Summary of Engagement Activities

Somerset Biomass Options Project

May 2015 to March 2016

Sally Mills

Contents

Energy for Nature: Somerset Biomass Options Project– Stakeholder Meeting #1

12th June 2015

Meeting notes compiled by Lynne Osgathorpe & Sally Mills

Attendees

Lynne Osgathorpe (LO) – RSPB
Sally Mills (SM) – RSPB
Richard Bradford (RB) – RSPB
Steve Hughes (SH) – RSPB
Ray Adlam (RA) – Farmer
David Banwell (DB) – Farmer
John Banwell (JB) - Farmer
Lynne Mundy-Pittman (LMP) – AB Systems
Faisal Salam (FS) – Natural Synergies
David Wynne (DW) – AB Systems
David Leach (DL) – SWT
John Leece (JL) - FWAG

Items discussed

N.*B. These notes only provide a summary of the key points and issues raised during the meeting*

1. *DECC* (SM, DW & FS)

General

- The final reports are still to be finalised from each of the DECC applicants and it is hoped that these will be concluded by the end of June and signed off by DECC. Redacted versions of these will then be available for circulation.
- We now have a portfolio of techniques for processing different biomass types and moisture content, these can be applied to different situations depending on habitat types, amounts and energy need.
- Some of the analysis work is still to be completed and this will influence our final conclusions about how biomass types will be processed. This is particularly in relation to materials with high mineral content, which may need to be de-mineralised before sold for combustion in the retail market, as these can create high emissions.

AMW-IBERS (SM)

- The work initiated by AMW-IBERS up in Scotland has progressed well, although there are still a number of areas that need further trials.
- Jonathan of AMW is currently applying for funding through the Scottish Local Energy Challenge Fund to continue the work started through DECC. This fund is particularly looking at ways to provide community energy, and Jonathan is looking to utilise both anaerobic digestion and combustion.
- It has been very beneficial to have projects with cover either end of the UK.
- AMW and AB Systems have been sharing ideas and machinery and have worked together well through the latter stages of the DECC project and this will continue.

AB Systems (DW)

- The project has enabled to development of efficient and effective harvesting machinery for difficult wetland situations. Both double chop and precision chop can be achieved.
- Through their DECC project they've established that there are three main types of material to work with, depending on wetland type and accessibility:
    - Winter - dry dead material, eg common reed – more cost effective to produce a dry, chopped feedstock
    - Summer –dry material through wilting or using AgBags, but this requires storage capability and the need to house bags on site.
    - Summer – green material, most suitable for anaerobic digestion

- If utilising the material close to the production site despite its low bulk density, the use of dry, loose material is far more cost effective and carbon efficient that using briquettes or briquette wafers. Compaction in the form of briquettes only needs to be used if the material is to be transported for long distances.
- Some issues have been identified with burning the material due to its high mineral content causing problems with ash and clinker production in some types of biomass boilers. However boilers that can take the material and burn it efficiently are available, such as though supplied/installed by the company BGI:

  http://www.b-g-i.co.uk/awkeco-biomass-boilers.html
- AB Systems currently working with BGI to undertake burn trials and the utilisation of different feedstocks, such as rush and reed. So far the boilers have dealt with the unconventional material very well with no problems. Results of the emissions and by-products are being undertaken by BGI and are expected in the next few weeks.
- Precision chopping of the material is important and increase the markets for the products.
- Soon to be starting commercial work with three landowners; combination of landowners wanting rid of material and some are keen to use the material.
- Keen to be able to undertake harvesting work, with the capability of storing the material in AgBags depending on the designated afteruse.
- Marketing the material is still very new and lots to learn.

