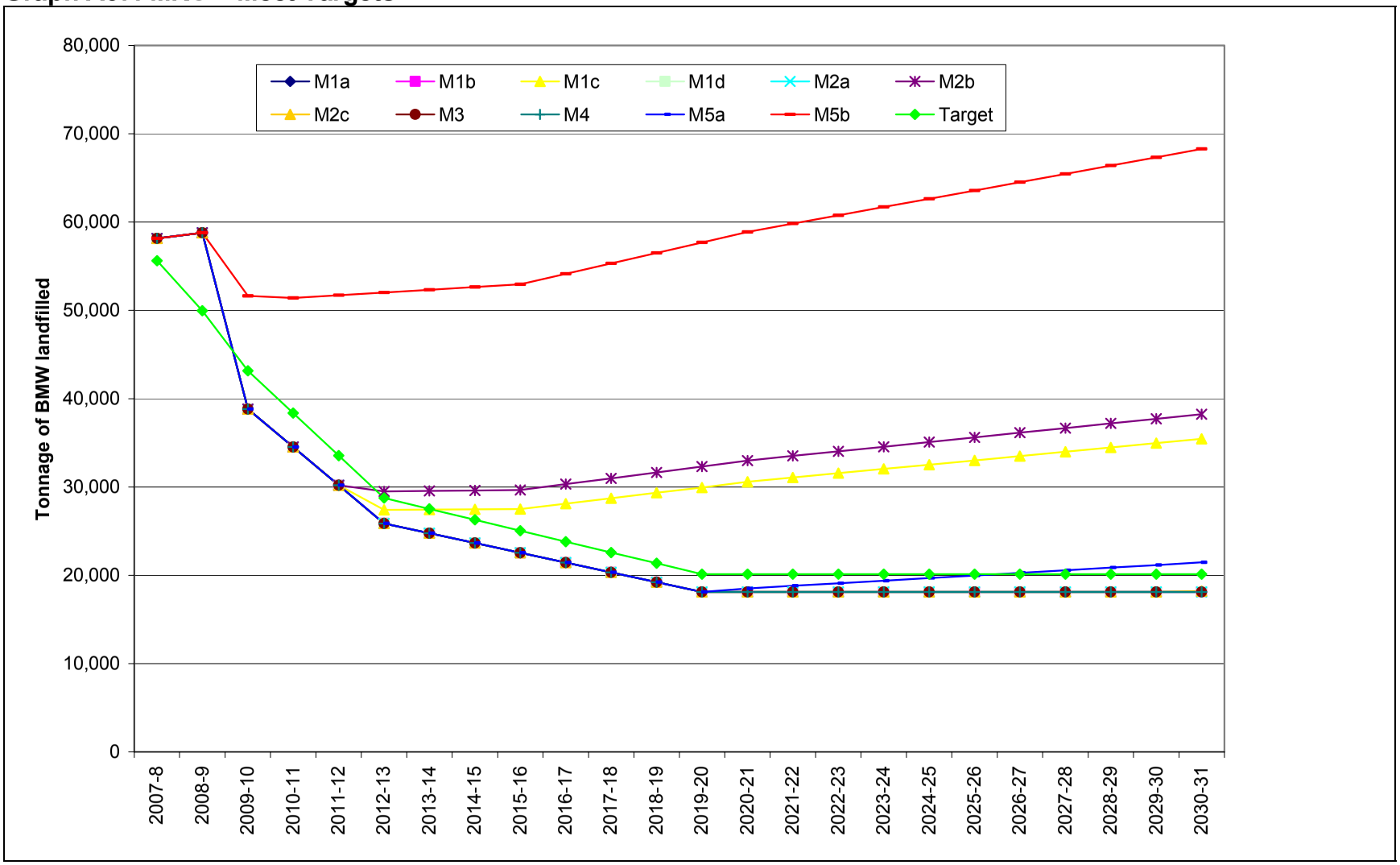
Graph A65: BCC – Meet targets –


140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
Tonnage of BMW landfilled
M1a
M1b
M1c
M1d
M2a
M2b
M2d
M3
M4
M5a
M5b
Target
2007-08
2008-09
2009-10
2010-11
2011-12
2012-13
2013-14
2014-15
2015-16
2016-17
2017-18
2018-19
2019-20
2020-21
2021-22
2022-23
2023-24
2024-25
2025-26
2026-27
2027-28
2028-29
2029-30
2030-31

