Greater Manchester District Heating

Commercial Support Model User Guide

March 2011

Ernst & Young LLP

Ernst & Young

Contents

1. Model structure

1.1 Overview

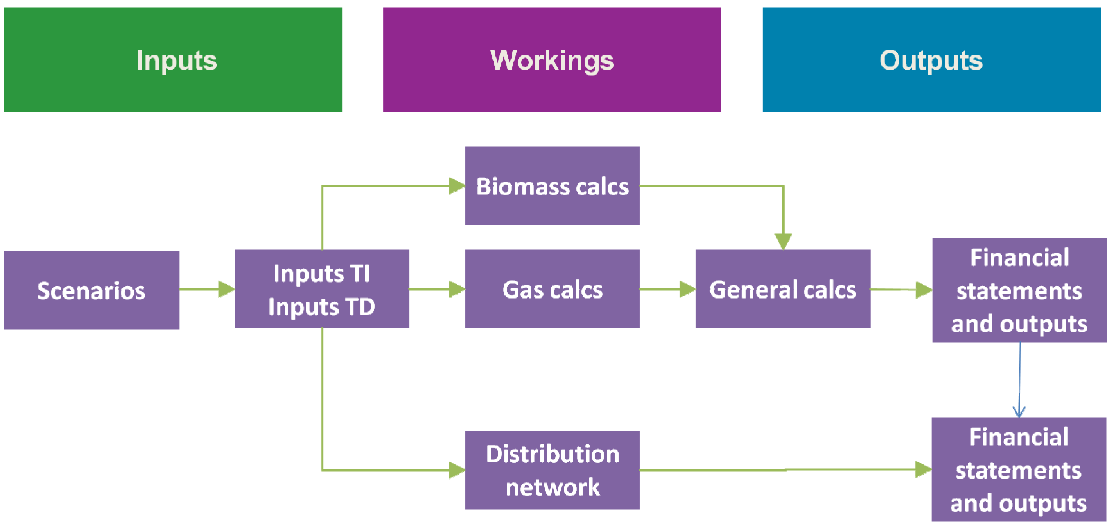
The district heating commercial support model 'AGMA Gas & biomass project cashflow model March 2011 v1.xls' ('the model') is prepared to simulate the financial position of a biomass and gas CHP project.

The model has been produced in Microsoft Excel 2007 and is compatible with Excel 2003, and represents a 25 year operational cash flow, accounting and tax forecast. The model has been formulated as an annual model during both construction and operation phases, with summary financial statements also shown.

The model is constructed in three main sections (inputs, workings and outputs) each section consisting of a number of related worksheets as shown below.

All assumptions for the project are presented in three different worksheets. Inputs that remain the same throughout the life of the project are time independent, and are included in the "Inputs_TI" worksheet. Inputs that are time dependent are included in the "Inputs_TD". The "Scenario sheet" has been included in the model to allow key scenarios to be evaluated. For ease of use, the main variables of the model have been included in this sheet, and key inputs should be modified here.

Figure 1



The model is split into two distinct parts, calculating the outputs for the plant and the network separately. This is highlighted in figure 1 above, illustrating the structure of the model diagrammatically. The Scenario sheet links directly into the individual input sheets and allows specific scenarios to be investigated. Inputs called up from the scenario sheet are highlighted by a blue font colour and white background in other sheets. The model itself is predominantly driven from the Scenario Sheet.

Time independent inputs include key model information, model timing and periodicity, inflation, working capital days, operating cost, revenue, accounting, and taxation assumptions. Time dependent assumptions include information disposal costs (for the biomass plant option), capital expentidutre, availability and cost and revenue assumptions.

1.2 Description of worksheets

The table below sets out the individual worksheets within the model and gives a brief description of each worksheet.