Natural Synergies (FS)

- Through the DECC project have developed a medium scale horizontal anaerobic digester, which is using a wet anaerobic digestion (AD) process.
- Lots of learning has been around the material itself and how to process it and get it into a form that can then be utilised due to its composition.
- AD needs precision cut material to enable the feed mechanism to be more efficient and to avoid secondary processing.
- Currently applying for funding to keep the AD unit and more trials on material, beyond that from wetlands. Two main interests depending on focus of funders:
    - Looking at a greater range of materials (e.g. to other materials relevant to farms).
    - Looking at the efficiency of producing gas from a range of typical feedstocks.
- In Natural Synergies' experience, EA classification of wetland material as a waste would mean a permit is required for commercial enterprises. They currently operate under an exemption. However the EA do tend to look favourably on material that is considered as a low risk, which wetland material is.
- It is felt that there will be a need to mix other materials with those from wetlands to increase gas production and so enable a faster payback. These materials could be in the form of slurry, other agricultural materials etc.
- In comparison to more conventional feedstocks such as maize, wetland material doesn't produce large amounts of gas so there's potentially a long payback period – depending on commercial or community set up
- AD biomass to bioenergy needs to be integrated into the landowners'/co-operatives operations, so processing a variety of feedstocks to get maximum efficiency.

2. *Defra* (LO & SM)

- LO talked through the different approaches that the RSPB has come up with to approaching the 'biomass challenge'. This includes taking a Payments for Ecosystem Services (PES) approach to developing a framework which could deliver payments to land managers for their biomass.
- This work has been supported by the DEFRA Pilot scheme which has provided the opportunity to look at the different ways in which biomass to bioenergy could be delivered on the ground.
- From working with stakeholders it has become apparent that having a locally based 'coordinator' who works with the land managers, contractors and buyers is a key element of developing an approach to this problem.
- This coordinator would help deal with the issues surrounding different biomass suppliers, types and seasonal variances. They would need to be local and be aware of the different local scenarios, players and landscape issues. It is felt important that they need to be local with the knowledge of the local landscape.
- The two models presented were: Land Manager Model; Community Model[1]
- The intention is to develop and test the Land Manager Model in the Somerset Levels and Moors area, and to carry out a feasibility study based on implementing it around the Meare and Westhay area.
- The hope is also that this work will help the area to access other funding through which the feasibility around the Community Model can be explored.
- The DEFRA pilot scheme has also enabled the development of a biomass calculator which is designed to assist with the assessment of land and associated biomass to contribute to the delivery of a biomass to bioenergy scheme. This electronic tool makes both financial and carbon assessments and helps the land manager to assess the feasibility of their ideas.

3. *SRA fund update* (RB & SM)

- There was some money left over from the Somerset Flood Action Plan. Some money has gone to FWAG and some to pay for furthering the work around wetland biomass in Somerset. The biomass proposal was based on the first year of a 5-year plan that was originally submitted to Wessex Water for funding but was unsuccessful.
- The biomass work is regarded as part of the long term solution on the Levels.
- £20K has been provided to kick-start the next phase of the work, looking at the Land Manager Model on the ground, and looking at whether additional communities might be interested in the biomass to bioenergy approach.
- The intention is to take the DECC and DEFRA work so far and look at their application on the ground. The project will enable the employment of expertise to look at aspects of feasibility such as what agreements and administrative structures might need to be employed.

4. *Discussion* (All)

- To test the Community Model it would be worth contacting the local Green Groups (Wedmore, Glastonbury) and Parish Councils. Wedmore Green Group has experience of this with their solar park (DB).
- Farmers could potentially sell bales at the farm gate (DB). There are boilers that can burn whole bales, eg Farm 2000, but they are not that refined (DW).
- This could work at a larger scale (DB), need to consider whether we achieve the larger scale through several small/medium scale, which may be more appropriate to rural communities (SM).

[1]For more details about the models and how they operate please see the pdf. of the presentation attached with the email from Sally Mills

- Most material from farms would be dry by autumn so this would allow time to plan who provides how much to which contractor (DB).
- Harvesting and ensiling material near the beginning of the season would also be an option, allowing buffer of material (DB/RA).
- The scheme would need to build in flexibility – wouldn't need long term contracts as in everyone's' best interests to get rid of this material (DB/RA).
- The coordinator would assist with developing continuity of supply and having a specific community system would potentially negate the need for long term contracts (SM).
- Capital grants will soon be available through LEADER+, with c. 40% funding for commercial enterprises and up to 100% for non-commercial (DL & RB).
- Would be worth meeting the local councillors to get them interested in the project and prevent future barriers to project development and delivery in the area (RA).
- SWT are probably going to apply for some INTERREG funding to look at suitable metrics to measure the emissions for peatlands/habitats in the Brue Valley (DL).