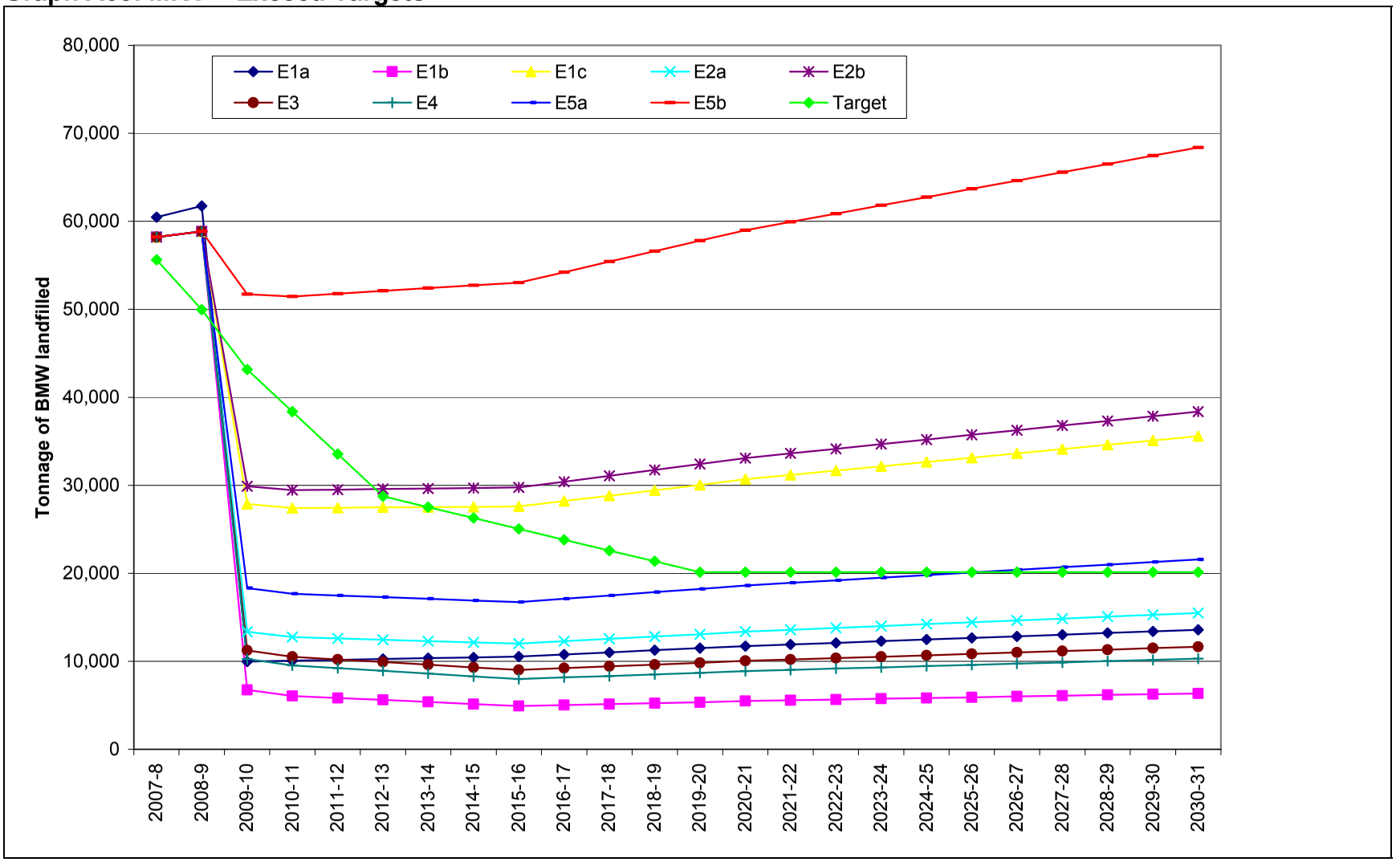
Graph A66: BCC – Exceed Targets



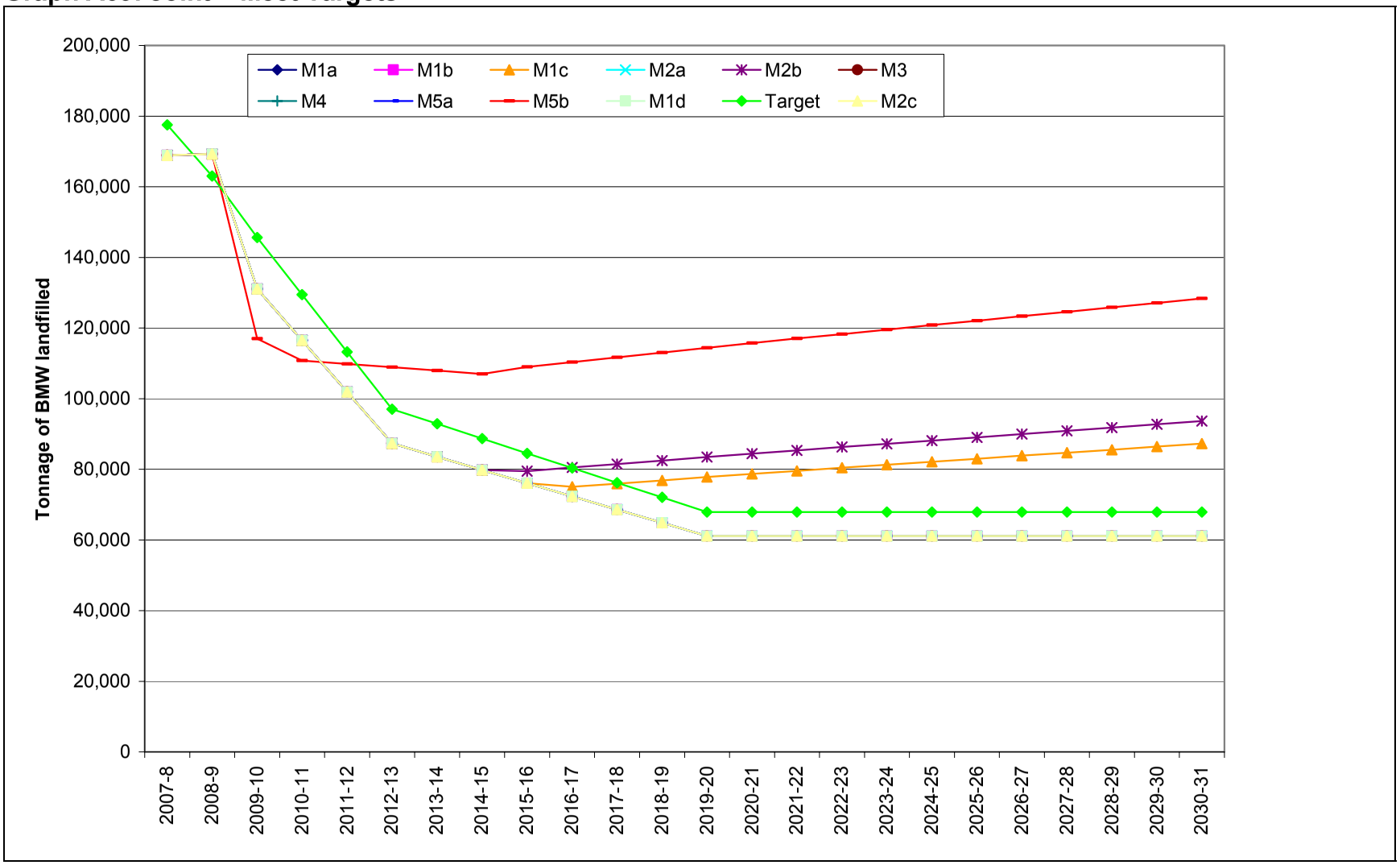
Graph A67: MKC – Meet Targets



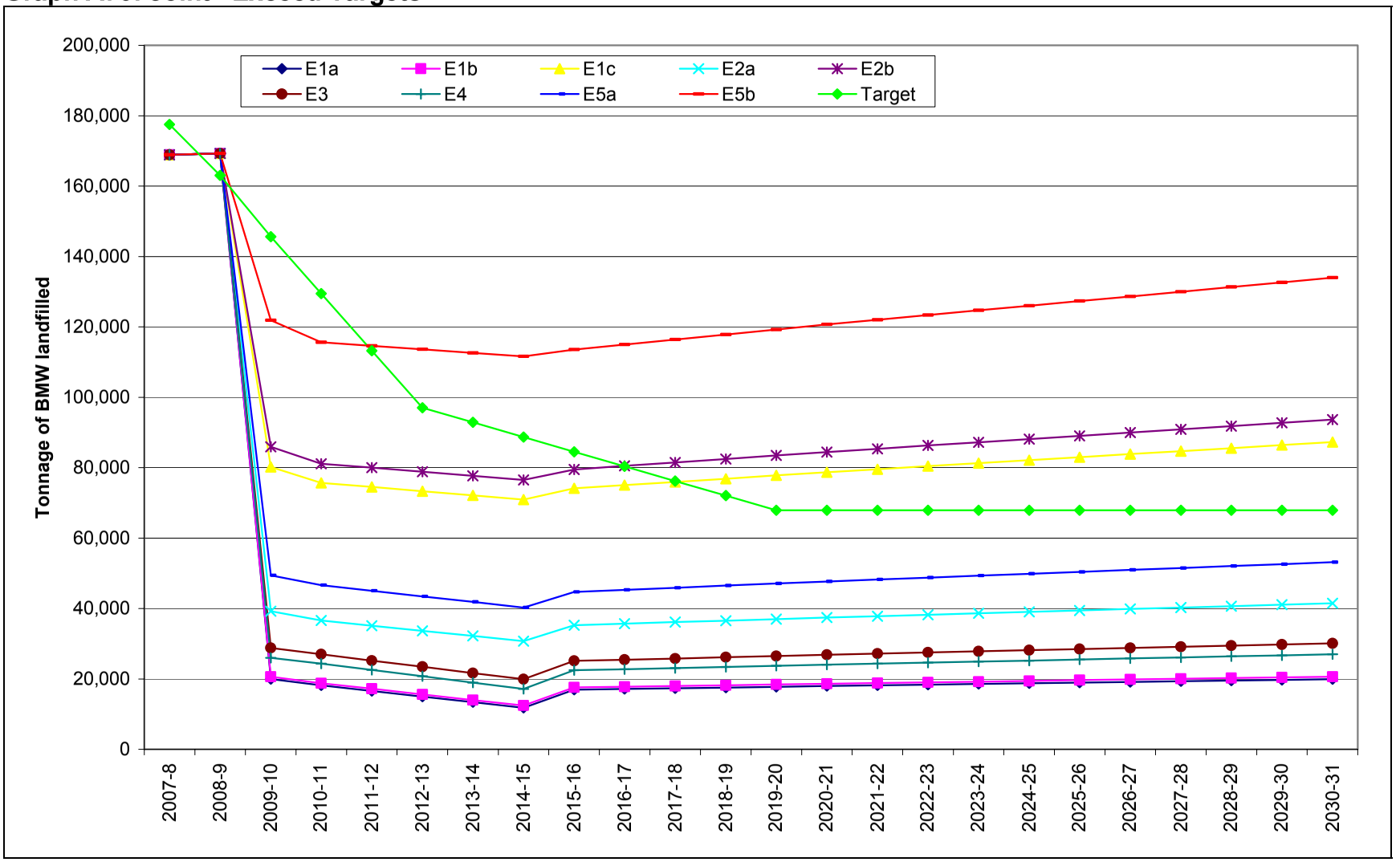
Graph A68: MKC – Exceed Targets



Graph A69: Joint – Meet Targets

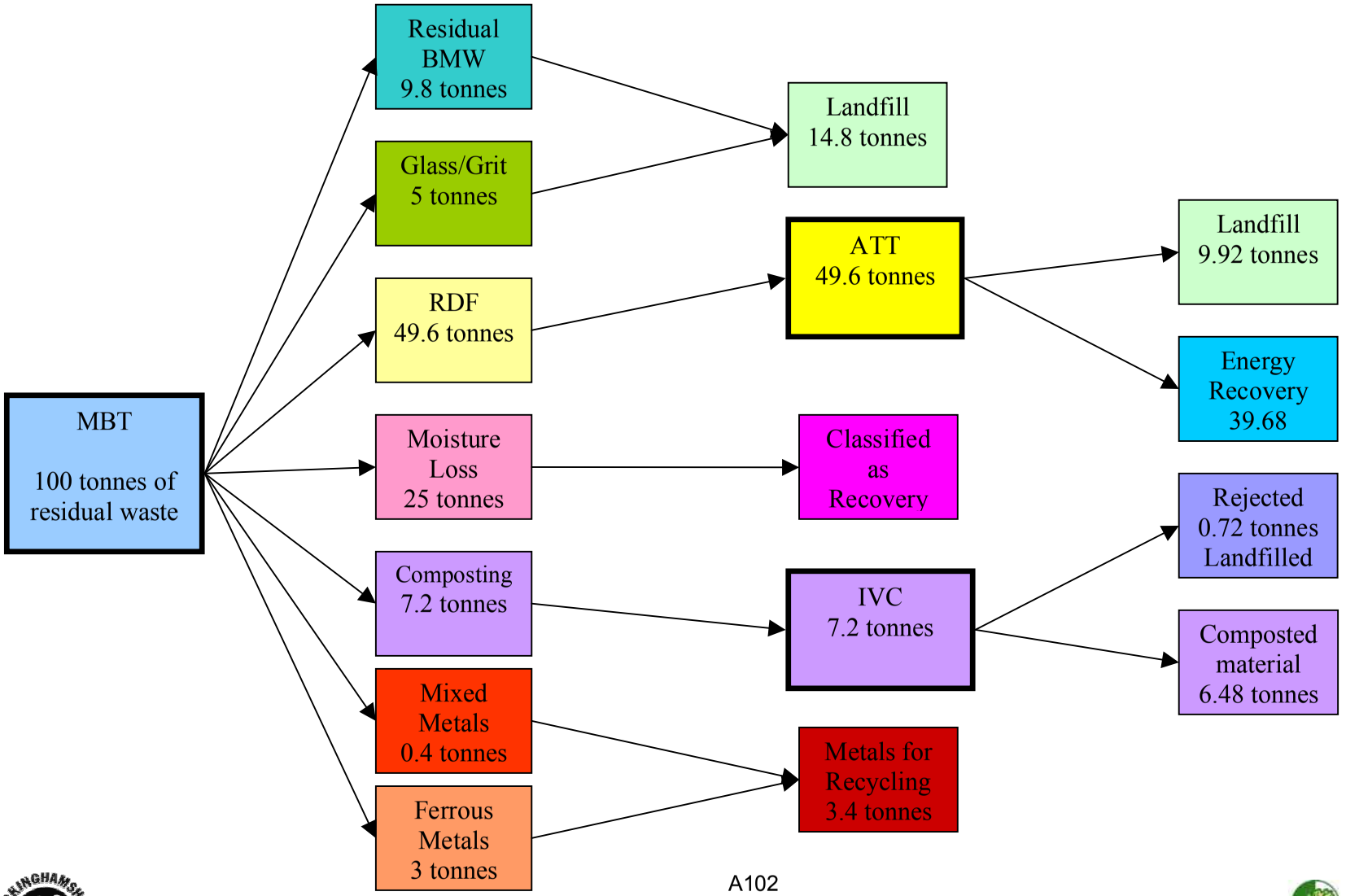


Graph A70: Joint– Exceed Targets

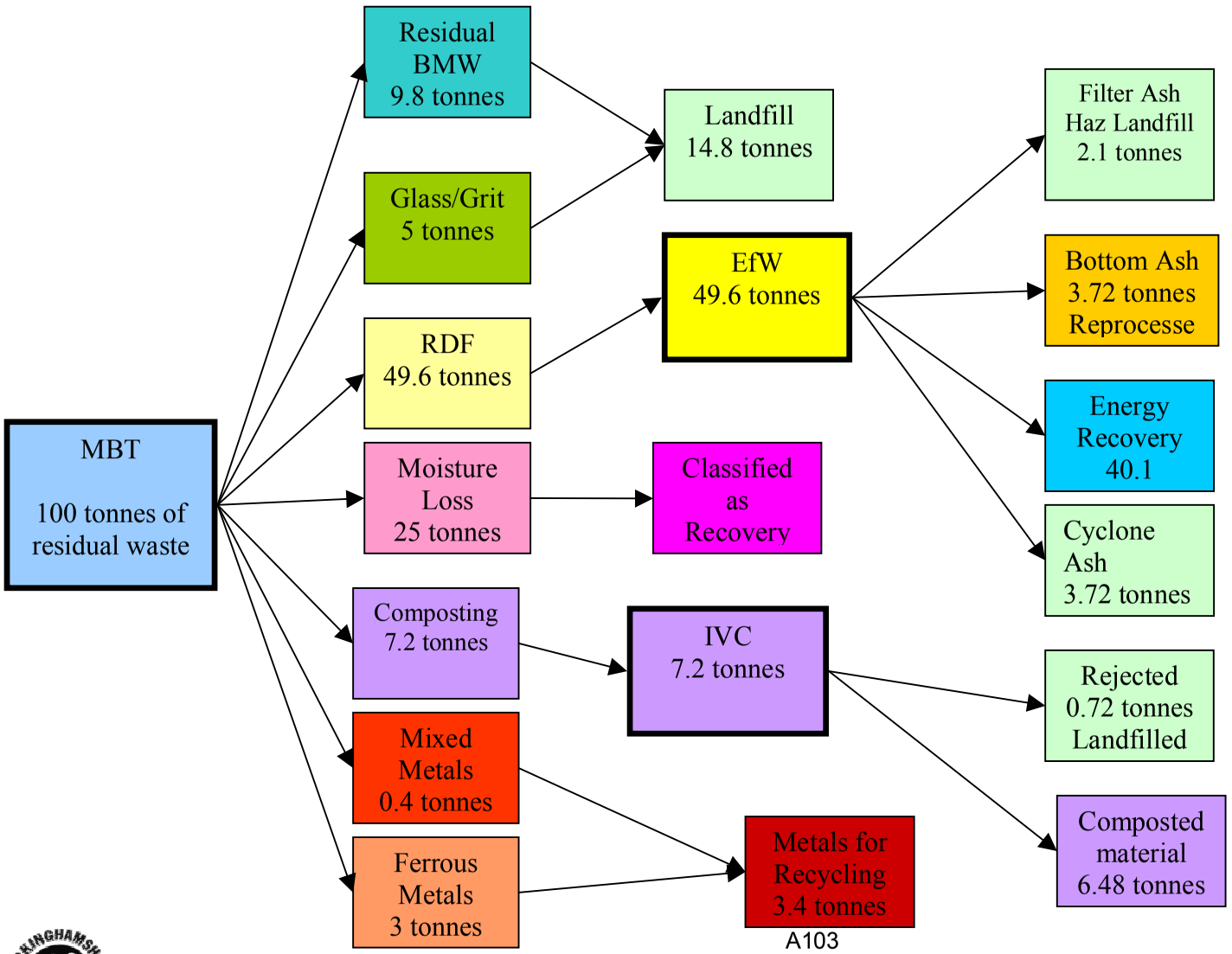


Appendix VIII: Technology Mass Balance

Option 1a: **Mechanical Biological Treatment + Advanced Thermal Treatment of RDF + In-Vessel Composting of waste derived compost.**

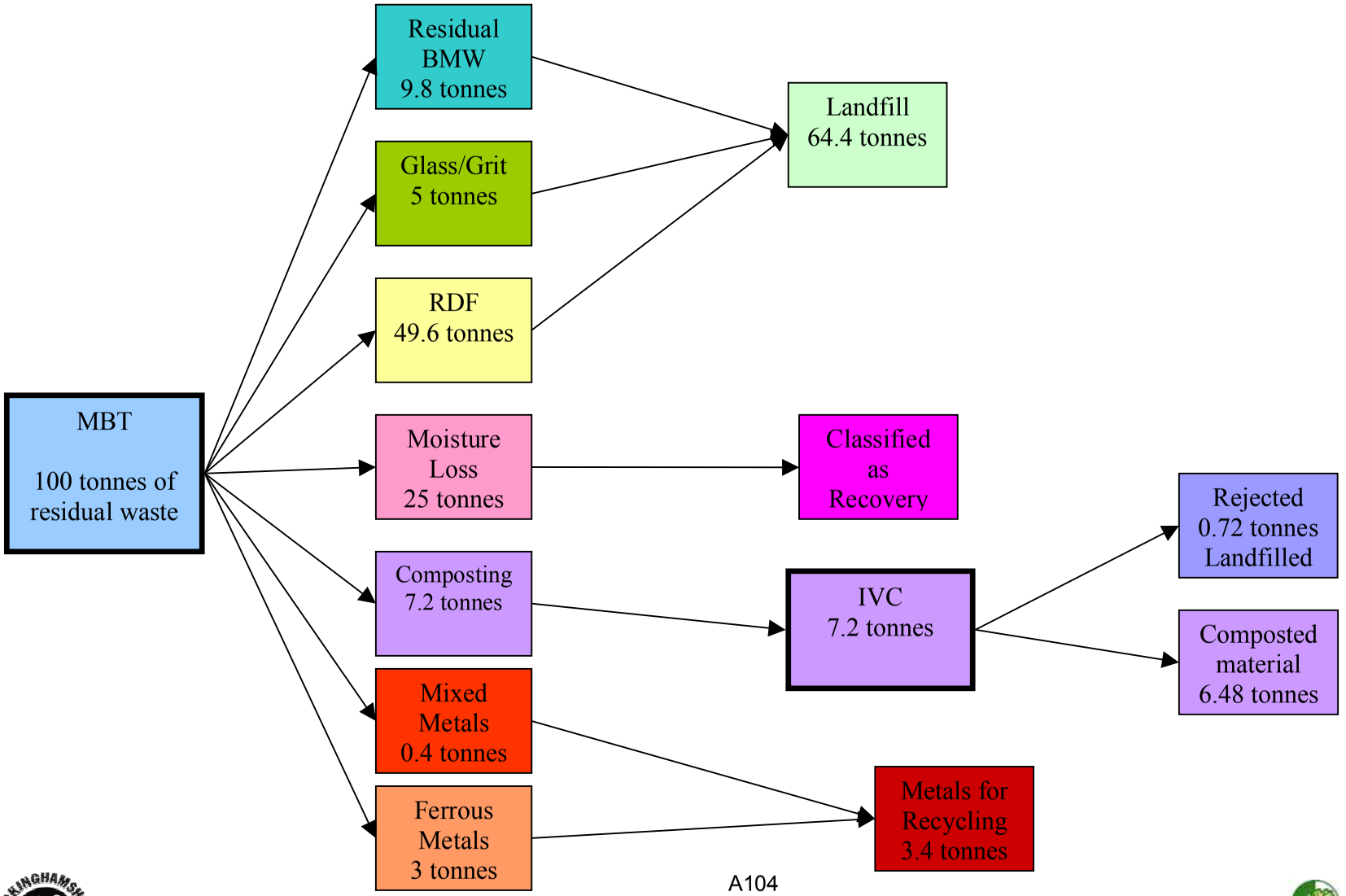


Option 1b: Mechanical Biological Treatment + EfW (Fluidised bed) + In-Vessel Composting of waste derived compost

