BRAMPTON AND BEYOND COMMUNITY TRUST
PROJECT OUTLINE FOR BRAMPTON AD

Version: 001
Date: 2012-01-12
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Version History:

Version	Auth	Date	Comment
001	Tim Coombe	2012-01-12	Initial document

This document summarises the scope of the Brampton AD project prior to the terms of reference being agreed and the subsequent production of other project documents.

This document is linked with the Energy Saving and Generation Project Outline which describes how Brampton AD will contribute to the energy generation part of the Brampton and Beyond Community Trust's long term energy strategy (referred hereafter as the Trust).

Much of the information below has been derived from the Feasibility Study Report by Newcastle University, prepared for Sustainable Brampton in Nov 11.

WHY

This section describes the business opportunity; the social, economic or environmental requirement; or general rational for initiating this project. Should include the desired outcome, when this is wanted (and why that date!), and any associated opportunity, requirement or interdependent reasoning.

Policy Drivers. The main UK drivers behind the development of the AD industry relate to new government legislation responding to climate change. In order to change the behaviour of the UK population to resource management, the government has been forced to introduce punitive measures, from some of which the AD industry should benefit, such as:

- Landfill Tax
- Increasing targets for recycling

- Renewable Energy Directive (RED)
- Reduction in Greenhouse Gas emissions – Kyoto Protocol

Aim. The long term aim of the AD project is to make the Brampton community more resilient, prosperous and sustainable. Unlike many other RE systems, AD uses a very low profile and low risk technology which should minimise objections arising either from within the community or local authorities.

Feasibility. The feasibility study was commissioned to assess the potential of an AD plant to meet some of Brampton's energy requirements from renewable sources in order to:

- Reduce the carbon footprint of the town
- Address how the town's energy requirements could best be met from renewable sources
- Create an additional income stream for the Trust.

WHAT

This section describes the product in terms of objects, service and documentation to be delivered. (Objects being items such as: knowledge, equipment, property or product).

Plant Types. Two types of AD plant have been investigated, using different mixes of feed-stock:

- **Scenario 1 – Farmyard manure and silage**. There is sufficient farm feedstock available to support a 150kW anaerobic digestion plant which would cost approximately £850K but would generate a minimum profit of £60K per annum which could be augmented by RHI payments based on the heat used.

- **Scenario 2 – Domestic waste**. Using different feed-stocks including domestic waste, the plant capacity would be the same, cost a similar amount to build but with a slightly higher profit of £68K due to the lower cost of the feedstock. The advantage of this scenario is the greater potential for involvement by the local business and domestic communities in providing non-farm waste, ideally linked in with the activities of the local recycling centre.

AD Products. See Feasibility Study for more details. The main products are:

Gas. The choices for using the methane produced by the plant are:

- **Methane for Heat**. A conventional gas boiler can be used to combust the gas with the resulting heat used for nearby buildings such as farmhouses and workshops in addition to the parasitic heat requirements of the digestion tanks.
- **Methane for Power**. The methane produced would be burnt in an engine to produce electricity and where heat is recovered from the engine jacket and from the exhaust gas to form a CHP unit. This creates electricity for injection back to the grid or for business use. Electricity conversion efficiencies vary from 25% to 40% with an additional 45% to 55% of the energy value of the biogas converted to heat.
- **Methane for Fuel.** Once the biogas is purified with the removal of the carbon dioxide and other impurities, the gas may be used as a vehicle fuel for CNG based vehicles. The cost of this process is high and is at present only economically viable for larger AD plants.
- **Bio-methane Injection.** The gas can be upgraded and purified, and injected with a gas with a higher calorific value such as propane to meet the requirements specified by Ofgem and injected back to the gas grid.

