

# WIDP Monte Carlo Simulation Model

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## Read Me

This sheet explains the working of the Waste Capacity Forecast Model, including the use of Monte Carlo simulation methods.  
A separate report is available which goes into greater detail.

Values in yellow are user inputs. These define the distribution of the random variables and allow entry of historical data.

Values in blue are calculations - please do not edit.

Values in pale green are links to other cells or sheets - please do not edit.

## WIDP Monte Carlo Simulation Model

### Objectives

The objective of this model is to provide WIDP with a forecast of the waste infrastructure capacity operational by 2020.

Diversion capacity is needed by 2020 in order to ensure that England meets its EU Directive target for the diversion of biodegradable municipal solid waste (BMW) from landfill.

### Methods Used

- 1 An estimate of the municipal solid waste (MSW) arising in 2020 is provided by Defra colleagues. From this, the assumed tonnage of recycling is deducted giving the residual MSW arising. The BMW % of MSW is specified. This gives the residual BMW arising. A forecast of BMW diversion capacity is then deducted from this, to give a figure for BMW consigned to landfill. This is compared to the 2020 target to give a surplus/(deficit) of diversion capacity.
- 2 An alternative method is also used to forecast surplus/(deficit) capacity. This method can be updated each year using actual outturn data. The most recent year when data is available is selected. Arisings in that year are compared to the BMW consigned to landfill to give an implied BMW diversion capacity. Diversion capacity in 2020 is calculated as implied diversion in base year + expected future additions. This is compared to forecast arisings in 2020 to calculate surplus/(deficit) capacity.

### Monte Carlo Simulation

NERA Economic Consulting were commissioned to adapt the model to allow random simulation of likely outcomes. This simulation is referred to as a "Monte Carlo" model.

Examining the result of this simulation will allow Defra to understand the probability of achieving the 2020 target, *conditional* on no further action being taken to develop infrastructure.

Random simulation of different inputs also allows Defra to examine the sensitivity of surplus/deficit capacity to certain inputs.

### Using The Model

Using the Monte Carlo features of this model requires the Excel add-in @Risk. This add-in allows the simple manipulation of random variables and simulation runs.

Using Excel 2010, @Risk appears as a separate ribbon. Toggle between static (i.e. mean) and random values by clicking the "dice" icon.

To run the model, and examine the likely values of the outputs in 2020, select a cell containing =RiskOutput() and click "Start Simulation".

To examine changes to input variables, vary the mean and range of the random variables, all highlighted in yellow.

To alter the distribution of a random variable, click it and select "Define Distribution" from the @Risk ribbon.

Different random variables are likely to be correlated, for example waste arising from households and C&I. These correlations may be varied between -1/1.

Date	Change
22/11/2012	BMW content to landfill changed from 11.38 to 12.22MT
26/11/2012	LA waste arisings forecasts updated (central = mean of model A and model B)
26/11/2012	C&I waste arisings forecasts updated
26/11/2012	Ranges for LA and C&I updated
26/11/2012	Correlation changed to zero for "arising to projects" and "projects to projects"
27/11/2012	LA ranges extended to include Model A+1s.d. and Model B-1s.d.
27/11/2012	Household recycling rate updated to reflect latest data
27/11/2012	C&I recycling rate updated to use 2009 figure of 52%
27/11/2012	Positive shocks to arisings given a probability of 20%
28/11/2012	C&I recycling rate updated to use 2010 estimate of 62%
29/11/2012	C&I min and max updated to draw from MSW% variable
29/11/2012	LA recycling rate: mean 51.4% from LAWRRD model, min and max 5% either side
29/11/2012	MSW% of industrial to 4% either side of mean
29/11/2012	MSW% of commercial to 5% either side of mean
29/11/2012	BMBT to EfW changed to 40-60%
29/11/2012	LFMBT efficiency min to 50%
29/11/2012	MT to EfW range introduced of 70-90%
29/11/2012	Outages to 100% (to avoid double counting of adjustments made elsewhere)
30/11/2012	Project inclusion switches added for 4 non-closed PFI projects
30/11/2012	Correlation assumptions changed for recycling-arising for household (15%) and C&I (35%)
05/12/2012	C&I max forecast increased to use (3,2,1) forecast
05/12/2012	Correlation assumptions changed for recycling-arising for household (0%) and C&I (0%)
05/12/2012	BMW % changed to range of 55% to 75% with mid of 68%
05/12/2012	Utilisation rates for technologies other than EfW all given max of 100% as based on throughput estimates
06/12/2012	Updated C&I forecasts to use final published OBR growth determinants (makes no difference)
07/12/2012	C&I recycling rate range increased to 8 percentage point either side of centre
10/12/2012	DARs reverted to original rates, except for operational projects which are 100% because outages are captured by utilisation rates
13/12/2012	Red DAR for merchants changed to 3%
13/12/2012	Programme level risk introduced at uniform 90-100% DAR
13/12/2012	Formula for programme level risk under method 2 amended in output sheet
14/12/2012	Distribution for BMW waste amended
21/12/2012	DAR Option changed from 5% to 0% for projects yet to close
03/01/2013	Mean, 10th percentile and 90th percentile output boxes added

changes from IMAG meeting 29/11/12

changes following Chief-Econ meet 4/12

**Modelling**

The following worksheets are used to perform the modelling.