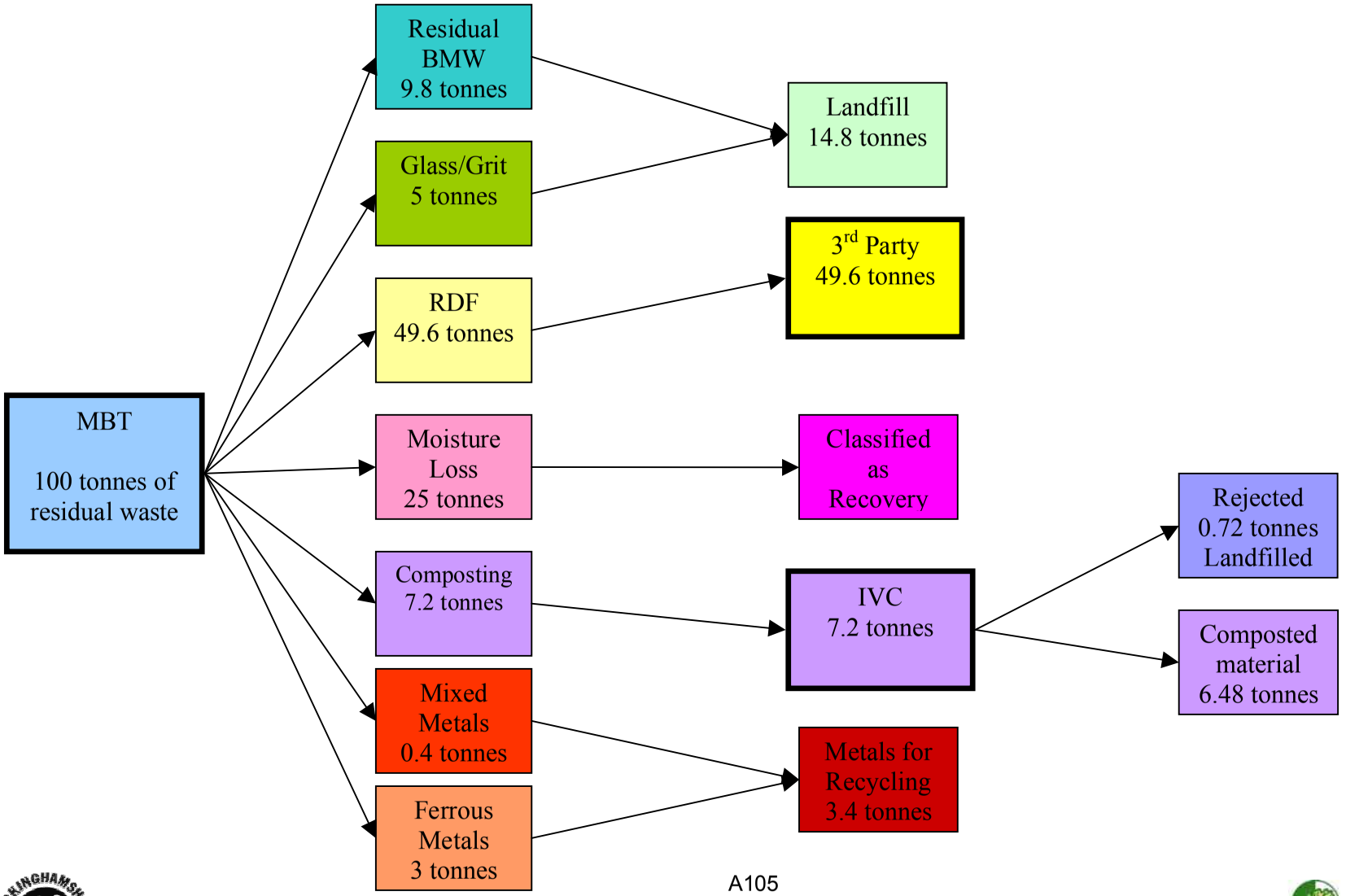


A103

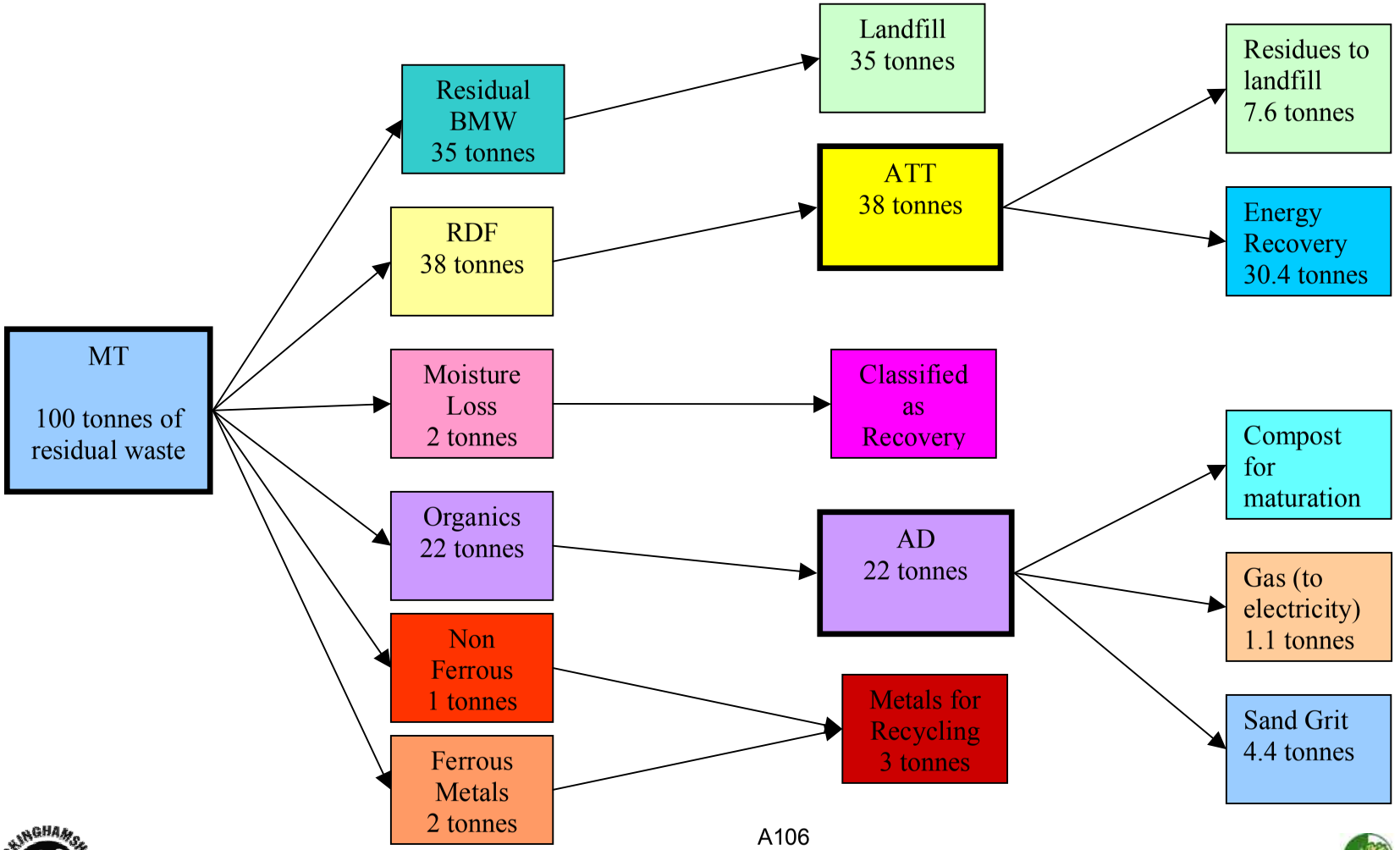
Option 1c: Mechanical Biological Treatment + In-Vessel Composting of waste derived compost + Landfill



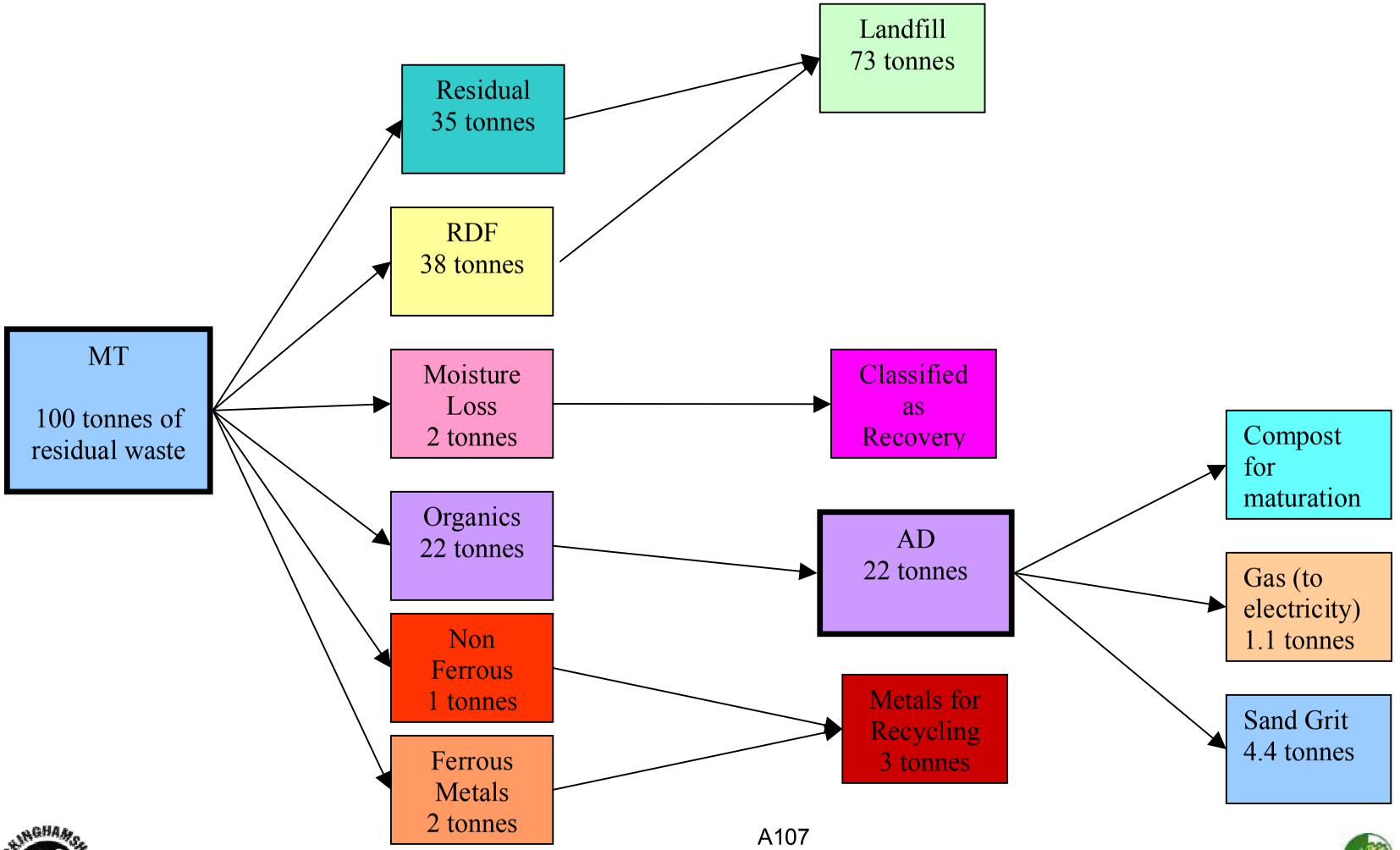
Option 1d: Mechanical Biological Treatment + In-Vessel Composting of waste derived compost + 3rd Party



