

Appendix 5

Llanidloes Scenario 2

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

Abattoir Waste - Blood

Mass	32.5 tonnes/week
%DS	4.0 % TS
%ODM	90.0 % VS
Specific Methane Yield	350 m3 CH4/tODM
Dry Solids	1.3 tonnes/week
Organic Dry Solids	1.2 tonnes/week
Methane Production	410 m3 CH4/week

Abattoir Waste - Lairage (Manure & Gutfill

Mass	196.0 tonnes/week
%DS	10.0 % TS
%ODM	77.0 % VS
Specific Methane Yield	242 m3 CH4/tODM
Dry Solids	19.6 tonnes/week
Organic Dry Solids	15.1 tonnes/week
Methane Production	3,652 m3 CH4/week

Total Digester Feedstock

Mass	233.3 tonnes/week
%DS	9.4 % TS
%ODM	78.5 % VS
Specific Methane Yield	257 m3 CH4/tODM
Dry Solids	22.0 tonnes/week
Organic Dry Solids	17.3 tonnes/week
Methane Production	4,441 m3 CH4/week

ECONOMICS**INCOME**

Biowaste	40 £/tonne
Blood	80 £/tonne
Lairage	20 £/tonne
Gate Fee (Average)	29 £/tonne
Waste Treatment	12166 tonnes/year
Income from Gate Fee	350,037 £/year
Value of Electricity	85 £/MWh
Gross Electricity Production	698 MWh/year
Income from Electricity Sales	59,343 £/year
Value of Surplus Heat	25 £/MWh
Surplus Heat Production	388 £/year
Potential Value of Surplus Heat	9691 £/year
% Utilisation of Surplus Heat	100 %
Income from Surplus Heat	9,691 £/year
Value of Solid Biofertiliser	10 £/tonne
Value of Liquid Biofertiliser	0 £/tonne
Solid Biofertiliser Production	1362 tonnes/year
Liquid Biofertiliser Production	10336 tonnes/year
Income from Biofertiliser Sales	13,617 £/year
Total Income	432,688 £/year

OPERATING COSTS

Management	1 £/tonne
Cost of Management	12,166 £/year
Labour	2 £/tonne
Cost of Labour	24,333 £/year
Maintenance Contract	5 £/tonne
Cost of Maintenance & Spares	60,831 £/year
Cost of Electricity	80 £/MWh
Cost of Water	1 £/m3
Electricity Consumption	30 MWh/year
Water Consumption	0 m3/year
Cost of Utilities	2,400 £/year
Cost of Solid Biofertiliser Disposal	0 £/tonne
Cost of Liquid Biofertiliser Disposal	5 £/tonne
Solid Biofertiliser Production	1362 tonnes/year
Liquid Biofertiliser Production	10336 tonnes/year
Cost of Disposal of Biofertiliser	51,680 £/year
Waste Management License	2,000 £/year
Laboratory Costs	2,000 £/year
Collection Costs	2,420 £/year
Office Costs	0 £/year
Miscellaneous Costs	10,000 £/year
Other Operating Costs	16,420 £/year
Total Operating Cost	167,830 £/year

ECONOMIC ASSESSMENT

Capital Cost	928,400 £
Income	432,688 £/year
Operating Cost	167,830 £/year
Net Income	264,858 £/year
Annual Discount Rate	7 %
Lifetime of Plant	15 years
Present Value of Net Income	2,412,305 £
Less Capital Cost	-928,400 £
NET PRESENT VALUE	1,483,905 £

Feedstock Conditioning & Storage

Mass of Organic Waste	233.3 tonnes/week
%DS of Organic Waste	9.4 % TS
%ODM of Organic Waste	78.5 % VS
Dry Solids of Organic Waste	22.0 tonnes/week
Organic Dry Matter of Organic Waste	17.3 tonnes/week
Mass of Process Water	0.0 tonnes/week
Mass of Digestate Liquor Recirculation	0.0 tonnes/week
%DS of Digestate Liquor Recirculation	0.0 % TS
%ODM of Digestate Liquor Recirculation	0.0 % VS
Dry Solids of Digestate Liquor Recirculation	0.0 tonnes/week
Organic Dry Matter of Digestate Liquor Recirculation	0.0 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	233.3 tonnes/week
Dry Solids of Digester Feedstock	22.0 tonnes/week
Organic Dry Matter of Digester Feedstock	17.3 tonnes/week
Specific Gravity of Feedstock	1.04 tonnes/m ³
Volume of Digester Feedstock	224.4 m ³ /week
Capacity of Conditioning Tank	35 m ³
Storage Time Available in Conditioning Tank	1.1 days
Capacity of Raw Waste Buffer Tank	198 m ³
Storage Time in Available in Raw Waste Buffer Tank	6.2 days