Digestate. Digestate is a nutrient-rich substance which can be used as a bio-fertiliser, thereby reducing the requirement for inorganic fertilisers. There are three main types of digestate, all of which have some commercial value:

- **Whole digestate.** Processed material as it is unloaded from the digester. It is pumpable and has less than 14% dry matter.
- **Separated liquor** – where the digestate has been passed through a separator or a centrifuge to remove the coarse fibres. The liquor contains up to 6% dry matter with a particle size of normally less than 12mm.
- **Separated fibre** – this is the fibre produced from the separation process. It can be composted or used as a fresh soil conditioner. The dry matter is usually in excess of 20% and may be as high as 40%.

Carbon Dioxide. The four main methods for removing the carbon dioxide from the biogas are: water absorption, polyethylene glycol scrubbing, carbon molecular sieves, and membranes. The cost of purification is usually only undertaken for large CAD schemes in excess of 2MW. However, raw CO2

pumped into greenhouses accelerates plant growth through improved photosynthesis (creating O2 as a by-product) so it would be highly beneficial for a poly-tunnel based nursery business to be located close to an AD plant.

HOW

This section describes the approach or actions to be done in terms of (for example): analysis, communications, stakeholder consultation, planning, design, training, implementation, go/no-go criteria, knowledge transfer, trial period. Should include an indication of the skills and effort (days) required for each activity.

Site Selection. The site was chosen because of its location on the edge of the Townfoot Industrial Estate. Although there are at least 2 other site options, this one is particularly suitable for the following reasons:

- It lies within 2 miles of sufficient feedstock material to enable the plant to generate 365 days a year.
- It is near many potential high users of electrical power (including William Howard School) as well as the local recycling centre.
- There is additional space to generate other income from other bi-products of digestion.
- There are good access roads for both HGVs and off-road tractor/trailers.
- Close proximity to suitable grid and gas connections.
- Far enough from residential areas to minimise the impact of any smells and other emissions.
- Near to large commercial buildings the owners of which may wish to purchase a low cost source of heat.
- Proximity to Council owned grassland where the digestate (under scenario 2) could be spread for additional silage production.
- Not too close to livestock (for bio-security considerations).

Contractor Selection. Several suppliers have been approached informally, including Hochreiter and Marches Biogas. Rob Skinner from Core North West/Hochreiter has undertaken the waste feedstock analysis. Brampton AD should benefit from the Low Luckens ADDS+UP project which is currently entering the tendering phase, to inform the selection of well proven contractors for Brampton AD.

Feedstock Analysis. Sustainable Brampton has sourced potential additional feedstock within the surrounding area. These include: baking waste, domestic waste, fatty domestic waste, and meadow hay. Regarding

food waste, care must taken to ensure that it contains no animal by-products as any waste containing meat has to be pasteurised at 70^{o} for an hour. Baking waste is a particularly useful feedstock as it can significantly boost biogas yield as it generates 651m^3 of biogas per tonne compared to domestic waste which only averages 15-20m^3. Meadow hay at £5 per tonne production costs is also a very useful feedstock, producing 426m^3 per tonne.

The current guaranteed levels of feedstock from Rob Skinner's survey are detailed in the table below, however these may be augmented by the other food wastes listed in Scenario 2 (still to be negotiated).

Scenario 1		**Farm based waste**
Cattle slurry	2000t	
Farm yard manure	1000t	
Grass silage	2850t	Total feedstock 5850t
Scenario 2		**Farm supplanted by domestic waste**
Cattle slurry	1000t	
Farm yard manure	500t	
Grass clippings	100t	
Meadow hay	1000t	
Baking waste	100t	
Domestic waste	1000t	
Fatty domestic waste	200t	Total feedstock 3900t

Figure 1 – Feedstock Requirements

Planning Considerations. The plant would need to be sited more than 200m away from buildings to be eligible for a standard EA permit. However if this is not possible, then a bespoke permit would be required, which would be significantly more expensive and would introduce additional regulations.

Key Issues before submitting Planning Application. Before submitting an application the following issues must have been resolved by the selected contractor:

- **Visual Impact Mitigation.** Height of digester and storage tank, screening by earth embankments, plantation, bunds, location below ground. Gas storage – location, shape and colour.
- **Noise mitigation.** Traffic – both on and off site – access design, delivery times, ability to move around site without continually reversing. Equipment – silencer on CHP, using hydraulics instead of pump engines.
- **Odour/Emission Mitigation.** Slurry pumped directly from source, spills quickly dealt with. Prevention of secondary fermentation. CHP flare and emission controls.
- **SSIs, Nature Sites.** Care of protected species – animals, fish, birds and plants.