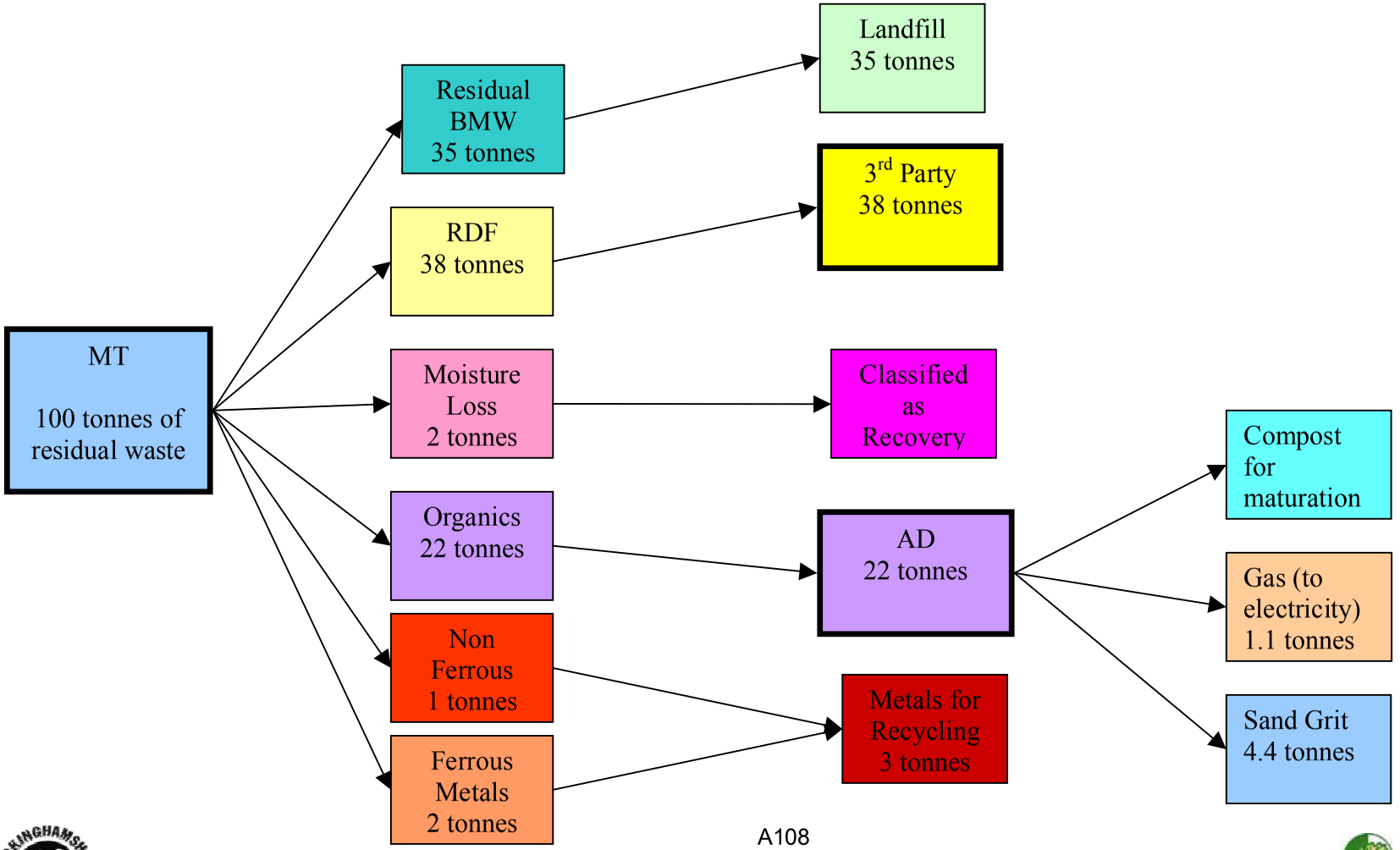
Option 2a: Mechanical Treatment + Advanced Thermal Treatment of RDF + Anaerobic Digestion of waste derived compost



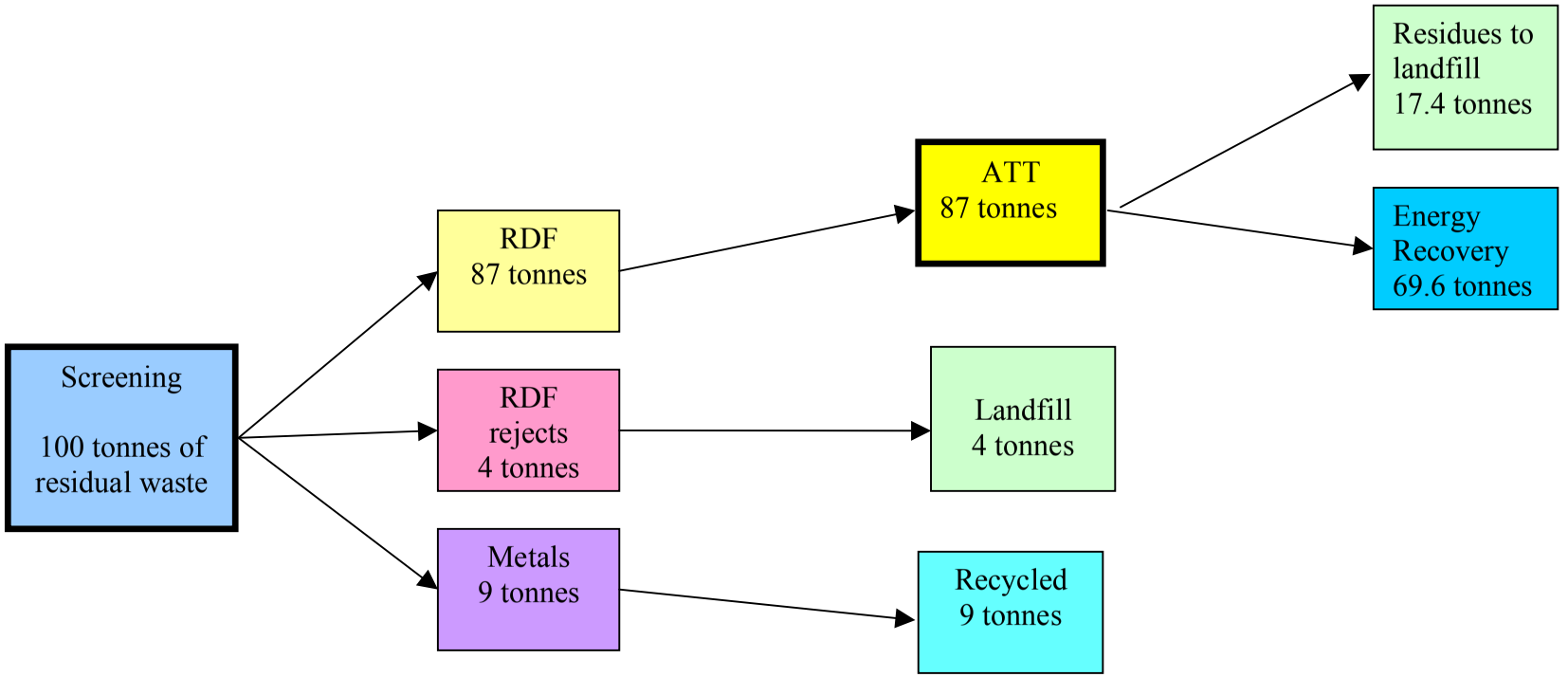
Option 2b: Mechanical Treatment + Anaerobic Digestion of waste derived compost and kerbside organics + Landfill



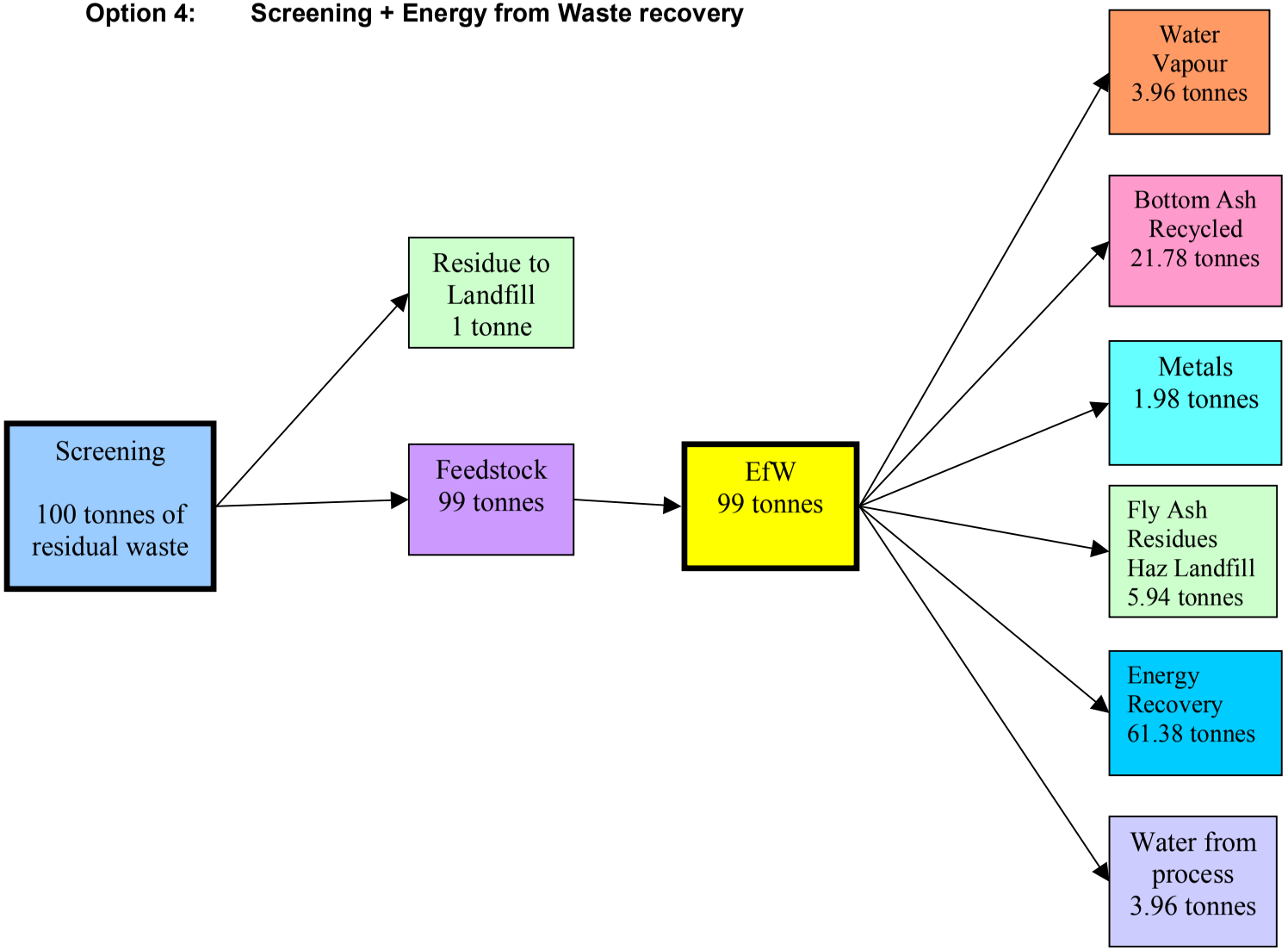
Option 2c: Mechanical Treatment + Anaerobic Digestion of waste derived compost and kerbside organics + third party treatment of RDF