Sheet	Sheet type	Purpose
Disclaimer	Disclaimer	Disclaimer detailing limitations of model use. The model disclaimer must be accepted via the message box prior to accessing the model.
Contents	Contents	This shows the layout of the workbook, and the different subsections included within each sheet.
Summary	Output	This worksheet contains a summary of the key outputs from the financial model. This is split in to three sections, showing the project returns of the plant only, the heating netowrk only, and the returns of the plant and network combined.
Scenario Sheet	Input	Contains inputs which can be adjusted under different scenarios. Inputs include: ▶ Project type ▶ Timing ▶ Caipital expenditure ▶ Operating costs ▶ Biomass specific assumptions ▶ Gas specific assumptions ▶ Auxilary boiler use ▶ Revenue assumptions ▶ Sensitivities ▶ A summary of scenario outputs is also included in the final section.
Inputs_TD	Input	Time dependant inputs including the following: ▶ Capex disbursement assumptions ▶ Generation build up profiles ▶ Power curves ▶ Fuel factor ▶ ROC and LEC banding ▶ Landfill tax rates
Inputs_TI	Input	Time independant inputs including the following: ▶ Project details ▶ Timing ▶ Working capital ▶ Taxation ▶ Biomass and gas input cost ▶ Electricity revenue ▶ Heat revenue ▶ Inflation rates ▶ Land lease costs ▶ Lifecycle costs

Generic calcs	Calculation	This worksheet contains accounting, cost, taxation and financial calculations for the construction and operations period. These are calculated on an annual basis.
Biomass calcs	Calculation	This worksheet calculates the operating costs and revenues generated by the plant and auxilary boiler if the the scenario specifies the use of biomass technology and an auxilary boiler. This worksheet will provide no outputs for other types of technology.
Gas calcs	Calculation	This worksheet calculates the operating costs and revenues generated by the plant and auxilary boiler if the the scenario specifies the use of gas technology and an auxilary boiler. This worksheet will provide no outputs for other types of technology.
Distribution Network	Calculation	This sheet calculates operating costs and revenues of the distribution network, only if the scenario specifies the use of the network. The worksheet also contains a cash flow for the network.
Financial statements	Output	This sheet shows financial statements based on the input and workings sheets. They are shown on an annual basis until 31 December 2050.
Checks	Checks	This sheet contains numerous checks in place to ensure the functionality of the model, covering the calculation of the financial statements and tax workings.
Timing	Calculation	This sheet calculates the flags for the constuction and operation phases of the project, based in dates and timing assumptions entered into the model as inputs. These flags are used by all workings tabs to correctly model different phases of the project.
CF Chart	Graph	This graph shows movements of the elements that make up the cash flow throughout the life of the project.
BS Chart	Graph	This graph shows movements of the elements that make up the profit and loss throughout the life of the project.
PnL Chart	Graph	This graph shows movements of the elements that make up the balance sheet throughout the life of the project.

2. General

2.1 Macros

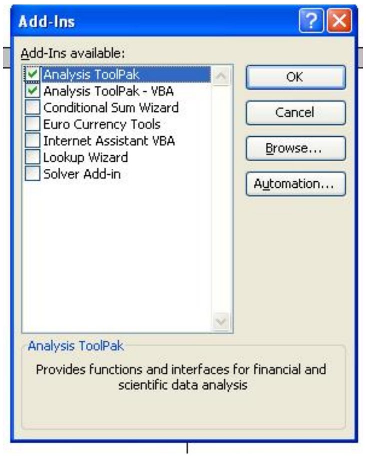
The user needs to “Enable Macros” on opening the file – if not some of the functionality in the model will be disabled.

2.2 Install Add-ins

In order to use the full functionality of the model on any computer, the user needs to install the following add-ins, if these have not already been installed:

- Analysis ToolPak
- Analysis ToolPak - VBA

In Excel 2003, go to Tools/Add-ins and tick both boxes as shown below:



Click OK and close Excel completely. On reopening, the user will be able to use and save the model locally.

For Excel 2007 go to the Office menu, Excel Options and under the Add Ins tab select Manage add ins option to access the above screen.

2.3 Conventions: colours of cells and sheets

2.3.1 Cell Formats

Remember to only input values in yellow cells at all times, the rest of the cells contain formulae and should not be amended or overwritten.

Calculation cells contain formulae and it is advisable not to use these cells, as accidental deletions and formulae amendments can affect the accuracy of the outputs.

The model is based on the classical separation between inputs (in blue ink throughout the model) and calculated values (black ink).

- Modifiable inputs: the user can insert values, these fields are indicated in yellow with blue text:

- Called-up inputs: these fields are linked to an input cell. The user should not change these cells but revert to the original input cell. These cells are white with blue text.