File Note

Meeting with Vanessa Becker Hughes from Community Power Limited, Wedmore

6th July 2015

Attendees:

Vanessa Becker Hughes (VBH)	Community Power Ltd
Lynne Osgathorpe (LO)	RSPB
Sally Mills (SM)	RSPB

Vanessa Becker Hughes is the Director of Community Power Limited and was one of the driving forces in the establishment of Wedmore Community Power Limited, who back in 2013 set up a Co-operative to run the installation and running of a solar array in Wedmore.

The meeting with Vanessa was organised to enable RSPB to benefit from the experiences and lessons learnt undertaking this project so that they could be applied to the Biomass to Bioenergy work looking to be initiated under the Somerset Rivers Authority project. There was particular interest in the way the project had been set up, administered and which model of approach had been used. The meeting was found to be very relevant and informative, with many transferable lessons between the two projects.

These notes provide a summary of the discussions, key points and issues raised during the meeting.

1. Model

- Wedmore Community Power Cooperative Ltd was set up by VBH and business partner Robin Mewes, who both run Rooftop Consulting, a company that focuses on the installation of Solar PV on community buildings. The cooperative model was selected as it was felt that it had the values and the principles need to enable a community to all work together to deliver a renewable energy scheme.

- Every member of the Cooperative has an equal vote, regardless of how many shares they have bought.

- The Cooperative has a board meeting every 6 to 8 weeks.

- With a total of 6 on the board, 2 are made up from public share holders who are members are voted on at the AGM, with a maximum term of 2 years.

- The Cooperative owns the scheme and all the associated infrastructure.

- The cooperative has a sub committee that proposes how the excess money generated is spent, which is then put to the vote at the AGM.

- Community Investment Company structure may also be relevant and should be considered alongside the Cooperative approach. Their relationship to the Enterprise Investment Scheme will also need to be considered – as mentioned below.

- For all models community and public engagement is a central part of a successful project. Reassuring doubters about such 'green' ideas and dealing with any potential objectors early on through adaptation of proposals, additional information and more detailed consultation can ease planning.

2. Administrative Structures

- VBH stressed the importance of ensuring all relationships, agreements are set up legally, and particular reference was made in relation to leasing of land necessary for the scheme operation. Although the landowner may later become part of the cooperative, any land leased from him is done as a separate legal transaction, so that if personalities change then all the necessary agreements are in place. This all needs to be set up legally through solicitors and the costs built into the model adopted.

- Need to consider all the hidden cost and implications, such as planning permissions, council tax and rates. Another major consideration, if necessary is a grid connection and the ease of access, to reduce expense for a connection to be set up.

- VBH discussed the need for a coordinator for a biomass to bioenergy project, as it would be more complicated than a solar array, with material being brought in a processed and then by-products needing to be dealt with, such as digestate in the case of the anaerobic digestion process.

3. Finance

- Community Power Limited under wrote the whole scheme until it was up and running. This meant that the scheme could be delivered in 12 months, rather than over a much longer period, which would be needed to accommodate the time delay caused by income generation.

- The right financial model needs to be selected to provide the best return, which is tight and uncomplicated. If you are looking to raise lots of money (£1 million +) then shares through a Community Interest Company (CIC) would be a sensible option; bonds would be more appropriate for raising smaller amounts (<£1 million) and wouldn't require a co-op structure.

- In the case of the RSPB they could simply raise money through the sale of Bonds, which offer a rate of return, eg 4%, which can last for 2 to 5 years. All bonds are then paid back after 5 years and then

the project would be owned by the RSPB. Bonds can be made available to locals, RSPB members, or the general public – enabling people to make a 'green' investment and widening the pool of potential investors.

- Money can be raised via a share offer, which in the case of the Wedmore project offered 800,000 shares at £1 a share. Investors can by as little or as many as they like. These shares then offer a rate of return which may be increased through the life of the project, depending on the income generated over its term.

- All share holders then become a member of the cooperative.