Anaerobic Digestion

Mass of Digester Feedstock	33.3 tonnes/day
Volume of Digester Feedstock	32.1 m ³ /day
%DS of Digester Feedstock	9.4 % TS
%ODM of Digester Feedstock	78.5 % VS
Dry Solids of Digester Feedstock	3.1 tonnes TS/day
Organic Dry Matter of Digester Feedstock	2.5 tonnes VS/day
Capacity of Digester	792 m ³
Methane Production	634 m ³ CH ₄ /day
% Methane	60 % CH ₄
Volume of Biogas	1,057 m ³ /d
Specific Gravity of Biogas	1.21 kg/m ³
Mass of Biogas	1,284 kg/d
Mass of Digester Output	32.0 tonnes/day
%DS of Digester Output	5.8 % TS
%ODM of Digester Output	63.7 % VS
Dry Solids of Digester Output	1.9 tonnes/day
Organic Dry Matter of Digester Output	1.2 tonnes/day
Specific Gravity of Digester Output	1.02 tonnes/m ³
Volume of Digester Output	31.4 m ³ /day
Hydraulic Retention Time	25 days
%TS of Digester Feedstock	9.4 % TS
Specific Loading Rate	3.1 kg VS/m³/day
Biogas Production per day : Digester Capacity	1.3 m³/d/m³
Biogas Production : m³ Digester Feed	33 m³/m³
Biogas Production : Tonnes of Organic Waste	32 m³/tonne
Methane Production : Tonnes Organic Waste Organic Dry Matter	257 m³/tonneODM

ENERGY**Biogas**

Biogas Production	1,057 m3/day
Biogas Flow	44 m3/hour
% Methane	60 % CH4
Calorific Value of Biogas (LCV)	21.4 MJ/m3
Fuel Value of Biogas	22,651 MJ/day
Fuel Value of Biogas	262 kWf

Combined Heat & Power

Fuel Value of Biogas	262 kWf
Electrical Efficiency	32.0 %
Thermal Efficiency	53.0 %
Electricity Output	84 kW _e
Heat Output	139 kW _{th}
Availability of CHP Unit	95 %
Annual Electricity Output	698 MWh/yr
Annual Heat Output	1,156 MWh/yr

Gas Boiler

Fuel Value of Biogas	262 kWf
Thermal Efficiency	85.0 %
Heat Output	223 kW _{th}
Gas Boiler Operating Time	5 %
Annual Heat Output	98 MWh/yr

Heat Requirement

Volume of Digester Feedstock	32 m3/day
Temperature of Digester Feedstock	10 °C
Temperature of Digester	37 °C
Temperature of Outside Air	10 °C
Heat Input to Digester Feedstock	3,626 MJ/day
Total Surface Area of Digester	398 m ²
Thickness of Insulation	100 mm
Average Thermal Conductivity of Insulation	0.034 W/m.°C
Digester Heat Loss	316 MJ/day
Total Digester Heat Requirement	3,942 MJ/day
Total Digester Heat Requirement	45.6 kW _{th}
Volume of Pasteurisation Feedstock	31 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	4,476 MJ/day
Total Surface Area of Pasteurisation Tank	71 m ²
Thickness of Insulation	100 mm
Average Thermal Conductivity of Insulation	0.034 W/m.°C
Pasteurisation Tank Heat Loss	127 MJ/day
Total Pasteurisation Heat Requirement	4,603 MJ/day
Total Pasteurisation Heat Requirement	53.3 kW _{th}
Total Heat Requirement	8,544 MJ/day
Total Heat Requirement	866 MWh/yr

Electricity Balance

Electricity Output	698 MWh/yr
% Parasitic Electricity	4 %
Electricity Consumption of Plant	30 MWh/yr

Net Electricity Output**668 MWh/yr****Heat Balance**

Heat Output	1,254 MWh/yr
% Parasitic Heat	69 %
Heat Consumption of Plant	866 MWh/yr

Net Heat Output**388 MWh/yr**