No.	Name	Description
1	Outputs	This is where all the outputs that are affected by the Monte Carlo process are affected.
2	Inputs	This is where all the input assumptions that are randomised by the Monte Carlo process are defined.
3	Correlations	This sheet contains a covariance matrix for certain random variables which are model inputs. Please do not edit this sheet manually.
4	Empirical Correlations	This sheet contains a covariance matrix for modeled outputs. This sheet demonstrates the consequence of the input assumptions made on correlations.



**Outputs**

This sheet summarises the model's outputs. Cells in blue are all assigned a distribution by each simulation run of the model. The only user inputs on this sheet are the landfill target, which should not vary from 10.16 Mt, and the most recent financial year for which data is available in the case of Method 2. Simulation Results require the user to run a simulation using @Risk to populate the cells.

Method 1		Method 2	2011
	<i>Mt</i>		<i>Mt</i>
Waste Arising	#####	Waste Arising	#NAME?
Waste Recycled	#####	Waste Recycled	#NAME?
Residual Waste	#####	Residual Waste	#NAME?
Residual BMW	#####	Residual BMW	#NAME?
Landfill Target	10.16	Landfill Target	10.16
Diversion Capacity	#####	Diversion Capacity	#NAME?
BMW to Landfill	#####	BMW to Landfill	#NAME?
Surplus/(deficit) capacity	#####	Surplus/(deficit) capacity	#NAME?

**Simulation Results for Surplus/(Deficit) Capacity**

Mean	#####	Mean	#####
Maximum	#####	Maximum	#NAME?
Minimum	#####	Minimum	#NAME?
Standard Deviation	#####	Standard Deviation	#NAME?
Probability of hitting target	#####	Probability of hitting target	#####

Mean	<i>Mt</i>		
Waste Arising	#NAME?	Mean Waste Arising	#NAME?
Waste Recycled	#NAME?	Mean Waste Recycled	#NAME?
Residual Waste	#NAME?	Mean Residual Waste	#NAME?
Residual BMW	#NAME?	Mean Residual BMW	#NAME?
Landfill Target	#NAME?	Landfill Target	#NAME?
Diversion Capacity	#NAME?	Mean Diversion Capacity	#NAME?
BMW to Landfill	#NAME?	Mean BMW to Landfill	#NAME?
Surplus/(deficit) capacity	#NAME?	Mean Surplus/(deficit) capacity	#NAME?
90th Percentile	<i>Mt</i>		
Waste Arising	#NAME?	Waste Arising	#NAME?
Waste Recycled	#NAME?	Waste Recycled	#NAME?
Residual Waste	#NAME?	Residual Waste	#NAME?
Residual BMW	#NAME?	Residual BMW	#NAME?
Landfill Target	#NAME?	Landfill Target	#NAME?
Diversion Capacity	#NAME?	Diversion Capacity	#NAME?
BMW to Landfill	#NAME?	BMW to Landfill	#NAME?
Surplus/(deficit) capacity	#NAME?	Surplus/(deficit) capacity	#NAME?
10th Percentile	<i>Mt</i>		
Waste Arising	#NAME?	Waste Arising	#NAME?
Waste Recycled	#NAME?	Waste Recycled	#NAME?
Residual Waste	#NAME?	Residual Waste	#NAME?
Residual BMW	#NAME?	Residual BMW	#NAME?
Landfill Target	#NAME?	Landfill Target	#NAME?
Diversion Capacity	#NAME?	Diversion Capacity	#NAME?
BMW to Landfill	#NAME?	BMW to Landfill	#NAME?
Surplus/(deficit) capacity	#NAME?	Surplus/(deficit) capacity	#NAME?

END

**Inputs**

This sheet defines the parameter values and distributions of the key inputs to the Monte Carlo model.  
 TRIANGULAR - to remove the random component, set max = min = mode.  
 NORMAL - to remove the random component, set std deviation = 0.  
 UNIFORM - to remove the random component, set max = min.

**Forecast Inputs**

Waste Arisings	Baseline	2020	Distribution	Static Value	Parameter 1	Parameter 2
LA Arising (Central)	22.62	#NAME?	Triangular	Mode 22.62	Min. 20.31	Max. 24.93
C&I Arising (Central)	#NAME?	#NAME?	Triangular	Mode #####	Min. #####	Max. #####
LA Arising (Alternative)	0.00	#NAME?	Triangular	Mode 0.00	Min. 0.00	Max. 0.00
C&I Arising (Alternative)	#NAME?	#NAME?	Triangular	Mode #####	Min. 0.00	Max. 0.00
<b>Model Selection</b>						
LA Arising (Model Input)	#NAME?	#NAME?				
C&I Arising (Model Input)	#NAME?	#NAME?				
LA Arising (Post- Shock)	#NAME?	#NAME?				
C&I Arising (Post- Shock)	#NAME?	#NAME?				