- Look at government incentive schemes such as the Feed in Tarriff (FiTS) as the back bone of scheme financing. Once a proposal is put in place this can be registered with the incentive schemes such as FiTS and then the rate of tariff can be frozen for 6 months. This helps with planning the finances and the rate of return that can be offered to investors.

- In addition to the percentage interest paid back to investors the Wedmore project has a community grant scheme, which offers sums of money for community projects each year. This is delivered through applications from the community being made to the cooperative for projects, which are then considered by the board. The amount offered through this grant scheme will depend on the amount of income generated.

- Although the share offer and cooperative approach is far more complicated than a simple 2 to 5 year bond offer, the former can deliver many more benefits. The cooperative approach provides links to the local community and brings the community together.

- The bond offer for the RSPB would be simple and straight forward and as a reputable organisation would have the profile and credibility to de risk and attract investors. However the RSPB would stand alone.

- The cooperative and share offer approach would bring the RSPB into the community and as part of that community. They would be associated with and the driving force of a scheme that brought significant benefits to the community through areas such as a reduction in the reliance on fossil fuels and income generation which benefited the local economy.

4. Research

- In order for a project like this to succeed it needs to be built on thorough research and have good financial foundations.

- There needs to be a confidence about the return on investment, which can be sold to interested parties.

- Looking at the economic modes at the outset can be a good starting point and a guide as to how the project may or may not operate.

- Surveys of public opinion of the project prior to applying for planning permission are important

5. Enterprise Investment Scheme

- The Enterprise Investment Scheme (EIS) is an opportunity for investors to get an amount of tax back. For the first £150,000 of the share offer 50% of the investment can be claimed back of the investor tax liability should it be up to that amount. After this the return drops to 30%. This scheme is a good opportunity to attract investors who pay tax. Projects must meet a set of specified criteria - how this scheme could be used to help incentivise the project ideas going forward should be explored further.
  https://www.gov.uk/government/publications/the-enterprise-investment-scheme-introduction

6. Actions

- VBH to send SM and LO an example of a bond offer document, to accompany the share offer document already received so that comparisons can be drawn between the two approaches.

- LO and SM to assimilate all information in the light of their project proposal and consider whether a further meeting with Community Power Limited once Robin Mewes has returned from holiday would be beneficial.

- VBH very supportive of the idea and likes its innovation and will consider any potential future role of Community Power Limited to help it progress.

- LO and SM to continue to develop project ideas and look to complete some simple financial projects in to the various options available

Qube Renewables Meeting

13th July 2015

Meeting notes compiled by Lynne Osgathorpe & Sally Mills

Attendees

Lynne Osgathorpe (LO) – RSPB
Sally Mills (SM) – RSPB
Mark Clayton (MC) – Qube Renewables
Jo Clayton (MC) – Qube Renewables
Lynne Mundy-Pittman (LMP) – AB Systems
David Wynne (DW) – AB Systems

Apologies: Ray Adlam – Lilac Farm

Qube Renewables are a Somerset based medium sized company who specialise in rapidly deployable anaerobic digestion (AD) systems. They take a modular approach which means that systems can be easily designed specifically to cater for the requirements of individual applications. The technology they use is simple, compact and robust and for those reasons particularly, would seem to suit the requirements for dealing with nature conservation biomass. This meeting was set up as an exploratory meeting to see if the Qube Renewable approach of 'plug and play' could provide the basis for using anaerobic digestion as a way to convert biomass off reserves into energy.

Items discussed

N.*B. These notes only provide a summary of the key points and issues raised during the meeting*

5. Background

- DW explained that the reason why he was interested in hearing about the Qube technology was to deal with the 'wet' material that it was not efficient to combust.
- SM presented the reasons for the RSPB's interest in Qube Renewables, after first learning about it and seeing it through the AMW-IBERS project delivered through the DECC programme. RSPB are currently looking at ways to deliver biomass to bioenergy both on their reserves and within local communities. They are looking to identify an AD system that could be used both on the RSPB estate but also as part of a landscape approach, which can be trialled in one area and then replicated in others.
- MC asked whether the main drivers for the RSPB were in utilising their material or in energy generation. SM replied that definitely the former, but also the latter with the aspiration to generate their own heat and power – which had the additional financial incentive.