925

- Calculated fields: these fields cannot be modified by the user, because they contain formulae that are automatically calculated. These cells are white with a black text:

13,959

- When negative, the values in all types of cells will be appear in red colour (in parenthesis)

(500,000)

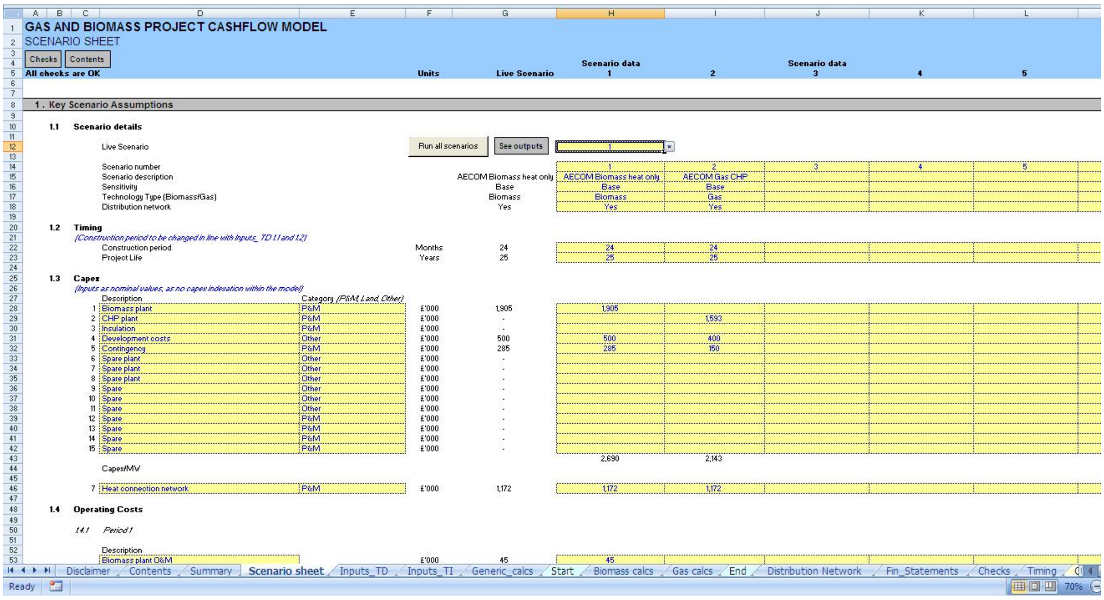
3. Financial Model Mechanism

3.1 Model Control

The model can be predominantly controlled via the worksheet named “Scenario sheet”. This contains the main modifiable inputs that drive the model, represented by cells with a yellow background and blue text. Different sceanrios can be selected via the drop down menu in cell H12 of the sheet as shown in figure 2 below, which allows the user to switch between different sets of assumptions, input into columns H to Q, referring to scearios 1 to 10 respectively.

The selected scenario is known as the “Live scenario”, and column G automatically updates to show the chosen set of assumptions. For example, selecting scenario 3 will pull through any data from the assumptions input in column J, to form the live scenario. In figure 2 below, the selected scenario is scenario 1, and therefore column G duplicates this data.

Figure 2



GAS AND BIOMASS PROJECT CASHFLOW MODEL
SCENARIO SHEET
Checks | Contents
All checks are OK

Row	Item	Category (P&M, Land, Other)	Units	Live Scenario	Scenario data 1	2	Scenario data 3	4	5
8	1 . Key Scenario Assumptions								
10	1.1 Scenario details								
12	Live Scenario		Run all scenarios	See outputs	1				
14	Scenario number				1	2	3	4	5
15	Scenario description			AECOM Biomass heat only	AECOM Biomass heat only	AECOM Gas CHP			
16	Sensitivity			Base	Base	Base			
17	Technology Type (Biomass/Gas)			Biomass	Biomass	Gas			
18	Distribution network			Yes	Yes	Yes			
20	1.2 Timing								
21	(Construction period to be changed in line with Inputs_TD 1.1 and 1.2)								
22	Construction period		Months	24	24	24			
23	Project Life		Years	25	25	25			
25	1.3 Capex								
26	(Inputs as nominal values, as no capex indexation within the model)								
27	Description	Category (P&M, Land, Other)							
28	1 Biomass plant	P&M	£'000	1,905	1,905				
29	2 CHP plant	P&M	£'000	-		1,593			
30	3 Insulation	P&M	£'000	-					
31	4 Development costs	Other	£'000	500	500	400			
32	5 Contingency	P&M	£'000	285	285	150			
33	6 Spare plant	Other	£'000	-					
34	7 Spare plant	Other	£'000	-					
35	8 Spare plant	Other	£'000	-					
36	9 Spare	Other	£'000	-					
37	10 Spare	Other	£'000	-					
38	11 Spare	Other	£'000	-					
39	12 Spare	P&M	£'000	-					
40	13 Spare	P&M	£'000	-					
41	14 Spare	P&M	£'000	-					
42	15 Spare	P&M	£'000	-					
43					2,690	2,143			
44	Capex/MW								
46	7 Heat connection network	P&M	£'000	1,172	1,172	1,172			
48	1.4 Operating Costs								
50	1.4.1 Period 1								
52	Description								
53	Biomass plant O&M		£'000	45	45				