WHEN

Assuming no resource constraints, this section indicates earliest reasonable date when key milestones could be achieved.

Task/Time Analysis. The following main tasks and timescales have been identified which lead to a (conservative) target completion date of Jun 14:

Jan 12	Project Team meeting
Jan 12	Application to Companies House
Jan 12	Agree relationships with BBCT and SB
Jan 12	Open discussions with Envirolink, CVS, Co-op and Charity Bank
Feb 12	Draft Business Plan
Feb 12	Draft prospectus
Feb 12	Open negotiations for site lease
Mar 12	Develop media plan
Mar 12	Grant applications
Mar 12	Site lease negotiations complete
Apr 12	Launch prospectus (3 month campaign)
May 12	Select consultants to prepare planning applications
Jul 12	Apply for planning permission
Dec 12	Planning permission granted
Mar 13	Construction Contract let
May 13	Construction begins
Dec 13	AD plant commissioned
By Jun 14	AD plant begins to deliver 150KW per day

Figure 2 – Milestones to Project Completion

Timings are largely resource driven and could be greatly accelerated if additional resources can be found.

WHO

This section identifies individuals, their organisation and principle responsibilities in respect of this project.

The Project will be managed by a core Project Team, augmented by others as required. The core team comprises:

Tim Coombe, Bob Allan, Bill Jefferson, Simon Sjenitzer and Gill Houston

Assistance of others members of the Energy Action Group may be sought for specific tasks:

Ann Oswin, Simon Haskins, Phil Dunn, John Hopkins, Jon March, Leo Ponton, Rob Brown,

Others (including potential private investors) who have asked to be kept informed of developments include:

Alistair Grant (Story Construction), Alistair and Matthew Fell (H&H Bowe), Paul Brennock (Brennock Accountants), Rob Skinner, Kevin Walsh, Steve Graham, Howard Long, Mike Downham, Jeremy Ancketill, Charmian McCutcheon, Rik Alexander, Mark Lloyd, Christopher Boyle, Chance Wilson, Nick Kittoe, Brad Kieser and Keith Johnstone.

HOW MUCH

This section is a summary of the anticipated funding, costs and benefits. This section should include tangible and intangible cost and benefits; may be in terms of capital, one off and ongoing values; and may refer to and copy from a financial forecast spreadsheet.

Financial Drivers. An AD plant has several potential income streams:

- Sale of electricity to the National Electricity Grid through FiTs.
- Sale of electricity to a green energy provider via a Power Purchase Agreement (PPA).
- Sale of bio-methane to the National Gas Grid.
- Gate-fees from externally sourced waste.
- Other Government financial incentives such as RHI and ROCs.
- Sale of digestate and other bi-products (like CO2).

Feed-in Tariffs (FiTs). Since April 2010, Feed-in Tariffs (FiTs) have provided a guaranteed price for a 20 year fixed period to small-scale