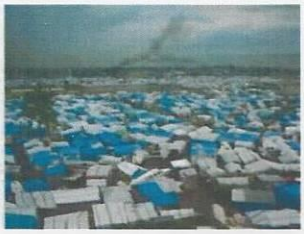
6. Qube Renewables

- MC and JC both talked through and displayed videos on the different technologies provided by the company. Specifically these were in the from of:
    - BioQube – a modular anaerobic digestion system developed through the use of shipping containers. A 20ft container is a 16m^3 system and a 40ft container a 32m^3+. Both sizes can be run individually or in series. Running together is achieved through gravity, to avoid the use of pumps and so the length of the series can be in part determined by the height difference required. Typically 5 modules are placed together, but can be up to 7.
    - QuickQube – based on the same principles, but is a flexible bag, which can be assembled in 45 minutes and is made of a fabric guaranteed for 10 years, these range from 20m^3 up to 300m^3 and occupy a 5m^2 and 15m^2 space respectively. The flexible bladder keeps the liquid digestate at the bottom and the gas rises to the top. Only the radius of the bladder increases in size, the height remains the same.

bioQUBE

Tel: +44 (0) 1984 624989 **Fax:** +44 (0) 1984 623912
enquiries@quberenewables.co.uk **www.quberenewables.co.uk**



Welcome to QUBE Renewables. Our technology converts biodegradable wastes to energy, and provides heat, power and sanitation.

bioQUBE is our containerised digestion system housed neatly in units built in standard 20ft ISO shipping containers, ready to plug and play.

The system is modular, so more units can be added to accommodate the wastes available for digestion.These could include waste food, arable crops, sewage and manures, amongst others. The biogas produced can be used for heating, cooking or transport. The biogas can also be used as a fuel in one of our powerQUBEs, which are combined heat and power generators specifically designed to run on biogas.

We design and fabricate the full system off-site based on individual client needs such as the site layout and waste types. The bioQUBE configuration is delivered by road transport and within a few hours can be installed and ready for commissioning and waste acceptance. The system requires minimal daily care, with the main control run remotely via a GSM connection (optional extra) to a computer or phone.

No. of bioQUBES	1 to 2	2 to 3	3 to 4	5+
In CHP Operation				
Electricity kWh per year	19,200	42,000	66,000	90,000
Hot Water (L at 70°C) per year	577,444	1,263,158	1,984,962	2,706,767
Equivalent to Litres per day	1,582	3,461	5,438	7,416
Or for Biogas for heating and cooking				
as kWh per year	61,714	134,999	212,142	289,284
as Megajoules per year	222,170	485,998	763,711	1,041,424
Or as KM as a transport fuel				
Car based per year	2,880	6,300	9,900	13,500
Motorbike based per year	8,640	18,900	29,700	40,500
Feedstock* tonnes per year based on food waste				
*Other wastes and the number of units will vary	150	300	450	600+

What is anaerobic digestion (or AD)?

Anaerobic digestion is a process in which microorganisms break down biodegradable material in the absence of oxygen. It is used in industry and for domestic purposes to manage waste and to produce energy. It is basically the same reaction that occurs in a cows stomach - the production of methane that cows do so efficiently, is captured in anaerobic digestion as biogas so that it can be used as a fuel.

The process of anaerobic digestion does not reduce the volume of the waste; what goes in must come out but as a semi liquid fertiliser (digestate) which has lost none of the nutrient value.

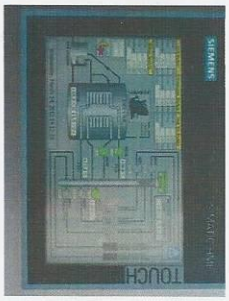
Anaerobic digestion not only produces energy but it also sanitises wastes removing pathogens.