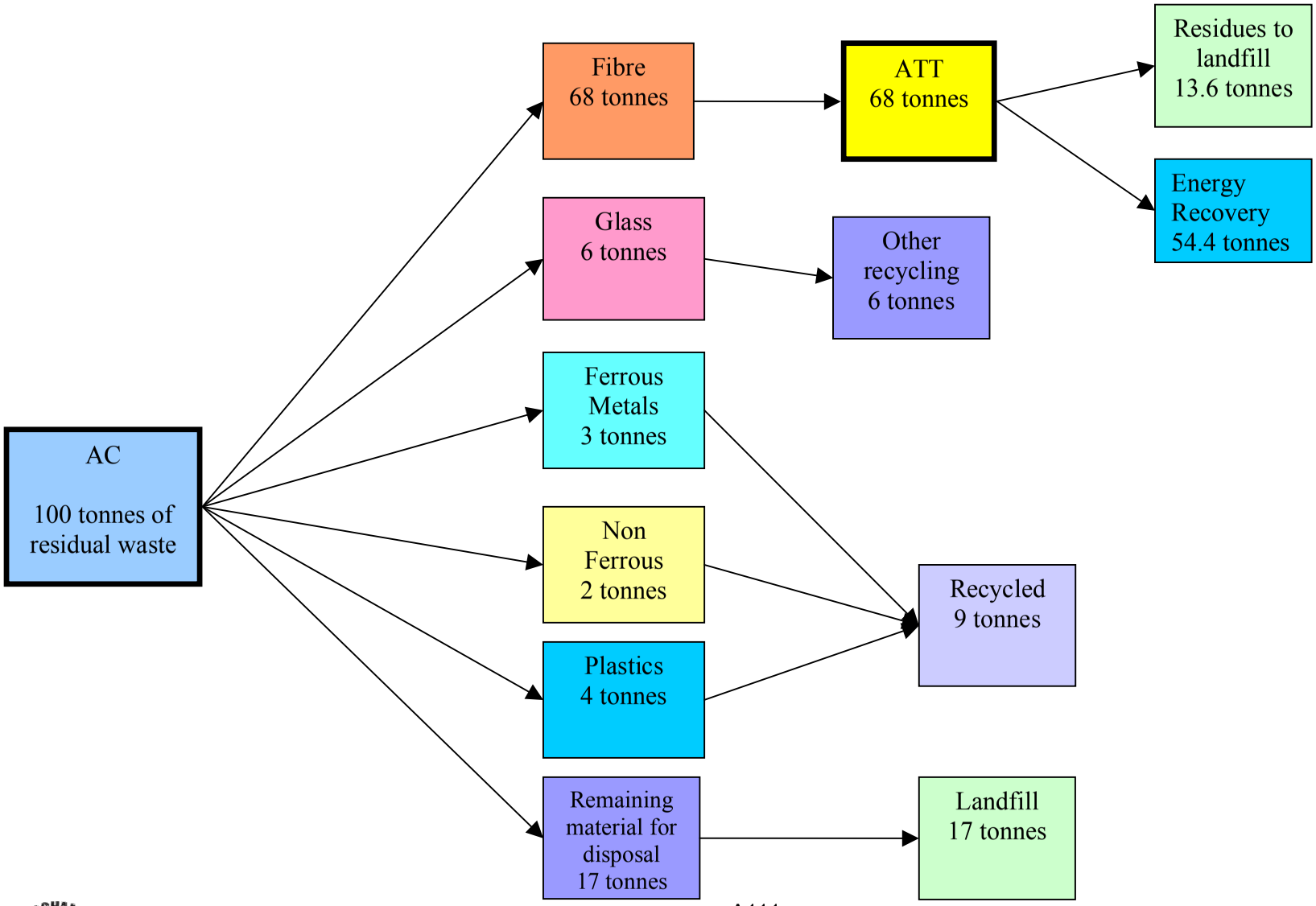
Option 3a and 3b: Screening + Advanced Thermal Treatment



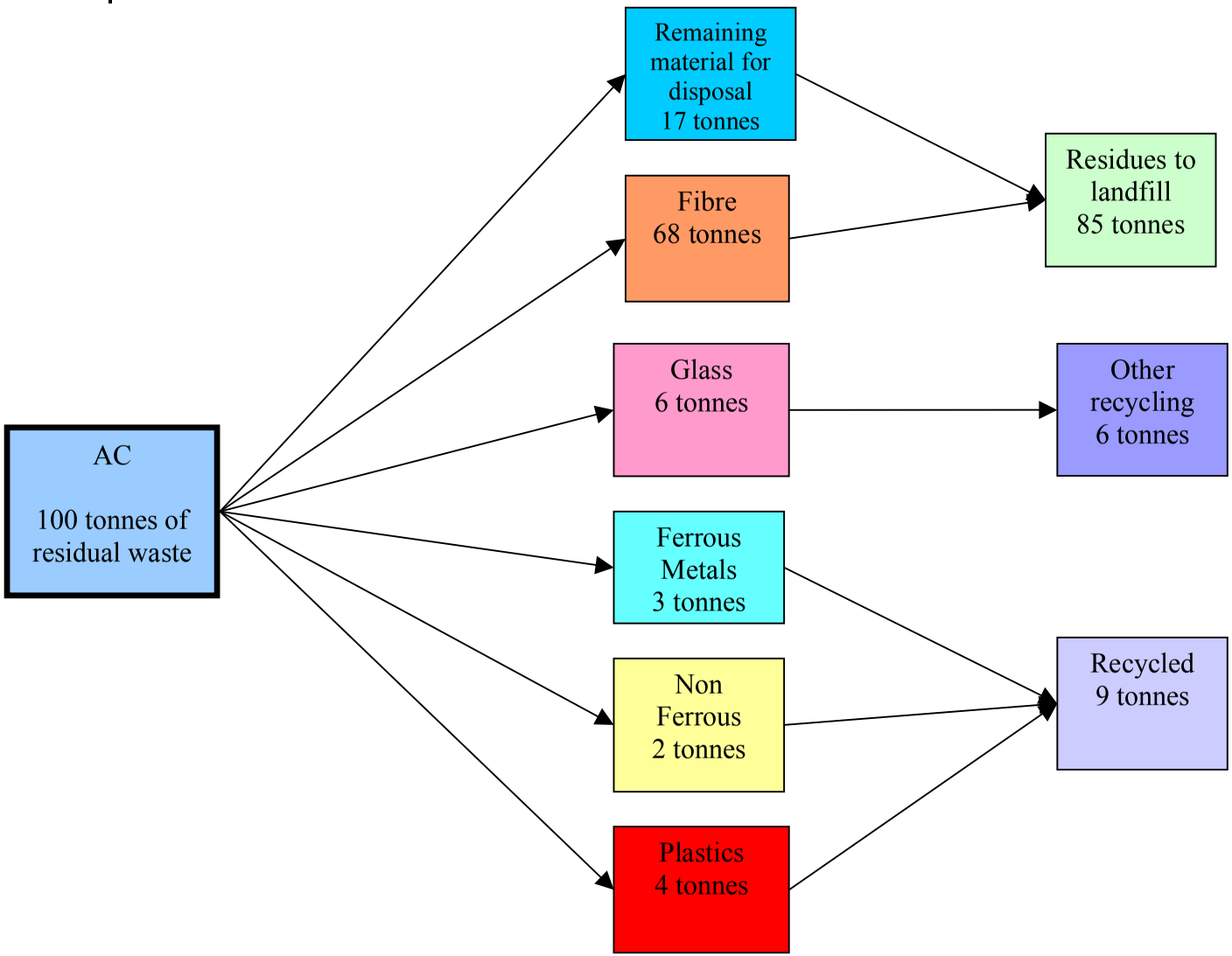
Option 4: Screening + Energy from Waste recovery



Option 5a: Autoclave + Advanced Thermal Treatment



Option 5b: Autoclave + Landfill



Appendix IX: Capital and Operational Cost Assumptions

Using confidential bidders data, industry reports, market reports, and Environment Agency data, Jacobs Babtie determined the OPEX and CAPEX of each facility, with the technologies being sized to cope with the maximum through put at any one time during contract period. The principal assumptions used in the financial model are summarised below.

Operating Costs (OPEX) are expressed in November 2004 prices, as £ per tonne throughput. **Capital Costs (CAPEX)** are expressed in November 2004 prices, as £ per tonne built capacity).
CAPEX and OPEX assumptions for BCC

MBT

Option	tpa	#	tpa per #	OPEX	CAPEX
M1a	102,963	1	102,963	£33.00	£157.50
M1c	146,714	1	146,714	£23.50	£145.00
M1b	103,417	1	103,417	£33.00	£157.50
M1d	102,963	1	102,963	£33.00	£157.50
E1a	150,828	1	150,828	£23.50	£145.00
E1b	150,828	1	150,828	£23.50	£145.00
E1c	150,828	1	150,828	£23.50	£145.00
E1d	150,828	1	150,828	£23.50	£145.00

ATT

Option	tpa	#	tpa per #	OPEX	CAPEX
M2a	45,452	1	45,452	£55.00	£404.00
M1a	51,070	1	51,070	£50.00	£388.00
E2a	57,918	1	57,918	£50.00	£371.00
E1a	74,811	1	74,811	£45.00	£338.00
M3a	86,157	1	86,157	£45.00	£322.00
M3b	86,157	2	43,078	£55.00	£404.00
M5a	78,707	1	78,707	£45.00	£332.00
E5a	93,992	1	93,992	£40.00	£312.00
E3a	120,768	1	120,768	£40.00	£285.00
E3b	120,768	2	60,384	£50.00	£371.00

MT & AD

Option	tpa	#	tpa per #	OPEX	CAPEX
M2a	118,363	1	118,363	£31.00	£185.00
M2b	146,714	1	146,714	£30.00	£180.00
M2c	118,363	1	118,363	£31.00	£185.00
E2a	150,828	1	150,828	£30.00	£180.00
E2b	150,828	1	150,828	£30.00	£180.00
E2c	150,828	1	150,828	£30.00	£180.00

AC

Option	tpa	#	tpa per #	OPEX	CAPEX
M5a	116,239	1	116,239	£17.00	£151.00
E5a	138,814	1	138,814	£15.50	£116.00
M5b	138,814	1	138,814	£15.50	£116.00
E5b	138,814	1	138,814	£15.50	£116.00

EfW (fluid)

Option	tpa	#	tpa per #	OPEX	CAPEX
M1b	51,295	1	51,295	£40.00	£388.00
E1b	74,811	1	74,811	£40.00	£340.00

EfW

Option	tpa	#	tpa per #	OPEX	CAPEX
M4	96,118	1	96,118	£20.00	£309.00
E4	137,426	1	137,426	£17.00	£287.00

MRF

Option	tpa	#	tpa per #	OPEX	CAPEX
M1a	58,010	1	58,010	£50.00	£100.00
M1b	58,010	1	58,010	£50.00	£100.00
M1c	58,010	1	58,010	£50.00	£100.00
M1d	58,010	1	58,010	£50.00	£100.00
M2a	58,010	1	58,010	£50.00	£100.00
M2b	58,010	1	58,010	£50.00	£100.00
M2c	58,010	1	58,010	£50.00	£100.00
M3a	58,010	1	58,010	£50.00	£100.00
M4	58,010	1	58,010	£50.00	£100.00
M5a	58,010	1	58,010	£50.00	£100.00
M5b	58,010	1	58,010	£50.00	£100.00
E1a	58,010	1	58,010	£50.00	£100.00
E1b	58,010	1	58,010	£50.00	£100.00
E1c	58,010	1	58,010	£50.00	£100.00
E1d	58,010	1	58,010	£50.00	£100.00
E2a	58,010	1	58,010	£50.00	£100.00
E2b	58,010	1	58,010	£50.00	£100.00
E2c	58,010	1	58,010	£50.00	£100.00
E3a	58,010	1	58,010	£50.00	£100.00
E4	58,010	1	58,010	£50.00	£100.00
E5a	58,010	1	58,010	£50.00	£100.00
E5b	58,010	1	58,010	£50.00	£100.00

GWC

Option	tpa	#	tpa per #	OPEX	CAPEX
M1a	25,283	2	12,641	£15.00	£35.00
M1b	25,283	2	12,641	£15.00	£35.00
M1c	25,283	2	12,641	£15.00	£35.00
M1d	25,283	2	12,641	£15.00	£35.00
M2a	25,283	2	12,641	£15.00	£35.00
M2b	25,283	2	12,641	£15.00	£35.00
M2c	25,283	2	12,641	£15.00	£35.00
M3	25,283	2	12,641	£15.00	£35.00
M4	25,283	2	12,641	£15.00	£35.00
M5a	25,283	2	12,641	£15.00	£35.00
M5b	25,283	2	12,641	£15.00	£35.00
E1a	25,283	2	12,641	£15.00	£35.00
E1b	25,283	2	12,641	£15.00	£35.00
E1c	25,283	2	12,641	£15.00	£35.00
E1d	25,283	2	12,641	£15.00	£35.00
E2a	25,283	2	12,641	£15.00	£35.00
E2b	25,283	2	12,641	£15.00	£35.00
E2c	25,283	2	12,641	£15.00	£35.00
E3	25,283	2	12,641	£15.00	£35.00
E4	25,283	2	12,641	£15.00	£35.00
E5a	25,283	2	12,641	£15.00	£35.00
E5b	25,283	2	12,641	£15.00	£35.00

Baling/ WTS

Option	tpa	#	tpa per #	OPEX	CAPEX
M1a	21,462	1	21,462	£10.21	
M1b	21,462	1	21,462	£10.21	
M1c	21,462	1	21,462	£10.21	
M1d	21,462	1	21,462	£10.21	
M2a	21,462	1	21,462	£10.21	
M2b	21,462	1	21,462	£10.21	
M2c	21,462	1	21,462	£10.21	
M3a	21,462	1	21,462	£10.21	
M4	21,462	1	21,462	£10.21	
M5a	21,462	1	21,462	£10.21	
M5b	21,462	1	21,462	£10.21	
E1a	21,462	1	21,462	£10.21	
E1b	21,462	1	21,462	£10.21	
E1c	21,462	1	21,462	£10.21	
E1d	21,462	1	21,462	£10.21	
E2a	21,462	1	21,462	£10.21	
E2b	21,462	1	21,462	£10.21	
E2c	21,462	1	21,462	£10.21	
E3a	21,462	1	21,462	£10.21	
E4	21,462	1	21,462	£10.21	
E5a	21,462	1	21,462	£10.21	
E5b	21,462	1	21,462	£10.21	