**Input Parameters**

Recycling Rates	Baseline	2020	Distribution	Static Value	Parameter 1	Parameter 2
LA Recycling Rate	41.5%	#NAME?	Triangular	Mode 51.4%	Min. 46.4%	Max. 56.4%
C&I Recycling Rate	62.0%	#NAME?	Triangular	Mode 62.0%	Min. 54.0%	Max. 70.0%
<b>BMW Content</b>						
BMW Content of MSW	68.0%	#NAME?	Triangular	Static 68.0%	Min. 55.0%	Max. 75.0%
<b>MSW Content</b>						
MSW % of Industrial Waste	19.1%	#NAME?	Uniform	Static 19.1%	Min. 15.1%	Max. 23.1%
MSW % of Commercial Waste	84.3%	#NAME?	Uniform	Static 84.3%	Min. 79.3%	Max. 89.3%

**Plant Level Assumptions**

Utilisation Rates	Baseline	2020	Distribution	Static Value	Parameter 1	Parameter 2
BMBT Utilisation	80.0%	#NAME?	Triangular	Mode 80.0%	Min. 75.0%	Max. 100.0%
EFW Utilisation	100.0%	#NAME?	Triangular	Mode 100.0%	Min. 90.0%	Max. 105.0%
LFMBT Utilisation	80.0%	#NAME?	Triangular	Mode 80.0%	Min. 75.0%	Max. 100.0%
MT Utilisation	80.0%	#NAME?	Triangular	Mode 80.0%	Min. 75.0%	Max. 100.0%
<b>Diversion Efficiency</b>						
BMBT Efficiency	#NAME?	#NAME?	Triangular	Mode #####	Min. 70.0%	Max. 90.0%
EFW Efficiency	100.0%	#NAME?	Triangular	Mode 100.0%	Min. 100.0%	Max. 100.0%
LFMBT Efficiency	#NAME?	#NAME?	Triangular	Mode #####	Min. 50.0%	Max. 90.0%
MT Efficiency	0.0%	#NAME?	Triangular	Mode 0.0%	Min. 0.0%	Max. 0.0%
<b>Tonnes to EFW</b>						
BMBT to EFW	50.0%	#NAME?	Triangular	Mode 50.0%	Min. 40.0%	Max. 60.0%
EFW to EFW	100.0%	#NAME?	Triangular	Mode 100.0%	Min. 100.0%	Max. 100.0%
LFMBT to EFW	0.0%	#NAME?	Triangular	Mode 0.0%	Min. 0.0%	Max. 0.0%
MT to EFW	85.0%	#NAME?	Triangular	Mode 85.0%	Min. 70.0%	Max. 90.0%
<b>Adjustment to plants</b>						
Programme Contingency	95.0%	#NAME?	Uniform	Static 95.0%	Min. 90.0%	Max. 100.0%

**Correlation Between Inputs**

<b>LA Arisings and C&amp;I Arisings</b>	
Coefficient	0.25
<b>LA Recycling and C&amp;I Recycling</b>	
Coefficient	0.25
<b>LA Arising and LA Recycling</b>	
Coefficient	0.00
<b>C&amp;I Arising and C&amp;I Recycling</b>	
Coefficient	0.00
<b>Arisings and Project Delivery</b>	
Coefficient	0.00
<b>Between Different Projects</b>	
Coefficient	0.00

**Forecast Shocks**

Shock to LA Arisings	Probability	Magnitude (%)	Random Draw	Effect
Positive shock	20%	20%	#NAME?	#NAME?
Negative shock	0%	20%	#NAME?	#NAME?
"Shock"	#NAME?			
Shock to C&I Arisings	Probability	Magnitude (%)	Random Draw	Effect
Positive shock	20%	20%	#NAME?	#NAME?
Negative shock	0%	20%	#NAME?	#NAME?
"Shock"	#NAME?			

**Model Risk**

Weight on central forecast	Weight	Random Draw	Indicator
LA Arisings	100%	#NAME?	#NAME?
C&I Arisings	100%	#NAME?	#NAME?

END

**Correlations**

This sheet contains tables which @Risk uses to define the correlation between different random variables. These values are driven by the Monte Carlo sheet - please do not edit this sheet.

<b>LA and C&amp;I Arisings</b>	
	0.25
<b>LA and C&amp;I Recycling</b>	
	0.25
<b>LA Arising and Recycling</b>	
	0.00
<b>C&amp;I Arising and Recycling</b>	
	0.00
<b>Arisings and Project Delivery</b>	
	0.00
<b>Between Different Projects</b>	
	0.00