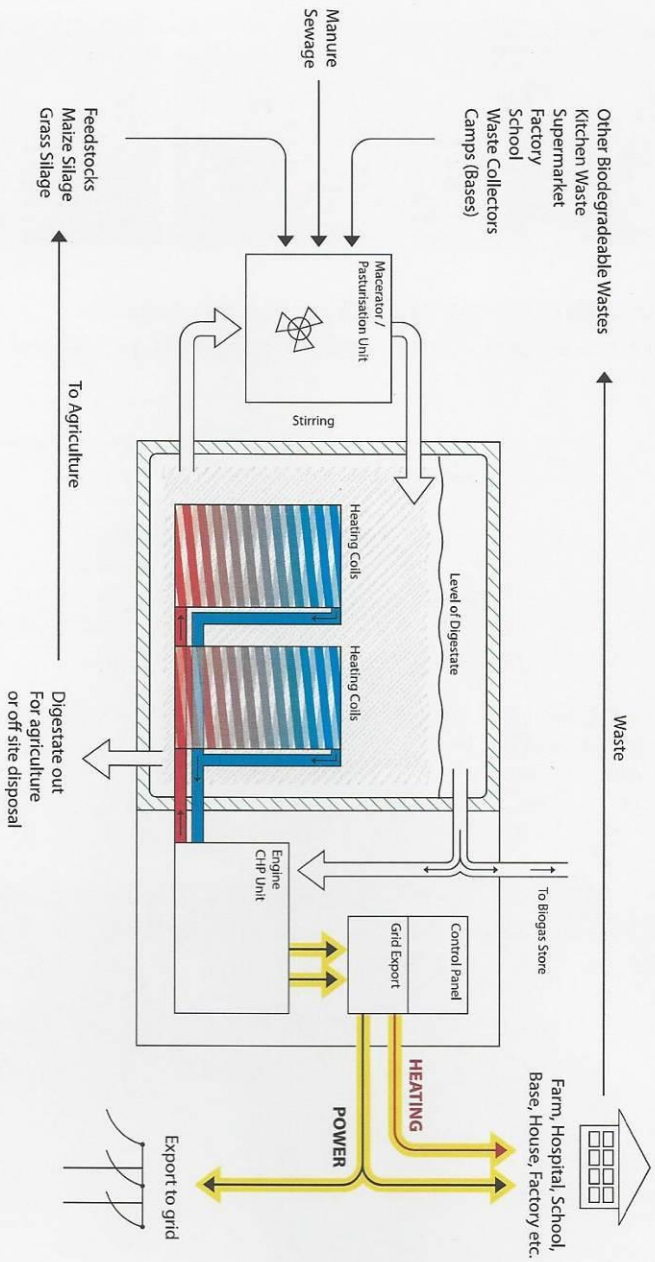
bioQUBE is for you if you are:

- A landowner that wants to produce your own energy and export excess to the grid
- A waste producer that collects wastes or produces wastes
- The military with bases and more remote outposts
- Involved in humanitarian programme work for sanitation and energy.

bioQUBE

Tel: +44 (0) 1984 624989 Fax: +44 (0) 1984 623912
enquiries@quberenewables.co.uk www.quberenewables.co.uk





bioQUBEs are

- ✓ Rapidly deployed
- ✓ Plug and Play system
- ✓ Compatible with existing grids
- ✓ Robust
- ✓ Cost effective
- ✓ And provide sanitation

+44 1984 624989 enquiries@quberenewables.co.uk www.quberenewables.co.uk #quberenewables

QUBE Renewables Ltd, Higher Ford, Taunton, Somerset, TA4 2RL, United Kingdom

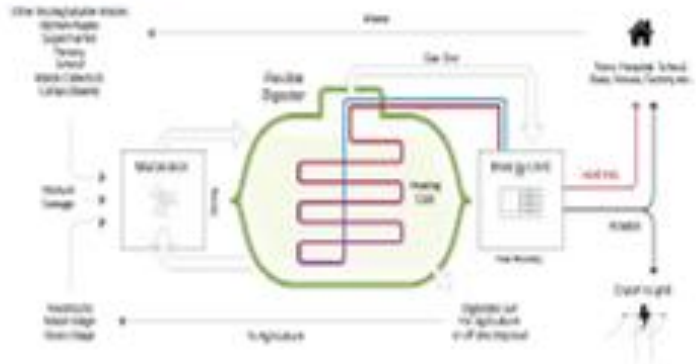
quickQUBE

quickQUBE is the rapid deployment version of bioQUBE designed to sanitise waste and create biogas for a variety of uses such as heat, power or transport fuel - quick, efficient, simple.