HWRCs

Option	tpa	#	tpa per #	OPEX	CAPEX
M1a	101,433	9	11,270	£31.28	
M1b	101,433	9	11,270	£31.28	
M1c	101,433	9	11,270	£31.28	
M1d	101,433	9	11,270	£31.28	
M2a	101,433	9	11,270	£31.28	
M2b	101,433	9	11,270	£31.28	
M2c	101,433	9	11,270	£31.28	
M3	101,433	9	11,270	£31.28	
M4	101,433	9	11,270	£31.28	
M5a	101,433	9	11,270	£31.28	
M5b	101,433	9	11,270	£31.28	
E1a	101,433	9	11,270	£31.28	
E1b	101,433	9	11,270	£31.28	
E1c	101,433	9	11,270	£31.28	
E1d	101,433	9	11,270	£31.28	
E2a	101,433	9	11,270	£31.28	
E2b	101,433	9	11,270	£31.28	
E2c	101,433	9	11,270	£31.28	
E3	101,433	9	11,270	£31.28	
E4	101,433	9	11,270	£31.28	
E5a	101,433	9	11,270	£31.28	
E5b	101,433	9	11,270	£31.28	

IVC

Option	tpa	#	tpa per #	OPEX	CAPEX
M1a	42,249	1	42,249	£20.00	£100.00
M1b	42,282	1	42,282	£20.00	£100.00
M1c	45,399	1	45,399	£19.00	£98.00
M1d	45,399	1	45,399	£19.00	£98.00
M2a	34,836	1	34,836	£22.00	£105.00
M2b	34,836	1	34,836	£22.00	£105.00
M2c	34,836	1	34,836	£22.00	£105.00
M3a	34,836	1	34,836	£22.00	£105.00
M4	34,836	1	34,836	£22.00	£105.00
M5a	34,836	1	34,836	£22.00	£105.00
M5b	34,836	1	34,836	£22.00	£105.00
E1a	45,399	1	45,399	£19.00	£98.00
E1b	45,399	1	45,399	£19.00	£98.00
E1c	45,399	1	45,399	£19.00	£98.00
E1d	45,399	1	45,399	£19.00	£98.00
E2a	34,836	1	34,836	£22.00	£105.00
E2b	34,836	1	34,836	£22.00	£105.00
E2c	34,836	1	34,836	£22.00	£105.00
E3a	34,836	1	34,836	£22.00	£105.00
E4	34,836	1	34,836	£22.00	£105.00
E5a	34,836	1	34,836	£22.00	£105.00
E5b	34,836	1	34,836	£22.00	£105.00

Notes: '#' indicates the number of facilities needeed.
'tpa' indicates the tonnage per annum needing to be treated by the technology/ facility. Thus 'tpa per #' indicates the tonnage throughput (per annum in each facility)

CAPEX and OPEX assumptions for MKC

MBT					
Option	tpa	#	tpa per #	OPEX	CAPEX
M1a	95,379	1	95,379	£35.00	£160.00
M1c	114,551	1	114,551	£30.00	£155.00
M1b	95,793	1	95,793	£35.00	£160.00
M1d	95,379	1	95,379	£35.00	£160.00
E1a	114,551	1	114,551	£30.00	£155.00
E1b	114,551	1	114,551	£30.00	£155.00
E1c	114,551	1	114,551	£30.00	£155.00
E1d	114,551	1	114,551	£30.00	£155.00

ATT					
Option	tpa	#	tpa per #	OPEX	CAPEX
M2a	42,118	1	42,118	£60.00	£425.00
M1a	47,308	1	47,308	£55.00	£403.00
E2a	43,987	1	43,987	£55.00	£409.00
E1a	56,817	1	56,817	£50.00	£374.00
M3a	81,110	1	81,110	£45.00	£322.00
M3b	81,110	2	40,555	£60.00	£425.00
M5a	68,845	1	68,845	£45.00	£348.00
E5a	68,845	1	68,845	£45.00	£348.00
E3a	88,457	1	88,457	£45.00	£319.00
E3b	88,457	2	44,228	£55.00	£409.00

MT & AD					
Option	tpa	#	tpa per #	OPEX	CAPEX
M2a	109,682	1	109,682	£32.00	£190.00
M2b	114,551	1	114,551	£32.00	£190.00
E2a	114,551	1	114,551	£32.00	£190.00
E2b	114,551	1	114,551	£32.00	£190.00

AC					
Option	tpa	#	tpa per #	OPEX	CAPEX
M5a	101,674	1	101,674	£18.00	£182.00
E5a	101,674	1	101,674	£18.00	£182.00
M5b	101,674	1	101,674	£18.00	£182.00
E5b	101,674	1	101,674	£18.00	£182.00

EfW (fluid)					
Option	tpa	#	tpa per #	OPEX	CAPEX
M1b	47,513	1	47,513	£45.00	£403.00
E1b	56,817	1	56,817	£40.00	£374.00

EfW					
Option	tpa	#	tpa per #	OPEX	CAPEX
M4	90,488	1	90,488	£21.00	£324.00
E4	100,658	1	100,658	£20.00	£304.00

MRF					
Option	tpa	#	tpa per #	OPEX	CAPEX
M1a	41,268	1	41,268	£40.00	£100.00
M1b	41,268	1	41,268	£40.00	£100.00
M1c	41,268	1	41,268	£40.00	£100.00
M1d	41,268	1	41,268	£40.00	£100.00
M2a	41,268	1	41,268	£40.00	£100.00
M2b	41,268	1	41,268	£40.00	£100.00
M2c	41,268	1	41,268	£40.00	£100.00
M3a	41,268	1	41,268	£40.00	£100.00
M4	41,268	1	41,268	£40.00	£100.00
M5a	41,268	1	41,268	£40.00	£100.00
M5b	41,268	1	41,268	£40.00	£100.00
E1a	41,268	1	41,268	£40.00	£100.00
E1b	41,268	1	41,268	£40.00	£100.00
E1c	41,268	1	41,268	£40.00	£100.00
E1d	41,268	1	41,268	£40.00	£100.00
E2a	41,268	1	41,268	£40.00	£100.00
E2b	41,268	1	41,268	£40.00	£100.00
E2c	41,268	1	41,268	£40.00	£100.00
E3a	41,268	1	41,268	£40.00	£100.00
E4	41,268	1	41,268	£40.00	£100.00
E5a	41,268	1	41,268	£40.00	£100.00
E5b	41,268	1	41,268	£40.00	£100.00

GWC					
Option	tpa	#	tpa per #	OPEX	CAPEX
M1a	12,385	1	12,385	£15.00	£35.00
M1b	12,385	1	12,385	£15.00	£35.00
M1c	12,385	1	12,385	£15.00	£35.00
M1d	12,385	1	12,385	£15.00	£35.00
M2a	12,385	1	12,385	£15.00	£35.00
M2b	12,385	1	12,385	£15.00	£35.00
M2c	12,385	1	12,385	£15.00	£35.00
M3	12,385	1	12,385	£15.00	£35.00
M4	12,385	1	12,385	£15.00	£35.00
M5a	12,385	1	12,385	£15.00	£35.00
M5b	12,385	1	12,385	£15.00	£35.00
E1a	12,385	1	12,385	£15.00	£35.00
E1b	12,385	1	12,385	£15.00	£35.00
E1c	12,385	1	12,385	£15.00	£35.00
E1d	12,385	1	12,385	£15.00	£35.00
E2a	12,385	1	12,385	£15.00	£35.00
E2b	12,385	1	12,385	£15.00	£35.00
E2c	12,385	1	12,385	£15.00	£35.00
E3	12,385	1	12,385	£15.00	£35.00
E4	12,385	1	12,385	£15.00	£35.00
E5a	12,385	1	12,385	£15.00	£35.00
E5b	12,385	1	12,385	£15.00	£35.00

Baling/ WTS					
Option	tpa	#	tpa per #	OPEX	CAPEX
M1a	12,267	1	12,267	£10.21	
M1b	12,267	1	12,267	£10.21	
M1c	12,267	1	12,267	£10.21	
M1d	12,267	1	12,267	£10.21	
M2a	12,267	1	12,267	£10.21	
M2b	12,267	1	12,267	£10.21	
M2c	12,267	1	12,267	£10.21	
M3a	12,267	1	12,267	£10.21	
M4	12,267	1	12,267	£10.21	
M5a	12,267	1	12,267	£10.21	
M5b	12,267	1	12,267	£10.21	
E1a	12,267	1	12,267	£10.21	
E1b	12,267	1	12,267	£10.21	
E1c	12,267	1	12,267	£10.21	
E1d	12,267	1	12,267	£10.21	
E2a	12,267	1	12,267	£10.21	
E2b	12,267	1	12,267	£10.21	
E2c	12,267	1	12,267	£10.21	
E3a	12,267	1	12,267	£10.21	
E4	12,267	1	12,267	£10.21	
E5a	12,267	1	12,267	£10.21	
E5b	12,267	1	12,267	£10.21	

HWRCs					
Option	tpa	#	tpa per #	OPEX	CAPEX
M1a	49,146	3	16,382	£31.28	
M1b	49,146	3	16,382	£31.28	
M1c	49,146	3	16,382	£31.28	
M1d	49,146	3	16,382	£31.28	
M2a	49,146	3	16,382	£31.28	
M2b	49,146	3	16,382	£31.28	
M2c	49,146	3	16,382	£31.28	
M3	49,146	3	16,382	£31.28	
M4	49,146	3	16,382	£31.28	
M5a	49,146	3	16,382	£31.28	
M5b	49,146	3	16,382	£31.28	
E1a	49,146	3	16,382	£31.28	
E1b	49,146	3	16,382	£31.28	
E1c	49,146	3	16,382	£31.28	
E1d	49,146	3	16,382	£31.28	
E2a	49,146	3	16,382	£31.28	
E2b	49,146	3	16,382	£31.28	
E2c	49,146	3	16,382	£31.28	
E3	49,146	3	16,382	£31.28	
E4	49,146	3	16,382	£31.28	
E5a	49,146	3	16,382	£31.28	
E5b	49,146	3	16,382	£31.28	

IVC					
Option	tpa	#	tpa per #	OPEX	CAPEX
M1a	34,655	1	34,655	£22.00	£100.00
M1b	34,685	1	34,685	£22.00	£100.00
M1c	36,035	1	36,035	£22.00	£100.00
M1d	36,035	1	36,035	£22.00	£100.00
M2a	34,836	1	34,836	£22.00	£100.00
M2b	34,836	1	34,836	£22.00	£100.00
M2c	34,836	1	34,836	£22.00	£100.00
M3a	34,836	1	34,836	£22.00	£100.00
M4	34,836	1	34,836	£22.00	£100.00
M5a	34,836	1	34,836	£22.00	£100.00
M5b	34,836	1	34,836	£22.00	£100.00
E1a	36,035	1	36,035	£22.00	£100.00
E1b	36,035	1	36,035	£22.00	£100.00
E1c	36,035	1	36,035	£22.00	£100.00
E1d	36,035	1	36,035	£22.00	£100.00
E2a	34,836	1	34,836	£22.00	£100.00
E2b	34,836	1	34,836	£22.00	£100.00
E2c	34,836	1	34,836	£22.00	£100.00
E3a	34,836	1	34,836	£22.00	£100.00
E4	34,836	1	34,836	£22.00	£100.00
E5a	34,836	1	34,836	£22.00	£100.00
E5b	34,836	1	34,836	£22.00	£100.00

Notes: '#' indicates the number of facilities needeed.
'tpa' indicates the tonnage per annum needing to be treated by the technology/ facility. Thus 'tpa per #' indicates the tonnage throughput (per annum in each facility)
The 'HWRCs' for Milton Keynes specifically refer to Community Recycling Centres (CRCs).

CAPEX and OPEX Assumptions for BCC & MKC

MBT					
Option	tpa	#	tpa per #	OPEX	CAPEX
M1a	200,082	2	100,041	£33.00	£157.50
M1c	261,264	2	130,632	£25.00	£150.00
M1b	200,965	2	100,482	£33.00	£157.50
M1d	200,082	2	100,041	£33.00	£157.50
E1a	261,264	2	130,632	£25.00	£150.00
E1b	261,264	2	130,632	£25.00	£150.00
E1c	261,264	2	130,632	£25.00	£150.00
E1d	261,264	2	130,632	£25.00	£150.00

ATT					
Option	tpa	#	tpa per #	OPEX	CAPEX
M2a	86,680	1	86,680	£45.00	£321.00
M1a	99,240	1	99,240	£40.00	£306.00
E2a	100,325	1	100,325	£40.00	£306.00
E1a	129,587	1	129,587	£35.00	£278.00
M3a	167,423	1	167,423	£35.00	£253.00
M3b	167,423	3	55,808	£50.00	£374.00
M5a	150,266	1	150,266	£35.00	£258.00
E5a	159,687	1	159,687	£35.00	£258.00
E3a	205,178	2	102,589	£40.00	£306.00
E3b	205,178	4	51,294	£50.00	£388.00

MT & AD					
Option	tpa	#	tpa per #	OPEX	CAPEX
M2a	225,728	2	112,864	£32.00	£190.00
M2b	261,264	2	130,632	£21.00	£185.00
M2c	225,728	2	112,864	£32.00	£190.00
E2a	261,264	2	130,632	£31.00	£185.00
E2b	261,264	2	130,632	£31.00	£185.00
E2c	261,264	2	130,632	£31.00	£185.00

AC					
Option	tpa	#	tpa per #	OPEX	CAPEX
M5a	221,923	2	110,961	£17.00	£151.00
E5a	235,836	2	117,918	£17.00	£151.00
M5b	235,836	2	117,918	£16.00	£129.00
E5b	235,836	2	117,918	£17.00	£151.00