Disclaimer / Contents / Summary / Scenario sheet / Inputs_TD / Inputs_TI / Generic_calcs / Start / Biomass calcs / Gas calcs / End / Distribution Network / Fin_Statements / Checks / Timing

Data selected as the live scenario feeds through into the Inputs_TD and Inputs_TI sheets, which then drive the calculations in the workings sheets which ultimately derive the model’s outputs. Although there may some duplication between the input sheets, the model has been strucutred in order that all key assumptions can be configured on a single page, being the Scenario sheet.

Running the model with different sensitivities

In order to create a new scenario, simply input new data into one of the blank scenario columns, then proceed to select the desired column as described above.

In order to run a sensitivity, follow the steps as detailed below:

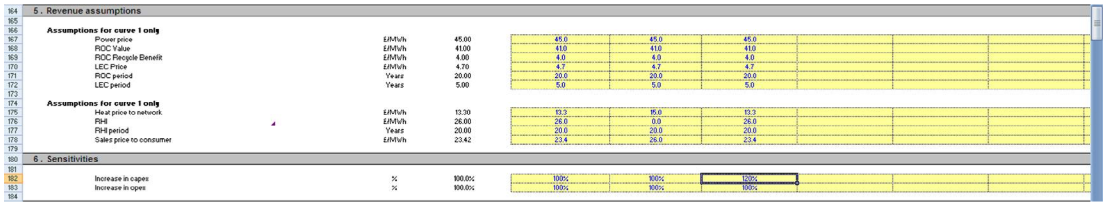
1. Copy the inputs from one of the existing scenarios into a blank scenario column. For example, in figure 2, if column H contains data for the base case, copy all inputs into a free column, such as column J.

   Please be sure to only copy across input cells, which feature a yellow background. This is to maintain the integrity of any formulas contained within this sheet.

2. Change the details of the "sensitivity" field to define the scenario. For instance, if the effects of an increase in capital expenditure are to be modelled, name the sensitivity "Downside capex" in cell J16.

3. Find the field applicable to the sensitivity, and input new data that is to be modelled. Following the same example, input a new percentage into the cell 182, as shown below.

Figure 3



164	5 . Revenue assumptions					
165						
166	**Assumptions for curve 1 only**					
167	Power price	£/MWh	45.00	45.0	45.0	45.0
168	ROC Value	£/MWh	41.00	41.0	41.0	41.0
169	ROC Recycle Benefit	£/MWh	4.00	4.0	4.0	4.0
170	LEC Price	£/MWh	4.70	4.7	4.7	4.7
171	ROC period	Years	20.00	20.0	20.0	20.0
172	LEC period	Years	5.00	5.0	5.0	5.0
173						
174	**Assumptions for curve 1 only**					
175	Heat price to network	£/MWh	13.30	13.3	15.0	13.3
176	RHI	£/MWh	26.00	26.0	0.0	26.0
177	RHI period	Years	20.00	20.0	20.0	20.0
178	Sales price to consumer	£/MWh	23.42	23.4	26.0	23.4
179						
180	6 . Sensitivities					
181						
182	Increase in capex	%	100.0%	100%	100%	120%
183	Increase in opex	%	100.0%	100%	100%	100%
184						

This example implies that scenario 3 is exactly the same as the base scenario, except for an increase in capital expenditure by an additional 20%.