Digestion and gas storage occur in a flexible unit which is light, strong and quick to deploy.

Heating and stirring are controlled within the digestion space to retain the optimum conditions for biogas production, as well as achieving the necessary retention time.

Built with varying diameters to allow for the required digestion volume (from 5m^3 to 313m^3), the quickQUBE is never more than 2m in height therefore making it visually acceptable in many situations.



Biogas Production

The waste stream (including human sewage) can be sanitised while being turned into a valuable fertiliser, and can be used to produce biogas for energy in the same simple unit.

quickQUBE can provide any of the following:

- ✓ Biogas for cooking and lighting
- ✓ Biogas for energy generation in the form of electricity and hot water when used in conjunction with a powerQUBE unit
- ✓ Biogas that can be upgraded and then used as a vehicle fuel

Who is it for?

- ✓ Designed for use in the UK where small scale, cost effective anaerobic digestion is required to provide heat, power and waste disposal savings. Energy generation can be eligible for UK FIT and RHI subsidies.
- ✓ Also suitable for use in overseas Emergency Humanitarian Response and by NGOs as part of planned development programmes where light and cooking fuels are needed as well as a requirement to sanitise waste.

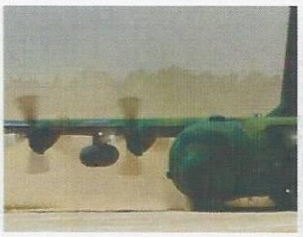
QUBE renewables

QUBE Renewables Ltd
Higher Ford, Wiveliscombe,
Taunton, Somerset TA4 2RL
www.quberenewables.co.uk
enquiries@quberenewables.co.uk
Telephone: +44 (0) 1984 624989

quickQUBE

Tel: +44 (0) 1984 624989 **Fax:** +44 (0) 1984 623912
enquiries@quberenewables.co.uk **www.quberenewables.co.uk**






Welcome to QUBE Renewables. Our rapidly deployable anaerobic digestion technology converts biodegradable wastes to heat, power or transport fuels as well as providing sanitation.

quickQUBE is the rapidly deployable version of bioQUBE, the containerised Anaerobic Digestion (biogas) solution.

The quickQUBE technology has packaged up the process control and energy recovery systems into two standard NATO pallets for easy transportation and deployment. Once at the site the plastic membrane is unfolded to become the digester space and gas holder, allowing the quickQUBE to be plugged in – simple, quick, efficient.

Typical Outputs for our range

System Size	40m³	80m³	160m³	200m³
In CHP Operation				
Electricity kWh per year	19,200	42,000	66,000	90,000
Hot Water (L at 70°C) per year	577,444	1,263,158	1,984,962	2,706,767
Equivalent to Litres per day	1,582	3,461	5,438	7,416
Or for Biogas for heating and cooking				
as kWh per year	61,714	134,999	212,142	289,284
as Megajoules per year	222,170	485,998	763,711	1,041,424
Or as KM as a transport fuel				
Car based per year	2,880	6,300	9,900	13,500
Motorbike based per year	8,640	18,900	29,700	40,500
Feedstock* tonnes per year based on direct sewage (non-western)				
*Other wastes and the number of units will vary	150	300	450	600+