EfW (fluid)					
Option	tpa	#	tpa per #	OPEX	CAPEX
M1b	99,679	1	99,679	£35.00	£305.00
E1b	129,587	1	129,587	£35.00	£278.00

EfW					
Option	tpa	#	tpa per #	OPEX	CAPEX
M4	186,781	1	186,781	£16.00	£244.00
E4	233,478	1	233,478	£15.00	£225.00

MRF					
Option	tpa	#	tpa per #	OPEX	CAPEX
M1a	99,278	2	49,639	£50.00	£100.00
M1b	99,278	2	49,639	£50.00	£100.00
M1c	99,278	2	49,639	£50.00	£100.00
M1d	99,278	2	49,639	£50.00	£100.00
M2a	99,278	2	49,639	£50.00	£100.00
M2b	99,278	2	49,639	£50.00	£100.00
M2c	99,278	2	49,639	£50.00	£100.00
M3a	99,278	2	49,639	£50.00	£100.00
M4	99,278	2	49,639	£50.00	£100.00
M5a	99,278	2	49,639	£50.00	£100.00
M5b	99,278	2	49,639	£50.00	£100.00
E1a	99,278	2	49,639	£50.00	£100.00
E1b	99,278	2	49,639	£50.00	£100.00
E1c	99,278	2	49,639	£50.00	£100.00
E1d	99,278	2	49,639	£50.00	£100.00
E2a	99,278	2	49,639	£50.00	£100.00
E2b	99,278	2	49,639	£50.00	£100.00
E2c	99,278	2	49,639	£50.00	£100.00
E3a	99,278	2	49,639	£50.00	£100.00
E4	99,278	2	49,639	£50.00	£100.00
E5a	99,278	2	49,639	£50.00	£100.00
E5b	99,278	2	49,639	£50.00	£100.00

GWC					
Option	tpa	#	tpa per #	OPEX	CAPEX
M1a	37,667	2	18,834	£15.00	£35.00
M1b	37,667	2	18,834	£15.00	£35.00
M1c	37,667	2	18,834	£15.00	£35.00
M1d	37,667	2	18,834	£15.00	£35.00
M2a	37,667	2	18,834	£15.00	£35.00
M2b	37,667	2	18,834	£15.00	£35.00
M2c	37,667	2	18,834	£15.00	£35.00
M3	37,667	2	18,834	£15.00	£35.00
M4	37,667	2	18,834	£15.00	£35.00
M5a	37,667	2	18,834	£15.00	£35.00
M5b	37,667	2	18,834	£15.00	£35.00
E1a	37,667	2	18,834	£15.00	£35.00
E1b	37,667	2	18,834	£15.00	£35.00
E1c	37,667	2	18,834	£15.00	£35.00
E1d	37,667	2	18,834	£15.00	£35.00
E2a	37,667	2	18,834	£15.00	£35.00
E2b	37,667	2	18,834	£15.00	£35.00
E2c	37,667	2	18,834	£15.00	£35.00
E3	37,667	2	18,834	£15.00	£35.00
E4	37,667	2	18,834	£15.00	£35.00
E5a	37,667	2	18,834	£15.00	£35.00
E5b	37,667	2	18,834	£15.00	£35.00

Baling/ WTS					
Option	tpa	#	tpa per #	OPEX	CAPEX
M1a	33,479	1	33,479	£10.21	
M1b	33,479	1	33,479	£10.21	
M1c	33,479	1	33,479	£10.21	
M1d	33,479	1	33,479	£10.21	
M2a	33,479	1	33,479	£10.21	
M2b	33,479	1	33,479	£10.21	
M2c	33,479	1	33,479	£10.21	
M3a	33,479	1	33,479	£10.21	
M4	33,479	1	33,479	£10.21	
M5a	33,479	1	33,479	£10.21	
M5b	33,479	1	33,479	£10.21	
E1a	33,479	1	33,479	£10.21	
E1b	33,479	1	33,479	£10.21	
E1c	33,479	1	33,479	£10.21	
E1d	33,479	1	33,479	£10.21	
E2a	33,479	1	33,479	£10.21	
E2b	33,479	1	33,479	£10.21	
E2c	33,479	1	33,479	£10.21	
E3a	33,479	1	33,479	£10.21	
E4	33,479	1	33,479	£10.21	
E5a	33,479	1	33,479	£10.21	
E5b	33,479	1	33,479	£10.21	

HWRCs					
Option	tpa	#	tpa per #	OPEX	CAPEX
M1a	150,579	12	12,548	£31.28	
M1b	150,579	12	12,548	£31.28	
M1c	150,579	12	12,548	£31.28	
M1d	150,579	12	12,548	£31.28	
M2a	150,579	12	12,548	£31.28	
M2b	150,579	12	12,548	£31.28	
M2c	150,579	12	12,548	£31.28	
M3	150,579	12	12,548	£31.28	
M4	150,579	12	12,548	£31.28	
M5a	150,579	12	12,548	£31.28	
M5b	150,579	12	12,548	£31.28	
E1a	150,579	12	12,548	£31.28	
E1b	150,579	12	12,548	£31.28	
E1c	150,579	12	12,548	£31.28	
E1d	150,579	12	12,548	£31.28	
E2a	150,579	12	12,548	£31.28	
E2b	150,579	12	12,548	£31.28	
E2c	150,579	12	12,548	£31.28	
E3	150,579	12	12,548	£31.28	
E4	150,579	12	12,548	£31.28	
E5a	150,579	12	12,548	£31.28	
E5b	150,579	12	12,548	£31.28	

IVC					
Option	tpa	#	tpa per #	OPEX	CAPEX
M1a	77,029	2	38,515	£20.00	£100.00
M1b	77,093	2	38,547	£20.00	£100.00
M1c	81,435	2	40,717	£20.00	£100.00
M1d	81,435	2	40,717	£20.00	£100.00
M2a	34,836	1	34,836	£22.00	£100.00
M2b	34,836	1	34,836	£22.00	£100.00
M2c	34,836	1	34,836	£22.00	£100.00
M3a	34,836	1	34,836	£22.00	£100.00
M4	34,836	1	34,836	£22.00	£100.00
M5a	34,836	1	34,836	£22.00	£100.00
M5b	34,836	1	34,836	£22.00	£100.00
E1a	81,435	2	40,717	£20.00	£100.00
E1b	81,435	2	40,717	£20.00	£100.00
E1c	81,435	2	40,717	£20.00	£100.00
E1d	81,435	2	40,717	£20.00	£100.00
E2a	34,836	1	34,836	£22.00	£100.00
E2b	34,836	1	34,836	£22.00	£100.00
E2c	34,836	1	34,836	£22.00	£100.00
E3a	34,836	1	34,836	£22.00	£100.00
E4	34,836	1	34,836	£22.00	£100.00
E5a	34,836	1	34,836	£22.00	£100.00
E5b	34,836	1	34,836	£22.00	£100.00

Notes: '#' indicates the number of facilities needeed.
'tpa' indicates the tonnage per annum needing to be treated by the technology/ facility. Thus 'tpa per #' indicates the tonnage throughput (per annum in each facility)

Pre-Residual Treatment Technologies

As indicated in Appendix VI, a number of facilities will be required to treat materials recovered from the kerbside, from bring banks and from HWRCs/ CRCs.

It has been assumed that these facilities will, on the whole, be financed through the contract. This is certainly the case for BCC, whereby the size of facility and the CAPEX costs associated with the necessary facility size, as shown in the CAPEX and OPEX assumptions detailed above, have determined the CAPEX necessary. MKC indicated in correspondence the following infrastructure assumptions:

- Bulky MRF, £2 million, contract to finance
- Food Waste composter i.e. IVC, £2.5 million, contract to finance
- MRF major upgrade, £2 million, MKC to finance
- Transfer Station, £1 million, MKC to finance
- CRC major upgrade, £1 million, MKC to finance
- Food waste containers, £1.2 million, MKC to finance.

The two elements that MKC would like to form part of the contract have been included in the determination of NPV as a fixed sum, rather than in calculating a total CAPEX based on tonnage throughput. The CAPEX is assumed to be payable (i.e. the facility constructed) in contract year 2 and 3.

Facility Sizing

Facilities have been sized according to those facilities/ technologies currently operational, or nearing the market (as proposed by bidders). A number of the technologies can be modular, for example, MBT, MT & AD, and ATT, where a number of modules may make up one facility i.e. at one site. ATT modules for example, vary from 30,000 tonne to 60,000 tonne throughputs. The CAPEX and OPEX assumptions have taken into account the modularity of certain technologies and the number required for BCC, MKC or BCC & MKC.

For BCC we have assumed one facility for each technology option. This does, however, take account of the fact that there may be more than one module operating at a single site. There are economies of scale in operating a number of modules at one site, keeping CAPEX and OPEX costs to a minimum and also in minimising planning and delivery risks. We have assumed two GWC facilities and one MRF.

For MKC we have also assumed one facility for each technology option. We have assumed one GWC facility and one MRF.

For BCC & MKC the tonnage throughput at facilities has increased and thus it was necessary for more than one facility to be constructed, this may or may not be at the same site, and would be dependent on factors and decisions beyond the remit of this report. As the table above indicates, two MBT facilities are necessary for all M1 and E1 options. Two ATT facilities were necessary under option E3. Two MT facilities are necessary for all M2 and E2 options. Two AC facilities are deemed necessary for all M5 and E5 options. Two MRFs were modelled.

In summary the facility sizes shown in the Table below were assumed.

Facility	One	Two or more	Typical module size
MRF	0 to < 60,000	60,000 to 120,000	
IVC	0 to < 40,000	40,000 to 80,000	
GWC	0 to < 15,000	15,000 to 30,000	
MBT	0 to < 120,000	120,000 to 240,000	60,000
MT (& AD)	0 to < 120,000	120,000 to 240,000	60,000
ATT	0 to < 180,000	>180,000	30,000 to 60,000
EfW (inc FBG)	0 to < 500,000	> 500,000	

RDF being processed at third party facilities was assumed to attract a gate fee of the OPEX at an appropriately sized ATT facility plus 15%, which reflects the premium that would likely be placed on the Council(s) for such an outlet.

Landfill Operating Costs

The OPEX of landfill used are described in the table below.

Landfill type	Cost element	BCC	MKC	BCC & MKC
MSW landfill	Tax	£24.00	£24.00	£24.00
	Haulage	£10.21	£10.21	£10.21
	Gate Fee	£15.11	£13.06	£14.70
Hazardous landfill	Tax	£24.00	£24.00	£24.00
	Haulage	£10.21	£10.21	£10.21
	Gate Fee	£70.00	£70.00	£70.00

Notes: Haulage costs to landfill were derived from data supplied by BCC on current arrangements, this was deemed suitable to be applied to both BCC and MKC waste.
Hazardous waste gate fees were supplied by MKC, and applied to BCC in addition.
MSW landfill gate fees were supplied by BCC and by MKC, and averaged in each case.

The Landfill Tax is subject to a standard escalator until the year 2004/5, at which point it will be £15 per tonne for non-inert waste i.e. MSW. The £24 per tonne indicated in the table is for contract year one i.e. 2007/8. A continued rise at £3 per year is assumed for the period 2007 to 2011/12 when it will reach the £35 per tonne indicated by DEFRA. From there on it is assumed to rise at the rate of inflation.

Landfill operating costs (gate fees) are increased by 1% above RPI i.e. 3.5%. The medium to long-term projection is that gate fees will naturally rise, due to the combined effects of:

- Regulatory compliance: increased reporting and monitoring requirements from the Environment Agency. Effects of the Landfill Directive (site conditioning plans etc)
- Environmental protection: higher engineering standards in site preparation and completion. Landfill Directive requires all landfills to be fitted with methane recovery systems.
- Supply and demand: a long-term decline in consented void space for non-inert waste leading to increased prices.

Haulage costs to take waste to landfill are not assumed to inflate above RPI. This is likely to underestimate the effects of increasing haulage distance, as local landfill void space depletes and other sites have to be utilized, and higher wages and tariffs.

Revenues applied to technologies

The following revenues were used in the Jacobs Babtie financial modelling.

Revenue (£/t)	KWh/ t	£/t
AD energy revenue (per tonne)	68 kWh	3.40
ATT energy revenue (per tonne) RDF feedstock	475 kWh	23.75
ATT energy revenue (per tonne) MSW feedstock	300 kWh	15.00
EfW (fluid) energy revenue (per tonne)	445 kWh	11.13
EfW energy revenue (per tonne)	500 kWh	12.50
LATS Permit		30.00

We have used a conservative estimate on revenues, avoiding reliance on uncertain revenue income in most cases. Thus the only incomes assumed are for energy income and the sale of landfill permits (under the LATS).

As per guidance from the Public Private Partnership Program (4Ps), a permit price of £30 per tonne has been assumed, though sensitivity tests were conducted at £40 and £70 per tonne for options landfilling RDF.[6] This served to illustrate the need to treat RDF. The cost of permits is unknown, and estimates have been conjectured by various consultancies and organisations suggesting this may well be a lower limit. Estimating how the cost of a permit may change over time is extremely difficult to predict, and dependent on a multitude of factors. Thus the cost has been assumed to be standard throughout the duration of the contract rising only at the rate of inflation (2.5%).