@RISK Correlations	LA Arisin	C&I Arisi
LA Arisings Cent in [4892001_1.XLSX]Inputs!\$E\$9	1	
C&I Arising Cent in [4892001_1.XLSX]Inputs!\$E\$10	0.25	1
LA Recycling Rate in [4892001_1.XLSX]Inputs!\$E\$21	0.00	0.00
C&I Recycling Rate in [4892001_1.XLSX]Inputs!\$E\$22	0.00	0.00
North London Waste Authority (NLWA) - Edmonton in [4892001_1.XLSX]Projects!\$P\$23	0.00	0.00
Nottingham City Council - Eastcroft in [4892001_1.XLSX]Projects!\$P\$24	0.00	0.00
Coventry Energy from Waste Project in [4892001_1.XLSX]Projects!\$P\$25	0.00	0.00
South East London Combined Heat and Power (SELCHP) in [4892001_1.XLSX]Projects!\$P\$26	0.00	0.00
Birmingham Energy from Waste Project in [4892001_1.XLSX]Projects!\$P\$27	0.00	0.00
Bolton Energy from Waste Project in [4892001_1.XLSX]Projects!\$P\$28	0.00	0.00
Council of the Isles of Scilly Energy from Waste Project in [4892001_1.XLSX]Projects!\$P\$29	0.00	0.00
Sheffield Energy from Waste Project in [4892001_1.XLSX]Projects!\$P\$30	0.00	0.00
Stoke on Trent Energy from Waste Project in [4892001_1.XLSX]Projects!\$P\$31	0.00	0.00
Hartlepool BC (Tees Valley Lines 1 and 2 (Hartlepool)) Cleveland Energy from Waste Project in [4892001_1.XLSX]Projects!\$P\$32	0.00	0.00
Dudley MBC Energy from Waste Facility in [4892001_1.XLSX]Projects!\$P\$33	0.00	0.00
Wolverhampton MBC waste to energy plant in [4892001_1.XLSX]Projects!\$P\$34	0.00	0.00
NE Lincolnshire Energy from Waste Project in [4892001_1.XLSX]Projects!\$P\$35	0.00	0.00
Kirklees Waste Management Project in [4892001_1.XLSX]Projects!\$P\$36	0.00	0.00
Project Integra Energy from Waste Basingstoke in [4892001_1.XLSX]Projects!\$P\$37	0.00	0.00
Newcastle-upon-Tyne City Council Waste Management in [4892001_1.XLSX]Projects!\$P\$38	0.00	0.00
Project Integra Energy from Waste Marchwood in [4892001_1.XLSX]Projects!\$P\$39	0.00	0.00
Leicester City Council Integrated Waste Management Project in [4892001_1.XLSX]Projects!\$P\$40	0.00	0.00
Whites Pit Waste Management Project in [4892001_1.XLSX]Projects!\$P\$41	0.00	0.00
Project Integra Energy from Waste Portsmouth in [4892001_1.XLSX]Projects!\$P\$42	0.00	0.00
Durham County Council Waste Management Project in [4892001_1.XLSX]Projects!\$P\$43	0.00	0.00
East London Waste Authority Integrated waste Management (ELWA) in [4892001_1.XLSX]Projects!\$P\$44	0.00	0.00
Kent County Council Waste Management Project in [4892001_1.XLSX]Projects!\$P\$45	0.00	0.00
Merseyside - Huyton Knowsley in [4892001_1.XLSX]Projects!\$P\$46	0.00	0.00
Isle of Wight Waste Management Project in [4892001_1.XLSX]Projects!\$P\$47	0.00	0.00
Northumberland Waste Management Project in [4892001_1.XLSX]Projects!\$P\$48	0.00	0.00
Lakeside Energy From Waste in [4892001_1.XLSX]Projects!\$P\$49	0.00	0.00
Leicestershire County Council Waste Management Project in [4892001_1.XLSX]Projects!\$P\$50	0.00	0.00
Lancashire Waste Partnership - 1 in [4892001_1.XLSX]Projects!\$P\$51	0.00	0.00
Lancashire Waste Partnership - 2 in [4892001_1.XLSX]Projects!\$P\$52	0.00	0.00
New Earth Solutions Waste Management Project - gloucs in [4892001_1.XLSX]Projects!\$P\$53	0.00	0.00
Cumbria Waste PPP Project (North) in [4892001_1.XLSX]Projects!\$P\$54	0.00	0.00
North Lincolnshire in [4892001_1.XLSX]Projects!\$P\$55	0.00	0.00
East Sussex County Council and Brighton & Hove City Council - New waste partnerships in [4892001_1.XLSX]Projects!\$P\$56	0.00	0.00
Western Riverside WDA in [4892001_1.XLSX]Projects!\$P\$57	0.00	0.00
London Borough of Southwark Integrated Waste Management Solutions Project in [4892001_1.XLSX]Projects!\$P\$58	0.00	0.00
Cambridgeshire County Council Waste Management Project in [4892001_1.XLSX]Projects!\$P\$59	0.00	0.00
Merseyside in [4892001_1.XLSX]Projects!\$P\$60	0.00	0.00
Cumbria Waste PPP (South) in [4892001_1.XLSX]Projects!\$P\$61	0.00	0.00
Greater Manchester WDA - Manchester Waste in [4892001_1.XLSX]Projects!\$P\$62	0.00	0.00
Dorset - Dorset Green (Avonmouth) in [4892001_1.XLSX]Projects!\$P\$63	0.00	0.00
Lincolnshire CC in [4892001_1.XLSX]Projects!\$P\$64	0.00	0.00
West Sussex County Council Waste Management in [4892001_1.XLSX]Projects!\$P\$65	0.00	0.00
Wiltshire Council Waste PPP Project in [4892001_1.XLSX]Projects!\$P\$66	0.00	0.00
Staffordshire Waste Management Project in [4892001_1.XLSX]Projects!\$P\$67	0.00	0.00
North Lincolnshire Waste Management Project in [4892001_1.XLSX]Projects!\$P\$68	0.00	0.00
Peterborough City Council in [4892001_1.XLSX]Projects!\$P\$69	0.00	0.00