4. Using the scenario selector in cell H12 as shown in figure 2 above, select the relevant scenario from the drop down menu. Column G will now replicate the inputs from column J. The model will now be driven of the new set of assumptions, and will result in different outputs, as detailed in the "Summary" tab.

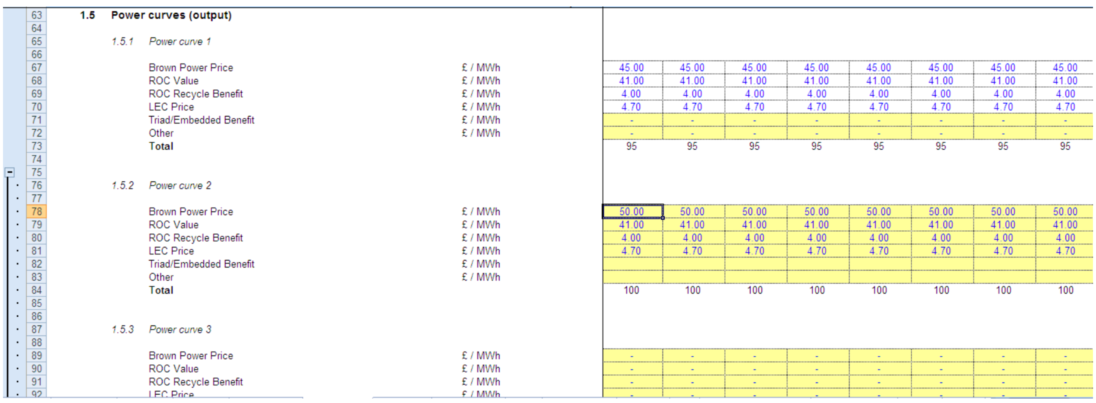
Running the model with time dependent sensitivities

As described previously, time dependent inputs are located in the Inputs_TD tab. In this model, these are mostly relevant to changing prices during the life of the project. This applies to both costs and revenues.

In order to run a time dependent sensitivity, follow steps 1 and 2 as above, then proceed with the steps as detailed below.

3. Find the field applicable to the sensitivity in the Inputs_TD sheet, and input new data that is to be modelled. For example, to input new data for the power curves, locate the relevant section in row 63. Ungroup the hidden rows by clicking on the button to the left of row 75 to reveal more modifiable input cells. In the example shown in figure 4 below, brown power price has been increased by £5/MWh for every year.

Figure 4



63	1.5	**Power curves (output)**										
64												
65	1.5.1	*Power curve 1*										
66												
67		Brown Power Price	£ / MWh	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00
68		ROC Value	£ / MWh	41.00	41.00	41.00	41.00	41.00	41.00	41.00	41.00
69		ROC Recycle Benefit	£ / MWh	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
70		LEC Price	£ / MWh	4.70	4.70	4.70	4.70	4.70	4.70	4.70	4.70
71		Triad/Embedded Benefit	£ / MWh	-	-	-	-	-	-	-	-
72		Other	£ / MWh	-	-	-	-	-	-	-	-
73		**Total**		95	95	95	95	95	95	95	95
74												
75												
76	1.5.2	*Power curve 2*										
77												
78		Brown Power Price	£ / MWh	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
79		ROC Value	£ / MWh	41.00	41.00	41.00	41.00	41.00	41.00	41.00	41.00
80		ROC Recycle Benefit	£ / MWh	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
81		LEC Price	£ / MWh	4.70	4.70	4.70	4.70	4.70	4.70	4.70	4.70
82		Triad/Embedded Benefit	£ / MWh								
83		Other	£ / MWh								
84		**Total**		100	100	100	100	100	100	100	100
85												
86												
87	1.5.3	*Power curve 3*										
88												
89		Brown Power Price	£ / MWh	-	-	-	-	-	-	-	-
90		ROC Value	£ / MWh	-	-	-	-	-	-	-	-
91		ROC Recycle Benefit	£ / MWh	-	-	-	-	-	-	-	-
92		LEC Price	£ / MWh	-	-	-	-	-	-	-	-

4. Locate the relevant section in the Inputs_TI sheet, and select the approprite curve to be used. Following the same example, select cells J130 and J131 and change the power purchase agreement (PPA) curve to 2 in the drop down menus. Rows 136 to 150 can also be manipulated, to demonstrate the discount applied to power prices during and after the PPA period. The changes illustrated in figure 5 are arbitary, and for indicative purposes only.