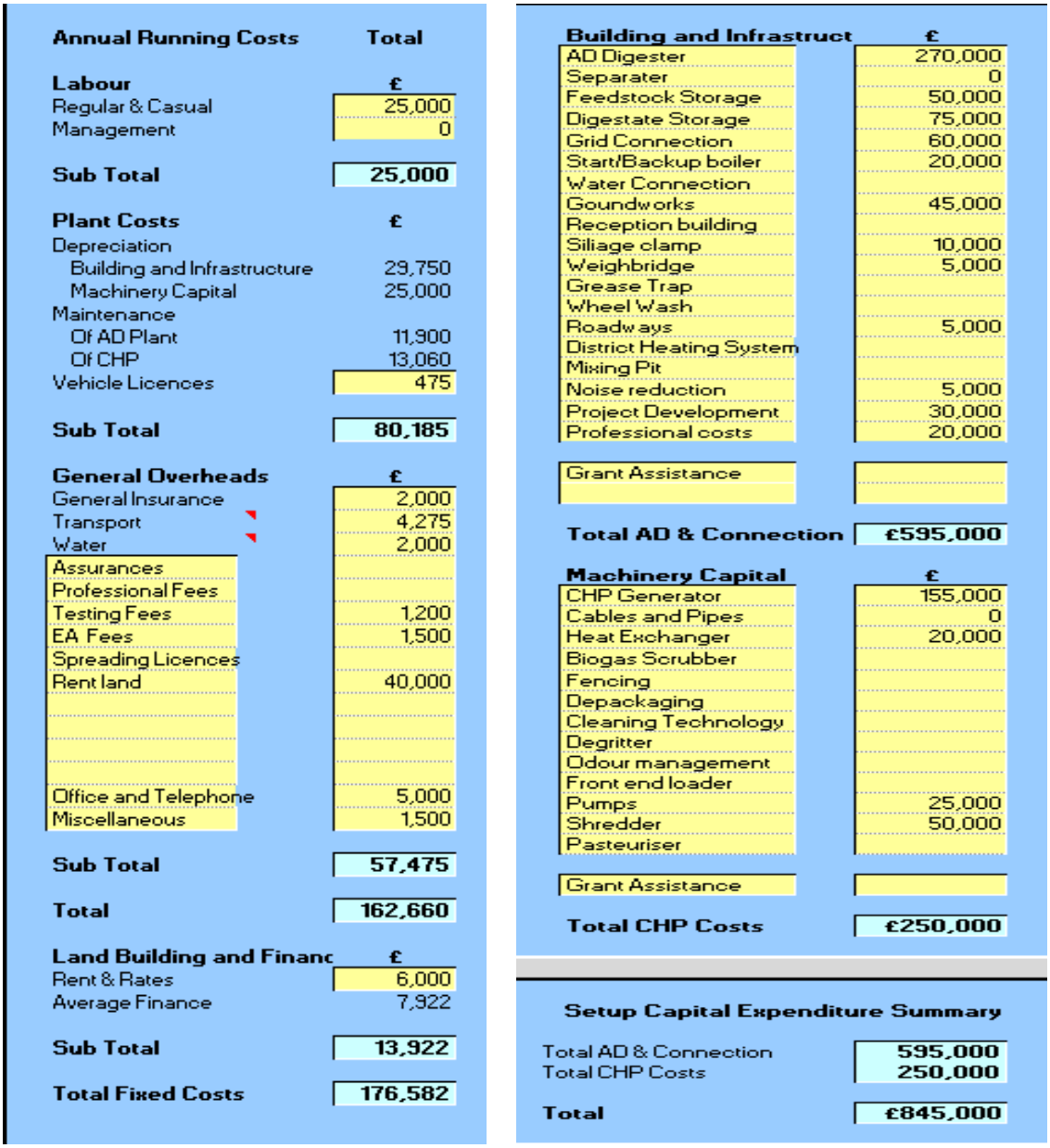
(<5MW) electricity producers. Anaerobic Digestion facilities completed after 15 July 2009 are eligible for the FiT. Facilities of less than or equal to 500kW entitled to 12.1p /kWh for the generation of electricity and 3.1p/kWh for electricity exported to the grid.

Renewable Heat Incentive (RHI). The world's first Renewable Heat Incentive was launched in March 2011 with the application system due to open at the end of September 2011. The subsidy involves a guaranteed payment being paid per kilowatt hour of renewable heat used over a period of 20 years to AD operators. The tariff level for small scale plants below 200 kilowatt thermal (kWt) amounts to 6.5p per kilowatt hour of heat generated, which has now risen with index linking to 6.8p per kW/h.