Peterborough City Council in [4892001_1.XLSX]Projects!\$P\$70	0.00	0.00
Devon, Exeter Energy From Waste in [4892001_1.XLSX]Projects!\$P\$71	0.00	0.00
South Tyne and Wear Waste Management Partnership (STWP) in [4892001_1.XLSX]Projects!\$P\$72	0.00	0.00
West of England - Avonmouth in [4892001_1.XLSX]Projects!\$P\$73	0.00	0.00
South West Devon Waste Partnership (SWDWP) Waste Management Project in [4892001_1.XLSX]Projects!\$P\$74	0.00	0.00
Suffolk Waste Management Project in [4892001_1.XLSX]Projects!\$P\$75	0.00	0.00
Derbyshire Waste Mngement Project in [4892001_1.XLSX]Projects!\$P\$76	0.00	0.00
Derby City - Sinfine Lane in [4892001_1.XLSX]Projects!\$P\$77	0.00	0.00
Leeds - Former Skelton Grange Power Station in [4892001_1.XLSX]Projects!\$P\$78	0.00	0.00
Oxfordshire County Council PPP Waste Project in [4892001_1.XLSX]Projects!\$P\$79	0.00	0.00
Norfolk Waste Management Project in [4892001_1.XLSX]Projects!\$P\$80	0.00	0.00
Wakefield Semi Integrated Waste Management in [4892001_1.XLSX]Projects!\$P\$81	0.00	0.00
Wigan Council Waste to Energy project in [4892001_1.XLSX]Projects!\$P\$82	0.00	0.00
Shropshire Integrated Waste Partnership Contract in [4892001_1.XLSX]Projects!\$P\$83	0.00	0.00
Essex County Council and Southend on Sea in [4892001_1.XLSX]Projects!\$P\$84	0.00	0.00
Nottinghamshire Sustainable Waste Solutions in [4892001_1.XLSX]Projects!\$P\$85	0.00	0.00
Hertfordshire County Council Waste Management Project in [4892001_1.XLSX]Projects!\$P\$86	0.00	0.00
Buckinghamshire County Council RW (EFW) in [4892001_1.XLSX]Projects!\$P\$87	0.00	0.00
West London Waste Authority (WLWA) in [4892001_1.XLSX]Projects!\$P\$88	0.00	0.00
South Yorkshire waste (BDR) in [4892001_1.XLSX]Projects!\$P\$89	0.00	0.00
Cornwall Council Semi-Integrated Waste Management Project in [4892001_1.XLSX]Projects!\$P\$90	0.00	0.00
Herefordshire and Worcestershire Waste Management Project in [4892001_1.XLSX]Projects!\$P\$91	0.00	0.00
Surrey Quest waste Disposal Project in [4892001_1.XLSX]Projects!\$P\$92	0.00	0.00
London Sustainable Industries Park in [4892001_1.XLSX]Projects!\$P\$93	0.00	0.00
Milton Keynes Waste Management Project in [4892001_1.XLSX]Projects!\$P\$94	0.00	0.00
Merseyside Waste Management Project (MWDA) in [4892001_1.XLSX]Projects!\$P\$95	0.00	0.00
Bradford Waste Treatment Services Project in [4892001_1.XLSX]Projects!\$P\$96	0.00	0.00
North London Waste Authority (NLWA) in [4892001_1.XLSX]Projects!\$P\$97	0.00	0.00
Leeds Residual waste Treatment Project in [4892001_1.XLSX]Projects!\$P\$98	0.00	0.00
South London Waste Partnership (SLWP) in [4892001_1.XLSX]Projects!\$P\$99	0.00	0.00
North Yorkshire Council and City of York Waste Management Project in [4892001_1.XLSX]Projects!\$P\$100	0.00	0.00
Kent in [4892001_1.XLSX]Projects!\$P\$101	0.00	0.00
Gloucestershire County Council Residual Waste in [4892001_1.XLSX]Projects!\$P\$102	0.00	0.00
Avonmouth North - Viridor in [4892001_1.XLSX]Projects!\$P\$103	0.00	0.00
Avonmouth South in [4892001_1.XLSX]Projects!\$P\$104	0.00	0.00
Avonmouth South in [4892001_1.XLSX]Projects!\$P\$105	0.00	0.00
Birmingham - Tyseley Extension waste Project in [4892001_1.XLSX]Projects!\$P\$106	0.00	0.00
Bradford in [4892001_1.XLSX]Projects!\$P\$107	0.00	0.00
Bradford in [4892001_1.XLSX]Projects!\$P\$108	0.00	0.00
Cheshire Energy from Waste in [4892001_1.XLSX]Projects!\$P\$109	0.00	0.00
Covanta Energy Cheshire - Middlewich in [4892001_1.XLSX]Projects!\$P\$110	0.00	0.00
Cheshire Waste Management Project in [4892001_1.XLSX]Projects!\$P\$111	0.00	0.00
Darlington in [4892001_1.XLSX]Projects!\$P\$112	0.00	0.00
Derby City in [4892001_1.XLSX]Projects!\$P\$113	0.00	0.00
Derbyshire - Dunston Road in [4892001_1.XLSX]Projects!\$P\$114	0.00	0.00
Devon - Hill Barton in [4892001_1.XLSX]Projects!\$P\$115	0.00	0.00
Devon in [4892001_1.XLSX]Projects!\$P\$116	0.00	0.00
Doncaster in [4892001_1.XLSX]Projects!\$P\$117	0.00	0.00
Durham - PARC in [4892001_1.XLSX]Projects!\$P\$118	0.00	0.00
East London in [4892001_1.XLSX]Projects!\$P\$119	0.00	0.00
East London in [4892001_1.XLSX]Projects!\$P\$120	0.00	0.00
East Sussex Waste to Energy Project in [4892001_1.XLSX]Projects!\$P\$121	0.00	0.00
Essex in [4892001_1.XLSX]Projects!\$P\$122	0.00	0.00
Essex in [4892001_1.XLSX]Projects!\$P\$123	0.00	0.00
Essex in [4892001_1.XLSX]Projects!\$P\$124	0.00	0.00
Gateshead in [4892001_1.XLSX]Projects!\$P\$125	0.00	0.00
Gloucestershire - Moreton Valence in [4892001_1.XLSX]Projects!\$P\$126	0.00	0.00
South Gloucestershire in [4892001_1.XLSX]Projects!\$P\$127	0.00	0.00
Hertfordshire - Westmill in [4892001_1.XLSX]Projects!\$P\$128	0.00	0.00



