

## Appendix 4

Llanidloes Scenario 1

25/11/05

### DIGESTER FEEDSTOCK

Page 1

#### Kitchen Waste

Mass	3.7 tonnes/week
%DS	22.5 % TS
%ODM	92.5 % VS
Specific Methane Yield	380 m3 CH4/tODM
Dry Solids	0.8 tonnes/week
Organic Dry Solids	0.8 tonnes/week
Methane Production	289 m3 CH4/week

#### School Catering Waste

Mass	0.2 tonnes/week
%DS	22.5 % TS
%ODM	92.5 % VS
Specific Methane Yield	380 m3 CH4/tODM
Dry Solids	0.0 tonnes/week
Organic Dry Solids	0.0 tonnes/week
Methane Production	15 m3 CH4/week

#### Commercial Catering Waste

Mass	0.2 tonnes/week
%TS	22.5 % TS
%DS	92.5 % VS
Specific Methane Yield	380 m3 CH4/tODM
Dry Solids	0.0 tonnes/week
Organic Dry Solids	0.0 tonnes/week
Methane Production	15 m3 CH4/week

#### Grass Verge Cuttings

Mass	0.8 tonnes/week
%DS	30.0 % TS
%ODM	85.0 % VS
Specific Methane Yield	300 m3 CH4/tODM
Dry Solids	0.2 tonnes/week
Organic Dry Solids	0.2 tonnes/week
Methane Production	61 m3 CH4/week

#### Total Digester Feedstock

Mass	4.8 tonnes/week
%DS	23.7 % TS
%ODM	90.9 % VS
Specific Methane Yield	364 m3 CH4/tODM
Dry Solids	1.1 tonnes/week
Organic Dry Solids	1.0 tonnes/week
Methane Production	380 m3 CH4/week

**ECONOMICS****INCOME**

Gate Fee	40 £/tonne
Waste Treatment	252 tonnes/year
<b>Income from Gate Fee</b>	<b>10,066 £/year</b>
Value of Electricity	85 £/MWh
Gross Electricity Production	0 MWh/year
<b>Income from Electricity Sales</b>	<b>0 £/year</b>
Value of Surplus Heat	25 £/MWh
Surplus Heat Production	118 £/year
Potential Value of Surplus Heat	2949 £/year
% Utilisation of Surplus Heat	100 %
<b>Income from Surplus Heat</b>	<b>2,949 £/year</b>
Value of Solid Biofertiliser	15 £/tonne
Value of Liquid Biofertiliser	2 £/tonne
Solid Biofertiliser Production	57 tonnes/year
Liquid Biofertiliser Production	165 tonnes/year
<b>Income from Biofertiliser Sales</b>	<b>1,188 £/year</b>
<b>Total Income</b>	<b>14,203 £/year</b>

**OPERATING COSTS**

Management	0 £/tonne
<b>Cost of Management</b>	<b>0 £/year</b>
Labour	63 £/tonne
<b>Cost of Labour</b>	<b>15,853 £/year</b>
Maintenance Contract	8 £/tonne
<b>Cost of Maintenance &amp; Spares</b>	<b>2,013 £/year</b>
Cost of Electricity	80 £/MWh
Cost of Water	1 £/m <sup>3</sup>
Electricity Consumption	10 MWh/year
Water Consumption	10 m <sup>3</sup> /year
<b>Cost of Utilities</b>	<b>810 £/year</b>
Cost of Solid Biofertiliser Disposal	0 £/tonne
Cost of Liquid Biofertiliser Disposal	0 £/tonne
Solid Biofertiliser Production	57 tonnes/year
Liquid Biofertiliser Production	165 tonnes/year
<b>Cost of Disposal of Biofertiliser</b>	<b>0 £/year</b>
Waste Management License	2,000 £/year
Laboratory Costs	1,000 £/year
Collection Costs	2,420 £/yr
Office Costs	0 £/year
Miscellaneous Costs	5,000 £/year
<b>Other Operating Costs</b>	<b>10,420 £/year</b>
<b>Total Operating Cost</b>	<b>29,097 £/year</b>

**ECONOMIC ASSESSMENT**

Capital Cost	278,400 £
Income	14,203 £/year
Operating Cost	29,097 £/year
Net Income	-14,894 £/year
Annual Discount Rate	7 %
Lifetime of Plant	15 years
Present Value of Net Income	-135,654 £
Less Capital Cost	-278,400 £
<b>NET PRESENT VALUE</b>	<b>-414,054 £</b>

**Feedstock Conditioning & Storage**

Mass of Organic Waste	4.8 tonnes/week
%DS of Organic Waste	23.7 % TS
%ODM of Organic Waste	90.9 % VS
Dry Solids of Organic Waste	1.1 tonnes/week
Organic Dry Matter of Organic Waste	1.0 tonnes/week
Mass of Process Water	0.2 tonnes/week
Mass of Digestate Liquor Recirculation	4.8 tonnes/week
%DS of Digestate Liquor Recirculation	3.6 % TS
%ODM of Digestate Liquor Recirculation	68.0 % VS
Dry Solids of Digestate Liquor Recirculation	0.2 tonnes/week
Organic Dry Matter of Digestate Liquor Recirculation	0.1 tonnes/week
% Organic Waste Rejected as Inert	0.0 %
Mass of Inert Rejects	0.0 tonnes/week
%DS of Inert Rejects	0 %
%ODM of Inert Rejects	0 %
Dry Solids of Inert Rejects	0.0 tonnes/week
Organic Dry Matter of Inert Rejects	0.0 tonnes/week
Mass of Digester Feedstock	9.8 tonnes/week
Dry Solids of Digester Feedstock	1.3 tonnes/week
Organic Dry Matter of Digester Feedstock	1.2 tonnes/week
Specific Gravity of Feedstock	1.04 tonnes/m <sup>3</sup>
Volume of Digester Feedstock	9.4 m <sup>3</sup> /week
Capacity of Conditioning Tank	1 m <sup>3</sup>
Storage Time Available in Conditioning Tank	0.4 days
Capacity of Raw Waste Buffer Tank	6 m <sup>3</sup>
Storage Time in Available in Raw Waste Buffer Tank	4.6 days