Digestate. The digestate is valued at £3.60 a tonne, which gives a value of £33,678. The site is in an NVZ zone so the digestate would need to be applied at no more than 38.8t/ha and would require a minimum amount of 400.8ha or 989.6acres

Operational Costs. Operational costs have been kept to a minimum in the analysis. However they include a full time plant operator and rent for land at Townfoot Estate. This rent could be reduced should the landlord of the estate decide to take a stake in the project. The Plant Operator could be a part time job, given the right individual.

Capital Costs. The capital build figures in the table below are illustrative of a 149kW wet based plant using cattle slurry as the main feedstock.



Annual Running Costs	Total
Labour	**£**
Regular & Casual	25,000
Management	0
Sub Total	**25,000**
Plant Costs	**£**
Depreciation	
Building and Infrastructure	29,750
Machinery Capital	25,000
Maintenance	
Of AD Plant	11,900
Of CHP	13,060
Vehicle Licences	475
Sub Total	**80,185**
General Overheads	**£**
General Insurance	2,000
Transport	4,275
Water	2,000
Assurances	
Professional Fees	
Testing Fees	1,200
EA Fees	1,500
Spreading Licences	
Rent land	40,000
Office and Telephone	5,000
Miscellaneous	1,500
Sub Total	**57,475**
Total	**162,660**
Land Building and Financ	**£**
Rent & Rates	6,000
Average Finance	7,922
Sub Total	**13,922**
Total Fixed Costs	**176,582**

Building and Infrastruct	£
AD Digester	270,000
Separater	0
Feedstock Storage	50,000
Digestate Storage	75,000
Grid Connection	60,000
Start/Backup boiler	20,000
Water Connection	
Goundworks	45,000
Reception building	
Siliage clamp	10,000
Weighbridge	5,000
Grease Trap	
Wheel Wash	
Roadways	5,000
District Heating System	
Mixing Pit	
Noise reduction	5,000
Project Development	30,000
Professional costs	20,000
Grant Assistance	
Total AD & Connection	**£595,000**
Machinery Capital	**£**
CHP Generator	155,000
Cables and Pipes	0
Heat Exchanger	20,000
Biogas Scrubber	
Fencing	
Depackaging	
Cleaning Technology	
Degritter	
Odour management	
Front end loader	
Pumps	25,000
Shredder	50,000
Pasteuriser	
Grant Assistance	
Total CHP Costs	**£250,000**

Setup Capital Expenditure Summary	
Total AD & Connection	595,000
Total CHP Costs	250,000
Total	**£845,000**

Figure 3 – Table showing likely capital costs of a 150kW AD Plant

Income Comparison. Figure 4 below compares the likely income streams arising from the 2 options currently under consideration.

SUMMARY OF FINDINGS		
Feedstocks	Scenario 1	Scenario 2
Total volume in tonnes	**5850**	**3900**
Slurry - dairy	2000	1000
Farm yard manure	1000	500
Grass silage	2850	
Grass clippings		100
Meadow hay		1000
Baking waste		100
Fatty domestic waste		200
General domestic waste		1000
Dry matter tonnes	1710	1465
Cost of feedstock	57000	7000
Calculations		
Biogas produced m3/yr	**653,000**	**667,578**
Slurry	38,000	19,000
Farm yard manure	45,000	22,500
Grass silage	570,000	
Grass clippings		17500
Meadow hay		426121
Baking waste		65100
Fatty domestic waste		25303
Domestic waste		92054
General Information		
Digester size m3 (40 days)	650	430
Electrical capacity	149	152
Thermal capacity	187	191
Finance		
Elec generated kWhe	1,306,000	1,335,157
Elec generated for plant	35,100	23,400
Elec generated for sale to grid kWhe	1,270,900	1,311,757
Elec displaced for business	0	0
Elec income £ FIT - August 2011 figure	**217,324**	**224,310**
Elec income £ ROC	**116,542**	**120,288**
Heat generation kWt	1,369,030	1,675,622
Heat displaced kWt	1,098,150	122,667
Heat saving £	10982	11,227
Heat income via RHI £	74674.2	76341
Digestate		
Digestate value £	13,884	10,218
Digestate land required ha for NVZ	140	94
Total Digestate m3	15,440	3,630
Income		
Total FIT+Digestate+Heat saving £	**242,190**	**245,755**
Total ROCs+Digestate+ Heat saving £	**141,408**	**141,733**
Total FIT+Digestate+Heat saving+RHI £	**316,864**	322,096
Direct use of energy		
Houses supplied with electricity	350	360
Houses supplied with gas	130	130

Table 4 – Income Comparison of the 2 AD options

Internal Rates of Return. The study model assumes a 9% return on capital in order to ensure that investors are paid a rate of return that was attractive compared with other forms of investment.