Hertfordshire - Ratty's Lane in [4892001_1.XLSX]Projects!\$P\$129	0.00	0.00
Kent - Blaise Farm Quarry in [4892001_1.XLSX]Projects!\$P\$130	0.00	0.00
Kingston-upon-Hull in [4892001_1.XLSX]Projects!\$P\$131	0.00	0.00
Medway Council in [4892001_1.XLSX]Projects!\$P\$132	0.00	0.00
Merseyside - Halton (facility at Widnes in Cheshire) in [4892001_1.XLSX]Projects!\$P\$133	0.00	0.00
Merseyside - Halton in [4892001_1.XLSX]Projects!\$P\$134	0.00	0.00
Merseyside - Ince Marshes in [4892001_1.XLSX]Projects!\$P\$135	0.00	0.00
Merseyside - Wirral (Hooton Park) in [4892001_1.XLSX]Projects!\$P\$136	0.00	0.00
Middlesbrough in [4892001_1.XLSX]Projects!\$P\$137	0.00	0.00
Newcastle in [4892001_1.XLSX]Projects!\$P\$138	0.00	0.00
North London - Brent Cross in [4892001_1.XLSX]Projects!\$P\$139	0.00	0.00
North Yorkshire - Marston in [4892001_1.XLSX]Projects!\$P\$140	0.00	0.00
North Yorkshire and York City in [4892001_1.XLSX]Projects!\$P\$141	0.00	0.00
Wilton International Site - Teeside in [4892001_1.XLSX]Projects!\$P\$142	0.00	0.00
Northamptonshire in [4892001_1.XLSX]Projects!\$P\$143	0.00	0.00
Northamptonshire - Blackridge Farm in [4892001_1.XLSX]Projects!\$P\$144	0.00	0.00
Runcorn Phase 2 - Halton in [4892001_1.XLSX]Projects!\$P\$145	0.00	0.00
Staffordshire - Kingswood EfW in [4892001_1.XLSX]Projects!\$P\$146	0.00	0.00
Sunderland in [4892001_1.XLSX]Projects!\$P\$147	0.00	0.00
Sutton - Beddington Lane in [4892001_1.XLSX]Projects!\$P\$148	0.00	0.00
Thurrock Council - Tilbury Green Power in [4892001_1.XLSX]Projects!\$P\$149	0.00	0.00
Warwickshire - Rugby in [4892001_1.XLSX]Projects!\$P\$150	0.00	0.00
West London - Park Royal in [4892001_1.XLSX]Projects!\$P\$151	0.00	0.00
Buckinghamshire - PHASE I Rookery Pit in [4892001_1.XLSX]Projects!\$P\$152	0.00	0.00
Buckinghamshire - PAHSE II Rookery Pit in [4892001_1.XLSX]Projects!\$P\$153	0.00	0.00
Central Bedfordshire Waste in [4892001_1.XLSX]Projects!\$P\$154	0.00	0.00
Blackburn with Darwen in [4892001_1.XLSX]Projects!\$P\$155	0.00	0.00
Dorset - Canford, Poole in [4892001_1.XLSX]Projects!\$P\$156	0.00	0.00
Kent in [4892001_1.XLSX]Projects!\$P\$157	0.00	0.00
INSERT NEW PROJECT HERE in [4892001_1.XLSX]Projects!\$P\$158	0.00	0.00
INSERT NEW PROJECT HERE in [4892001_1.XLSX]Projects!\$P\$159	0.00	0.00
INSERT NEW PROJECT HERE in [4892001_1.XLSX]Projects!\$P\$160	0.00	0.00
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INSERT NEW PROJECT HERE in [4892001_1.XLSX]Projects!\$P\$163	0.00	0.00
INSERT NEW PROJECT HERE in [4892001_1.XLSX]Projects!\$P\$164	0.00	0.00
INSERT NEW PROJECT HERE in [4892001_1.XLSX]Projects!\$P\$165	0.00	0.00
INSERT NEW PROJECT HERE in [4892001_1.XLSX]Projects!\$P\$166	0.00	0.00
INSERT NEW PROJECT HERE in [4892001_1.XLSX]Projects!\$P\$167	0.00	0.00
INSERT NEW PROJECT HERE in [4892001_1.XLSX]Projects!\$P\$168	0.00	0.00
INSERT NEW PROJECT HERE in [4892001_1.XLSX]Projects!\$P\$169	0.00	0.00
INSERT NEW PROJECT HERE in [4892001_1.XLSX]Projects!\$P\$170	0.00	0.00
INSERT NEW PROJECT HERE in [4892001_1.XLSX]Projects!\$P\$171	0.00	0.00
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INSERT NEW PROJECT HERE in [4892001_1.XLSX]Projects!\$P\$174	0.00	0.00
INSERT NEW PROJECT HERE in [4892001_1.XLSX]Projects!\$P\$175	0.00	0.00
INSERT NEW PROJECT HERE in [4892001_1.XLSX]Projects!\$P\$176	0.00	0.00
INSERT NEW PROJECT HERE in [4892001_1.XLSX]Projects!\$P\$177	0.00	0.00
INSERT NEW PROJECT HERE in [4892001_1.XLSX]Projects!\$P\$178	0.00	0.00
INSERT NEW PROJECT HERE in [4892001_1.XLSX]Projects!\$P\$179	0.00	0.00
INSERT NEW PROJECT HERE in [4892001_1.XLSX]Projects!\$P\$180	0.00	0.00
INSERT NEW PROJECT HERE in [4892001_1.XLSX]Projects!\$P\$181	0.00	0.00
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INSERT NEW PROJECT HERE in [4892001_1.XLSX]Projects!\$P\$184	0.00	0.00
INSERT NEW PROJECT HERE in [4892001_1.XLSX]Projects!\$P\$185	0.00	0.00
INSERT NEW PROJECT HERE in [4892001_1.XLSX]Projects!\$P\$186	0.00	0.00
INSERT NEW PROJECT HERE in [4892001_1.XLSX]Projects!\$P\$187	0.00	0.00