Figure 5

126	2.7 Electricity Revenue						
127							
128	*2.7.1 Sales under PPA*						
129							
130	Selected Power curve for PPA period	#	2	1	1	2	
131	Selected Power curve for none-PPA period	#	2	1	1	2	
132	PPA term (full operational year)	Years	15	15	15	15	
133							
134	*2.7.2 Revenue % to generator - during PPA*						
135							
136	Brown Power Price	%	95.0 %	90.0 %	90.0 %	95.0 %	
137	ROC Value	%	95.0 %	95.0 %	95.0 %	95.0 %	
138	ROC Recycle Benefit	%	95.0 %	95.0 %	95.0 %	95.0 %	
139	LEC Price	%	95.0 %	95.0 %	95.0 %	95.0 %	
140	Triad/Embedded Benefit	%	100.0 %	100.0 %	100.0 %	100.0 %	
141	Other	%	100.0 %	100.0 %	100.0 %	100.0 %	
142							
143	*2.7.3 Revenue % to generator - post PPA*						
144							
145	Brown Power Price	%	100.0 %	90.0 %	90.0 %	100.0 %	
146	ROC Value	%	95.0 %	95.0 %	95.0 %	95.0 %	
147	ROC Recycle Benefit	%	95.0 %	95.0 %	95.0 %	95.0 %	
148	LEC Price	%	95.0 %	95.0 %	95.0 %	95.0 %	
149	Triad/Embedded Benefit	%	100.0 %	100.0 %	100.0 %	100.0 %	
150	Other	%	100.0 %	100.0 %	100.0 %	100.0 %	

Note that other options are also available. For PPAs, the model allows for prices to be differentiated in the periods during and after the agreement. This is the choice of power curves in rows 130 and 131 respectively. The length of the PPA period can also be changed in row 132. In the example used, we assume a simple scenario where the same prices are applicable in both periods. As can be seen in figure 4 above, the model provides for further power curve prices to be input, which the user may choose to employ for the non-PPA period.

5. Using the scenario selector in cell H12 as shown in figure 2 above, select the relevant scenario from the drop down menu. The model will now be driven of the new set of assumptions, and will result in different outputs, as detailed in the "Summary" tab.

   The change in time dependant inputs can be seen on the Inputs_TD tab. Using the same example as before, the selected power curve can be seen in rows 120 to 137, as shown in figure 6 below. Note that cells H121 and H131 show the selection of the power curve, chosen in the Inputs_TI tab as previously demonstrated. This is highlighted by the blue font colour. The prices input in 'Power curve 2' in step 3 will now drive the calculations in the model.

Figure 6

118	1.6 Selection of PPA curves									
119										
120	*PPA period*									
121	*Selected power curve for PPA Period*	PPA #	2							
122	Brown Power Price		50	50	50	50	50	50	50	50
123	ROC Value		41	41	41	41	41	41	41	41
124	ROC Recycle Benefit		4	4	4	4	4	4	4	4
125	LEC Price		5	5	5	5	5	5	5	5
126	Triad/Embedded Benefit		-	-	-	-	-	-	-	-
127	Other		-	-	-	-	-	-	-	-
128			100	100	100	100	100	100	100	100
129										
130	*Out of PPA period*									
131	*Selected power curve for out of PPA Period*	PPA #	2							
132	Brown Power Price		50	50	50	50	50	50	50	50
133	ROC Value		41	41	41	41	41	41	41	41
134	ROC Recycle Benefit		4	4	4	4	4	4	4	4
135	LEC Price		5	5	5	5	5	5	5	5
136	Triad/Embedded Benefit		-	-	-	-	-	-	-	-
137	Other		-	-	-	-	-	-	-	-
138			100	100	100	100	100	100	100	100

   Note that the different selection of biomass and gas, PPA, heat and merchant price curves all function along similar lines. The example of PPAs above was chosen only to demonstrate the additional options available.

For ease of comparison, the model includes a macro that runs all scenarios automatically, and returns the key outputs into a table. The macro button is labelled as 'Run all scenarios', clearly visible in figure 2, to the left of the scenario selector. The output summary is found in the Scenarios sheet, in rows 185 to 217 as shown in figure 7 below.