Total Capital Expenditure	£845,000	
Internal Rates of Return	**Internal Rate of Return**	**Return on Capital**
At 5 years	-20.1%	9.0%
At 10 Years	**5.1%**	**9.0%**
After term of loan (10 years)	**5.1%**	**9.0%**
At full depreciation period (20th year)	**13.0%**	**9.0%**
At 20 Years	**13.0%**	**9.0%**

Table 5 – Internal Rates of Return

Funding Options. In addition to applying for grants from various bodies, which may include: the Anaerobic Digestion Loan Fund (ADLF), Round Table, Rotary Club, Freemasons, EDF Green Energy, Cumbria Waste Management Environment Trust, Shanks, Brampton Parish Council and various Community Sustainable Energy Funds (CAfS, EST, LEAF, Green Deal and Envirolink), it is likely that the management team will wish to form an IPS company in order to offer shares to members of the community to raise the bulk of the capital. The remainder would probably be secured as a long term loan from the Charity Bank who are generally supportive of the project at this early stage.

RAID

The Risks, Assumptions, Issues and Dependencies associated with this project.

Risks: Generic risks for energy related projects include: changes to legislation affecting FiTs, ROCs and the RHI: adverse environmental impact assessments: planning delays and finance shortfall.

Risk reduction for Brampton AD will be achieved through adopting good management principles, encompassing:

- Early and honest dialogue with official organisations such as the local authority and the EA
- Wide and regular consultation with all stakeholders, including members of the community as well as potential competitors.
- Technical support will be sought from academic and other institutions offering advice to community organisations.

- Wherever possible avoid dependency on grant aid, particularly from the EU, which is associated with much red tape.
- Adopt rigorous and transparent management procedures, using the Trust's management systems.
- Create a small core management team to conduct day to day business but be able to call on other advisors with specialist skills, as needed.

Specific risks associated with Brampton AD include:

- Failure to achieve community support for the project
  solution: a successful community share issue should be the top priority

- Contamination by or underperformance due to poor feedstock
  solution: install suitable monitoring systems

- Failure to raise sufficient capital
  solution: increase period or value of loan

- Failure to achieve required quantity of feedstock
  solution: engage with community to provide alternative domestic supply

Assumptions. This Project Outline assumes that**:**

- Full Landowner support can be negotiated.
- Effective partnerships will be forged with the Local Authority and appropriate stakeholder organisations.
- The Community Share issue will raise about 25% of the capital requirements (~£200K).
- Access to sufficient feedstock exists within 5 miles of the plant location.

Issues. Issues that may need to be addressed over the course of this project include:

- Land ownership and attitudes.
- Objections and objectors.
- Competitors and competition.
- Time and resource limitations.
- Insurance and legal claims.

Dependencies. The project will depend on:

- Admin and management support from B&BCT and SB, particularly seed-corn funding until the shares prospectus is launched.

- The Charity Bank for repayment of the loan element and for additional funding if necessary.
- The Local Authority for planning permission and access to additional land.
- The EA for agreement that the environmental safeguards are adequate.
- The Transport Authority for resolving vehicle access issues.

Conclusion

This Project Outline will be held on the web-based BBCT filing system at http://bramptonandbeyond.org/ which has public access. Updates will be published as and when necessary.

After Terms of Reference for Brampton AD have been drafted, it will also be lodged in the same online repository.

12 Jan 12

TBJ COOMBE
Chair
Brampton AD

Distribution:

All those named (by email only)