Correlations This sheet contains tables which Risk uses to define the correlation between different random variables. These values are driven by the Monte Carlo shell - please do not edit this sheet.

LA and CA Arisings
LA and CA Recycling
LA Arisings and Recycling
Arisings and Project Delivery
Between Different Projects

Main data table with columns for project names and correlation coefficients. Projects include: LA Arising Cent in 1491996, LA Recycling in 1491996, North London Waste Authority, Barking Energy from Waste, etc.







**Infrastructure**

The following worksheets all deal with infrastructure.

No.	Name	Description
1	Projects	Lists the waste diversion infrastructure that is already installed or is projected to come online. Edit project risk, delivery date, operational capacity and plant type here.
2	Diversion Efficiency	Calculates the diversion efficiency of BMBT and LFMBT plants. Edit moisture loss, recycling, residues to landfill etc. here.
3	Delivery Adjustment	Lists the delivery adjustment for different types of project, by stage of completion. Edit adjustment rates here.
4	Sum Capacity	Calculates the sum of infrastructure capacity in different years. No user entry.









**Diversion Efficiency**

This sheet is used to calculate the diversion efficiencies of different plant types.  
 These parameters are assigned a distribution in the Monte Carlo sheet.

Diversion Assumptions for residual waste technologies				
Technology Classification	Utilisation Rate %	Tonnes to EfW	Diversion Efficiency	Technology Example
BMBT	#NAME?	#NAME?	#NAME?	Bio drying MBT e.g. ELWA
EfW	#NAME?	#NAME?	#NAME?	EfW
LFMBT	#NAME?	#NAME?	#NAME?	LF MBT e.g. Lancs, Cambs
MT	#NAME?	#NAME?	#NAME?	Mechanical treatment
<b>Comments</b>				
The MBT and MT technologies generally do not operate at the reported operational capacity - hence 80% assumed It is assumed that for BMBT and MT processes the out put (rdf) is not consigned to landfill				

BMBT type generic process - biodrying - Ecodeco type			
	%	BMW %	Comment
Waste input	100.00	#NAME?	
Moisture loss plus some carbon loss	25.00		Typical value for this type of process - Source - [REDACTED]
Recycling (metals,paper,platics) residues to landrill	10.00		Typical value for this type of process - Source - [REDACTED]
RDF	15.00	#NAME?	Typical value for this type of process - Source - [REDACTED]
RDF	50.00		Typical value for this type of process - Source - [REDACTED]
BMW diverted =		#NAME?	
BMW diversion efficiency		#NAME?	

LFMBT type generic process - compost like output to landfill - lancs,cambs type			
	%	BMW	Comment
BMW of treated waste	35%		
Waste input	100.00	#NAME?	
Moisture loss plus carbon loss	45.00		Typical value for this type of process - Source - [REDACTED]
Recycling (metals,paper,platics) residues to landrill	10.00		Typical value for this type of process - Source - [REDACTED]
residues to landrill	15.00	5.25	Typical value for this type of process - Source - [REDACTED]
CLO	30.00	10.50	Typical value for this type of process - Source - [REDACTED]
BMW diverted =		#NAME?	
BMW diversion efficiency		#NAME?	

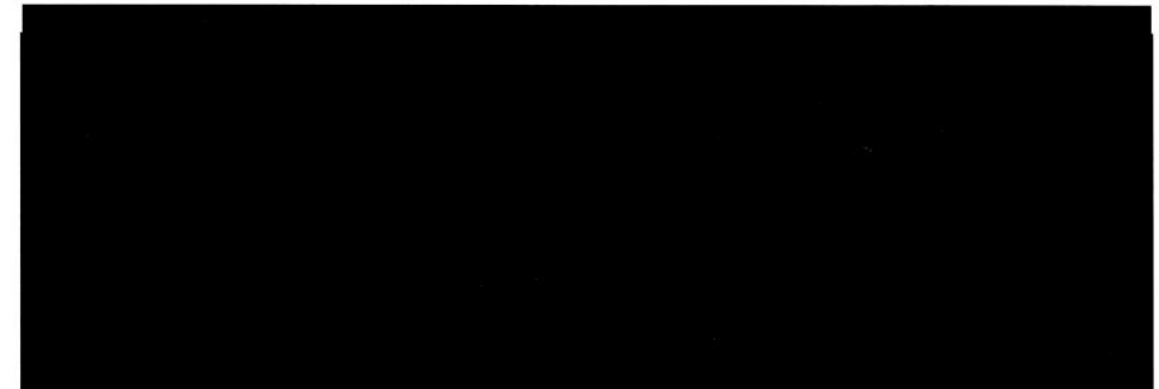
END

**Delivery Adjustment**

This sheet outlines the project delivery adjustment rates that are used in the model.  
Note that the values used seem slightly unintuitive - this is because a 0.95 adjustment for project outages has been applied.