Note that the way the macro runs, means that scenario 1 is automatically selected each time, after the macro is used.

Figure 7

7 . Scenario outputs						
7.1	**Returns and outputs**					
	Scenario			AECOM Biomass heat only	AECOM Gas CHP	AECOM Biomass heat only
				Base	Base	Downside capex
7.1.1	*Project returns (distribution network and plant)*					
	Pre tax project IRR	%	7.9%	7.9%	9.0%	7.0%
	Pre tax project NPV	£'000	(1,473)	(1,473)	(367)	(1,010)
	Payback period	Years	14	14	13	15
	Payback period (on DCF basis)		n/a	n/a	n/a	n/a
7.1.2	*Project returns - plant only*					
	Pre tax plant IRR	%	8.5%	8.5%	10.0%	7.2%
	Pre tax plant NPV	£'000	(977)	(977)	11	(704)
	Payback period	Years	14	14	12	15
	Payback period (on DCF basis)		n/a	n/a	25	n/a
7.1.3	*Project returns - distrubtion network only*					
	Pre tax distrubtion network IRR	%	6.0%	6.0%	6.0%	6.0%
	Pre tax distribution network NPV	£'000	1	1	3	1
	Payback period	Years	14	14	14	14
	Payback period (on DCF basis)		25	25	25	25
7.1.4	*Other outputs*					
	Year 1 heat price to consumer	£/MWh th	23.42	23.42	26.00	23
	Year 1 heat price to distribution network provider	£/MWh th	13.30	13.30	15.00	13
	Total funding requirement	£'000				

3.2 Model Checks

There are a number of cross-checks in the model the user must routinely check to ensure that the results of the model are properly calculated. These checks are summarised on the “Checks” worksheet.

Critical checks are made to ensure the following:

- Sources of funds match the application of funds
- The balance sheet balances
- Tax has been calculated correctly

4. Pro-forma databook

The table below details a typical databook that might include all the inputs used to drive the model, and the source from which they might be derived. Note that the assumptions provided in the model provided are taken from 'Oldham Heat Network Study', a report prepared by AECOM. These inputs are included for indicative purposes only, and are not to be relied upon. In order to utilise the model, the user should input their own assumptions, specific to their project. The financial advisor would provide all finance, tax and accounting assumptions in agreement with the Authority.

Assumption	Source
Modelling base date and financial close date	Authority
Construction period	Technical advisor
Operating period	Technical advisor
Phasing assumptions	Technical advisor
Inflation	Financial advisor
Heat generation assumptions	
Gross installed heat capacity	Technical advisor
Heat losses (distribution)	Technical advisor
Capacity factor	Technical advisor
Plant operational hours per day	Technical advisor
Boiler efficiency	Technical advisor
Auxiliary boiler used?	Technical advisor
Auxiliary boiler heat capacity	Technical advisor
Auxiliary boiler efficiency	Technical advisor
Auxiliary boiler availability	Technical advisor
Electricity generation assumptions	
Heat to power ratio	Technical advisor
Plant gross capacity	Technical advisor
Parasitic load	Technical advisor
Power losses (distribution/electrical)	Technical advisor
Additional losses	Technical advisor
ROCs	Per OFGEM guidelines
Energy to mass conversion factor	Technical advisor
Capital expenditure assumptions	
Biomass plant	Technical advisor
CHP plant	Technical advisor
Insulation	Technical advisor
Development costs	Technical advisor
Contingency	Technical advisor

Heat connection network	Technical advisor
Revenue assumptions	
Brown power price	Independent forecast provider or base on historic prices
Heat price to network	Targeted to provide reasonable return to power plant operator
Renewable heat incentive	Per OECC guidelines
Heat price to consumer	Targeted to provide reasonable return to heat connection network operator and be reasonable to end consumer
Operating costs assumptions	
Biomass plant (£000s pa)	Technical advisor
Lifecycle (£000s pa)	Technical advisor
Auxiliary boiler (£000s pa)	Technical advisor
CHP O&M (£000s pa)	Technical advisor
SPV costs (£000s pa)	Technical advisor
Insurance (£000s pa)	Insurance
Contingency (£000s pa)	Technical advisor
Heat connection network O&M (£000s pa)	Technical advisor
Biomass price (£/t)	Technical advisor
Gas price (CHP and boiler) (£/MWh)	Technical advisor