**Anaerobic Digestion**

Mass of Digester Feedstock	1.4 tonnes/day
Volume of Digester Feedstock	1.3 m <sup>3</sup> /day
%DS of Digester Feedstock	13.4 % TS
%ODM of Digester Feedstock	87.9 % VS
Dry Solids of Digester Feedstock	0.2 tonnes TS/day
Organic Dry Matter of Digester Feedstock	0.2 tonnes VS/day
Capacity of Digester	35 m <sup>3</sup>
Methane Production	54 m <sup>3</sup> CH <sub>4</sub> /day
% Methane	60 % CH <sub>4</sub>
Volume of Biogas	90 m <sup>3</sup> /d
Specific Gravity of Biogas	1.21 kg/m <sup>3</sup>
Mass of Biogas	110 kg/d
Mass of Digester Output	1.3 tonnes/day
%DS of Digester Output	6.1 % TS
%ODM of Digester Output	71.1 % VS
Dry Solids of Digester Output	0.1 tonnes/day
Organic Dry Matter of Digester Output	0.1 tonnes/day
Specific Gravity of Digester Output	1.02 tonnes/m <sup>3</sup>
Volume of Digester Output	1.3 m <sup>3</sup> /day
<b>Hydraulic Retention Time</b>	<b>26 days</b>
<b>%TS of Digester Feedstock</b>	<b>13.4 % TS</b>
<b>Specific Loading Rate</b>	<b>4.7 kg VS/m<sup>3</sup>/day</b>
<b>Biogas Production per day : Digester Capacity</b>	<b>2.6 m<sup>3</sup>/d/m<sup>3</sup></b>
<b>Biogas Production : m<sup>3</sup> Digester Feed</b>	<b>67 m<sup>3</sup>/m<sup>3</sup></b>
<b>Biogas Production : Tonnes of Organic Waste</b>	<b>131 m<sup>3</sup>/tonne</b>
<b>Methane Production : Tonnes Organic Waste Organic Dry Matter</b>	<b>364 m<sup>3</sup>/tonneODM</b>

**ENERGY****Biogas**

Biogas Production	90 m3/day
Biogas Flow	4 m3/hour
% Methane	60 % CH4
Calorific Value of Biogas (LCV)	21.4 MJ/m3
Fuel Value of Biogas	1,936 MJ/day
Fuel Value of Biogas	22 kWf

**Combined Heat & Power**

Fuel Value of Biogas	22 kWf
Electrical Efficiency	35.0 %
Thermal Efficiency	50.0 %
Electricity Output	8 kW <sub>e</sub>
Heat Output	11 kW <sub>th</sub>
Availability of CHP Unit	0 %
Annual Electricity Output	0 MWh/yr
Annual Heat Output	0 MWh/yr

**Gas Boiler**

Fuel Value of Biogas	22 kWf
Thermal Efficiency	85.0 %
Heat Output	19 kW <sub>th</sub>
Gas Boiler Operating Time	95 %
Annual Heat Output	159 MWh/yr

**Heat Requirement**

Volume of Digester Feedstock	1 m3/day
Temperature of Digester Feedstock	10 °C
Temperature of Digester	37 °C
Temperature of Outside Air	10 °C
Heat Input to Digester Feedstock	153 MJ/day
Total Surface Area of Digester	61 m <sup>2</sup>
Thickness of Insulation	100 mm
Average Thermal Conductivity of Insulation	0.034 W/m.°C
Digester Heat Loss	49 MJ/day
Total Digester Heat Requirement	201 MJ/day
Total Digester Heat Requirement	2.3 kW <sub>th</sub>
Volume of Pasteurisation Feedstock	1 m3/day
Temperature of Pasteurisation Feedstock	37 °C
Temperature of Pasteurisation Tank	71 °C
Temperature of Outside Air	10 °C
Heat Input to Pasteurisation Feedstock	181 MJ/day
Total Surface Area of Pasteurisation Tank	10 m <sup>2</sup>
Thickness of Insulation	100 mm
Average Thermal Conductivity of Insulation	0.034 W/m.°C
Pasteurisation Tank Heat Loss	18 MJ/day
Total Pasteurisation Heat Requirement	198 MJ/day
Total Pasteurisation Heat Requirement	2.3 kW <sub>th</sub>
Total Heat Requirement	400 MJ/day
Total Heat Requirement	41 MWh/yr

**Electricity Balance**

Electricity Output	0 MWh/yr
% Parasitic Electricity	#DIV/0! %
Electricity Consumption of Plant	10 MWh/yr

**Net Electricity Output****-10 MWh/yr****Heat Balance**

Heat Output	159 MWh/yr
% Parasitic Heat	26 %
Heat Consumption of Plant	41 MWh/yr

**Net Heat Output****118 MWh/yr**