Project Risk Adjustment - (adjustment for outages removed)				
	PFI	PPP	M	Project Status
B	100%	100%	100%	Fully operational
G	90%	90%	90%	Commissioning
AG	80%	80%	80%	Financial close, with planning
A	70%	70%	40%	Financial close, no planning
AR	60%	60%	20%	In procurement, no planning
R	20%	20%	3%	Unlikely to go live by 2020
n/a	0%	0%	0%	Cancelled Project

END



**Sum Capacity**

This sheet summarises the BMW diversion. All projects pre-March 2010 are included in the 2010 financial year. Projects becoming operational in subsequent years are recorded in the year they become operational. Random Delivery will report a different capacity each time the dice icon is toggled on/off in @Risk.

**Project Delivery**

Date	FY (End)	(Randomly Delivered) Capacity (mt)	PFI	PPP	M	Additional Capacity by Mar-2020 (mt)
31-Mar-10	2010	#NAME?	#NAME?	#NAME?	-	#NAME?
31-Mar-11	2011	#NAME?	#NAME?	#NAME?	-	#NAME?
31-Mar-12	2012	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
31-Mar-13	2013	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
31-Mar-14	2014	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
31-Mar-15	2015	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
31-Mar-16	2016	#NAME?	#NAME?	#NAME?	-	#NAME?
31-Mar-17	2017	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
31-Mar-18	2018	-	-	-	-	#NAME?
31-Mar-19	2019	#NAME?	-	#NAME?	#NAME?	#NAME?
31-Mar-20	2020	#NAME?	-	#NAME?	#NAME?	-
<b>Total</b>	<b>Total</b>	<b>#NAME?</b>	<b>#NAME?</b>	<b>#NAME?</b>	<b>#NAME?</b>	

END



## Arisings

The following worksheets all deal with arisings and the factors that influence them.

No.	Name	Description
1	Forecasts	Collects the most recent forecast values of LA and C&I waste arisings. Historical values can be entered when forecasts are updated.
2	Outturn	Collects historical data on BMW to landfill and recycling rates. Update as new data become available.



2018	2018q1	2018	5771.365	5173.669
2018	2018q2	2019	6335.197	5757.854
2018	2018q3	2019	6179.834	5690.383
2018	2018q4	2019	5567.328	4930.787
2019	2019q1	2019	5794.438	5117.901
2019	2019q2	2020	6358.27	5699.528
2019	2019q3	2020	6202.907	5633.554
2019	2019q4	2020	5590.401	4874.361
2020	2020q1	2020	5817.511	5060.002
2020	2020q2	2021	6381.343	5642.762
2020	2020q3	2021	6225.98	5576.758
2020	2020q4	2021	5613.474	4816.774

Source: SARIMA Models (Nov 2012)

**Outturn**

This sheet collects actual outturn data on recycling and waste to landfill.  
 Entering values into yellow cells that are currently blank will replace values that are currently forecasts elsewhere in the spreadsheet, if applicable.  
 Landfill data is from the EA. Recycling data is actually reported outturn.

**BMW to Landfill**

Date	FY (End)	EA Reported BMW to Landfill (mt)	Residual BMW (mt)	BMW Diversion Implied (mt)
31-Mar-10	2010	13.46	#NAME?	#NAME?
31-Mar-11	2011	12.22	#NAME?	#NAME?
31-Mar-12	2012		0.00	0.00
31-Mar-13	2013		0.00	0.00
31-Mar-14	2014		0.00	0.00
31-Mar-15	2015		0.00	0.00
31-Mar-16	2016		0.00	0.00
31-Mar-17	2017		0.00	0.00
31-Mar-18	2018		0.00	0.00
31-Mar-19	2019		0.00	0.00
31-Mar-20	2020		0.00	0.00

**Recycling Rates**

Date	FY (End)	Household	C&I	Household (forecast)	C&I (forecast)
31-Mar-10	2010	39.7%	62.0%	41.5%	62.0%
31-Mar-11	2011	41.5%	62.0%	41.5%	62.0%
31-Mar-12	2012	43.0%		43.0%	#NAME?
31-Mar-13	2013			#NAME?	#NAME?
31-Mar-14	2014			#NAME?	#NAME?
31-Mar-15	2015			#NAME?	#NAME?
31-Mar-16	2016			#NAME?	#NAME?
31-Mar-17	2017			#NAME?	#NAME?
31-Mar-18	2018			#NAME?	#NAME?
31-Mar-19	2019			#NAME?	#NAME?
31-Mar-20	2020			#NAME?	#NAME?
<b>P.p. change/year</b>		#NAME?	#NAME?		

END