Revenues from electricity production have been calculated using a number of sources, as detailed below.

The energy produced from advanced thermal treatment under options 1 and 2, where the feedstock is an RDF, was determined from figures supplied by Compact Power (pyrolysis process) to the Environment Agency, which is published in the Waste Technologies Data Centre. These numbers were corroborated with those supplied in the CIWM report *"Energy from Waste: A Good Practice Guide."* The indications are that RDF fed ATT achieves 475 kWh per tonne. This is sold at approximately £0.05 per kWh (£0.025 industry standard base electricity price + £0.025 from the sale of ROCs (Renewable Obligation Certificates)).

The energy produced from anaerobic digestion under option 2 was determined from figures from Hese Umwelt GmbH, suppliers of anaerobic digestion facilities, such as that being constructed as part of the Leicestershire PFI. They indicate that AD produces biogas, 90% of which is passed through the generators, and 35% of that is converted to electrical energy. This achieves approximately 68 kWh per tonne, which is assumed to attract a revenue of £0.05 per kWh (as for ATT above).

[6] As agreed by MKC and BCC in the meeting of 23/11/04

The energy produced from advanced thermal treatment under option 3, where the feedstock is MSW, was determined from figures supplied by Wastegen (pyrolysis process) to the Environment Agency, which is published in the Waste Technologies Data Centre. These numbers were corroborated with those supplied in the CIWM report, *"Energy from Waste: A Good Practice Guide."* The indications are that MSW fed ATT achieves 300 kWh per tonne. This is sold at approximately £0.05 per kWh (£0.025 industry standard base electricity price + £0.025 from the sale of ROCs (Renewable Obligation Certificates)).

The energy produced from a standard EfW plant under option 4 was determined using data from the CIWM report, *"Energy from Waste: A Good Practice Guide,"* and corroborated with data from the Environment Agency's Waste Technologies Data Centre. It was also cross-referenced with data held by Jacobs Babtie on the performance of EfW plants in the UK. It was determined that the industry standard 500 kWh per tonne would be used, generating a revenue of £0.025 per kWh. This energy is not currently ROCs eligible.

Under each scenario there is a CAPEX assumption that full scale facilities would be commissioned from the outset, as such a spare capacity would exist at certain facilities, which would diminish as the throughput from the contract increases. This spare capacity would no doubt be 'sold' to a third party, thereby off-setting the gate fee to. 80% of spare capacity was determined appropriate to be usable for third parties. Jacobs Babtie determined that the most sensible way to determine the revenue potential is to assume a net third party revenue of 15% of OPEX. Therefore under each scenario and for each contract year the available third party capacity was calculated, this tonnage was multiplied by 15% of OPEX plus OPEX.

Appendix X: Cost of Landfill

The total NPV costs of landfill (£ million) for each technology option for BCC, MKC and BCC & MKC are described in the table below. This also serves to illustrate that the cost of landfill under the Do Minimum option is both prohibitive and serves to underline the undesirability of a landfill only strategy.

BCC	TECHNOLOGY OPTION	Landfill £m NPV	MKC	TECHNOLOGY OPTION	Landfill £m NPV	BCC & MKC	TECHNOLOGY OPTION	Landfill £m NPV
DO-MIN	NONE	234	DO-MIN	NONE	158	DO-MIN	NONE	395
E1a	MBT + ATT + IVC	96	E1a	MBT + ATT + IVC	65	E1a	MBT + ATT + IVC	130
E1b	MBT + FBG + IVC	105	E1b	MBT + FBG + IVC	71	E1b	MBT + FBG + IVC	145
E1c	MBT + IVC + Lf	169	E1c	MBT + IVC + Lf	114	E1c	MBT + IVC + Lf	253
E1d	MBT + IVC + RDF to 3rd party	77	E1d	MBT + IVC + RDF to 3rd party	52	E1d	MBT + IVC + RDF to 3rd party	99
E2a	MT + ATT + AD	136	E2a	MT + ATT + AD	92	E2a	MT + ATT + AD	198
E2b	MT + AD + Lf	193	E2b	MT + AD + Lf	83	E2b	MT + AD + Lf	294
E2c	MT + AD + RDF to 3rd party	122	E2c	MT + AD + RDF to 3rd party	83	E2c	MT + AD + RDF to 3rd party	183
E3a	ATT	93	E3a	ATT	62	E3a	ATT	97
E3b	ATT (Multi)	93	E3b	ATT (Multi)	62	E3b	ATT (Multi)	97
E4	EfW	85	E4	EfW	63	E4	EfW	83
E5a	AC + ATT	116	E5a	AC + ATT	81	E5a	AC + ATT	135
E5b	AC + Lf	208	E5b	AC + Lf	141	E5b	AC + Lf	288
M1a	MBT + ATT + IVC	152	M1a	MBT + ATT + IVC	89	M1a	MBT + ATT + IVC	180
M1b	MBT + FBG + IVC	159	M1b	MBT + FBG + IVC	93	M1b	MBT + FBG + IVC	189
M1c	MBT + IVC + Lf	177	M1c	MBT + IVC + Lf	115	M1c	MBT + IVC + Lf	262
M1d	MBT + IVC + RDF to 3rd party	144	M1d	MBT + IVC + RDF to 3rd party	115	M1d	MBT + IVC + RDF to 3rd party	160
M2a	MT + ATT + AD	170	M2a	MT + ATT + AD	102	M2a	MT + ATT + AD	210
M2b	MT + AD + Lf	198	M2b	MT + AD + Lf	131	M2b	MT + AD + Lf	298
M2c	MT + AD + RDF to 3rd party	160	M2c	MT + AD + RDF to 3rd party	135	M2c	MT + AD + RDF to 3rd party	193
M3a	ATT	149	M3a	ATT	80	M3a	ATT	170
M3b	ATT (Multi)	149	M3b	ATT (Multi)	80	M3b	ATT (Multi)	170
M4	EfW	146	M4	EfW	82	M4	EfW	164
M5a	AC + ATT	135	M5a	AC + ATT	88	M5a	AC + ATT	175
E5b	AC + Lf	208	E5b	AC + Lf	141	E5b	AC + Lf	288

Appendix XI: Glossary of Terms

4Ps – Public Private Partnership Program
4ps is the local government procurement expert, providing advice, guidance and skills development to local authorities undertaking projects, procurement and partnerships. This includes private finance initiative (PFI) schemes, strategic service partnerships and all other forms of partnership working.

AC – Autoclave
These are pressure vessels that are similar to those used in hospitals to sterilise surgical instruments but are much larger and have unique patented characteristics. Unsorted household bagged waste is introduced directly into the vessels and steam and pressure is applied at over 140 degrees centigrade. A combination of the steam pressure, the rotation of the vessels and the internal helices results in the organic fraction of the waste being broken down into a fibrous lignocellulosic biomass; and the inorganics being sterilised and steam cleaned.

ABPR - Animal By-Products Regulations
The objective of these regulations is to ensure that all meat and other products of animal origin which are treated by composting or biogas digestion meet the treatment standards required, to ensure sufficient pathogen removal so that the treated material may be safely applied to land.

AD – Anaerobic Digestion
Residual waste is initially through an integrated **Mechanical Treatment** system as described above. The waste derived compostable organics are treated in an Anaerobic Digestion facility, which is part of the integrated system with the mechanical treatment. Biodegradable material is encouraged to break down in the absence of oxygen. Material is placed into an enclosed vessel and in controlled conditions the waste breaks down. This produces a waste derived (digestate) compost suitable for land spreading, and a methane rich biogas which is combusted for electricity production on site. The AD process is ABPR compliant, and hence is suitable for processing non-source segregated organics.

ATT – Advanced Thermal Treatment (pyrolysis and gasification)
A generic term for a group of technologies that degrade waste by gasification, pyrolysis or a combination of the two.

BMW – Biodegradable Municipal Waste
The EC Landfill Directive itself defines biodegradable waste as "any waste that is capable of undergoing anaerobic or aerobic decomposition" [Article 2(1)]. The House of Lords in its report *Sustainable Landfill* has noted that this definition is inadequate since it omits any reference to time. It therefore recommended that biodegradable waste should be defined in terms of its ability to degrade completely within the aftercare period set out in the Directive "for leaving the site in an environmentally benign state". That period is now given as 30 years (Common Position, European Environment Council, 23 March 1998).

BPEO – Best Practicable Environmental Option
The BPEO is the option that provides the most benefits or least damage to the environment as a whole, at acceptable cost, over the longer term as well as the short term. It is the outcome of a "systematic and consultative decision making procedure which emphasises the protection of the environment across land, air and water" (12th Report of the Royal Commission on Environmental Pollution, 1988).

BVPI - Best Value Performance Indicator
Places a duty on local authorities to deliver services (including waste collection and waste disposal management) to clear standards – covering both cost and quality – by the most effective, economic and efficient means available.

CAPEX – Capital Costs
The capital expenditure costs needed to deliver a facility/ technology

CIWM - Chartered Institution of Waste Management

CRC – Community Recycling Centre
Traditionally referred to as a Civic Amenity Site. Milton Keynes use this term to describe a Household Waste Recycling Centre.

DEFRA – Department of the Environment, Food and Rural Affairs

EfW – Energy from Waste
Energy from waste is the application of a sound proven combustion engineering principles to a variety of technologies which reduce the volume and quantity, and sanitise the municipal waste fraction, after recycling and composting has taken place, in order to recover energy from the input material.

There are a variety of different technologies, for example, moving grate and mass burn, which can produce energy from waste by burning mixed MSW material, after an initial screening/ sorting process which remove large and oversize contraries. Metals are extracted after combustion has taken place, and bottom ash produced can be used as an aggregate. Fly ash produced is deemed hazardous, and whilst some markets exist for its use, it is generally landfilled.

FBG – Fluidised Bed Gasifier (Energy from Waste technology)
Method of incineration in which combustion takes place on a fire bed composed of inert particles such as sand or ash. When air is blown through the bed, the material behaves as a fluid. This form of gasification is particularly suited to RDF input.

GWC – Green Waste Composting
An organic material produced through the decomposition of garden and kitchen waste.

HWRC – Household Waste Recycling Centre
Facilities provided by Buckinghamshire County Council for the disposal of waste that is usually excluded from the regular household waste collection service (Civic Amenity Waste). Milton Keynes call them Community Recycling Centres.

IVC – In-vessel Composting
The IVC systems are enclosed and so are able to compost a wider variety of waste due to increased control over environmental conditions and pests. This approach allows some kitchen waste and other putrescible materials to be composted into a good soil conditioner.

LATS – Landfill Allowance Trading Scheme
Article 5(2) of the EC Landfill Directive requires the UK to reduce the amount of biodegradable municipal waste it sends to landfill, in order to prevent or reduce as far as possible the negative effects of landfilling waste on the environment and human health.
The Government has already consulted twice on how to meet this obligation and the option preferred by respondents was a tradable landfill permit scheme (now known as allowances). The resultant Landfill Allowance Trading Scheme (LATS) is a means to achieve the Directive targets rather than the instrument that imposes those targets. The Landfill (Scheme Year and Maximum Landfill Amount) Regulations 2004 are a daughter of the Waste and Emissions Trading Act 2003, which ratifies the EC Landfill Directive.

Lf – Landfill
The engineered deposit of waste into or onto land.

MBT – Mechanical Biological Treatment
A treatment process dealing with residual waste after most recyclable materials have been removed (at an MRF or through kerbside collection). The residual waste is then mechanically sorted to produce three main fractions recyclable materials (mainly metals), organic material suitable for composting and materials suitable for use as refuse-derived fuel (RDF). The result is a major reduction in waste needing to be sent to landfill and energy recovery via the incineration of RDF.

MRF – Materials Recycling Facility

A factory capable of processing co-mingled or source separated wastes in order to recover recyclable materials.

MT – Mechanical Treatment
Treating residual waste through a Mechanical Treatment system can

- Remove bulky objects;
- Reduce the particle sizes of the waste;
- Extract out some recyclables i.e. metals;
- Produce a refuse derived fuel for energy recovery in an ATT or FBG facility, or co-fired in an existing facility, such as a cement kiln; and,
- Produce waste derived compostable organics for treatment in the AD facility.

Residual waste is initially through an integrated mechanical treatment system as described above. The waste derived compostable organics are treated in an Anaerobic Digestion facility, which is part of the integrated system with the mechanical treatment. This produces a waste derived compost suitable for land spreading for example, and a methane rich biogas which is combusted for electricity production on site. The AD process is ABPR compliant, and hence is suitable for processing non-source segregated organics.

MSW – Municipal Solid Waste
Those wastes which are collected for treatment and disposal by a local authority. They generally comprise waste from households, civic amenity sites, street sweepings, local authority-collected commercial waste and some non-hazardous industrial waste.

ODPM – Office of the Deputy Prime Minister

OPEX – Operating Costs
The operating expenditure costs needed to operate a facility/ technology i.e. to process material.

RDF - Refuse-derived fuel
A fuel product derived from the combustible fraction of household waste.

WCA – Waste Collection Authority
A Local Authority responsible for the collection of controlled waste.

WTS – Waste Transfer Station
A site to which waste is delivered for sorting prior to transfer to another place for recycling, treatment or disposal.