Emergency Humanitarian Response

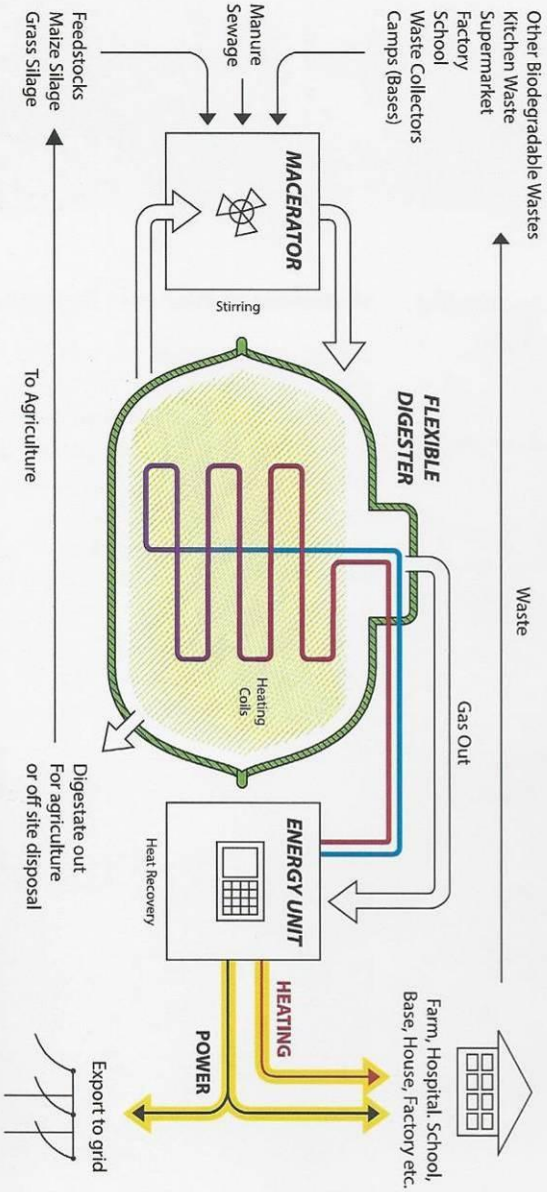
Conflict creates a mass movement of people to a neighbouring country resulting in urgent aid being required. 5000 people are without sanitation and fuel for cooking, power is needed for running the camp medical and communication centres. quickQUBE can be deployed on a plane to site within 48 hours, and be up and producing biogas within 10 days of arrival, processing the camp's human waste in to energy in either wet or dry digestion techniques.

Local Energy and Sanitation

As part of a planned development programme, light and cooking fuels are needed to improve education and prevent further deforestation. quickQUBE can be installed as part of the development programme with the additional benefit that sanitation is also improved.

quickQUBE

Tel: +44 (0) 1984 624989 **Fax:** +44 (0) 1984 623912
enquiries@quberenewables.co.uk **www.quberenewables.co.uk**



What is anaerobic digestion (or AD)?

Anaerobic digestion is a process in which microorganisms break down biodegradable material in the absence of oxygen. It is used in industry and for domestic purposes to manage waste and to produce energy. It is basically the same reaction that occurs in a cow's stomach - the production of methane that cows do so efficiently, is captured in anaerobic digestion as biogas so that it can be used as a fuel.

The process of anaerobic digestion does not reduce the volume of the waste; what goes in must come out but as a semi liquid fertiliser (digestate) which has lost none of the nutrient value.

QuickQUBE will provide biogas for a combination of the following:

- Cooking
- Lighting
- Upgraded for vehicle fuel
- Or put into a combined heat and power (CHP) generator to produce electricity and hot water.

If the biogas is being used in a CHP generator it can be operated in two modes:

- In 'island mode' where the CHP unit operates independently from the grid and supplies power locally
- In 'grid mode' where the unit is synchronised with the grid with the correct fail safes; the unit will automatically top up with electricity from the grid or export to the grid depending on demand.

Did you know?

Sewage waste from 1000 people in a year, is enough to run 5436 electric kettles for 1 hour or provide fuel for cooking for 500 people for a year?

quickQUBE is designed to: -

- ✓ Be involved in disaster recovery or humanitarian relief.
- ✓ As part of planned in-country support where sanitation is needed, as well as energy for cooking, lighting and/or power.
- ✓ Part of low cost energy supply for isolated communities.

powerQUBE

Tel: +44 (0) 1984 624989 **Fax:** +44 (0) 1984 623912
enquiries@quberenewables.co.uk www.quberenewables.co.uk




Welcome to QUBE Renewables. Our powerQUBE technology uses biogas from anaerobic digestion to generate electricity and hot water in a combined heat and power generator (CHP), neatly packaged in its own pod.

Both of our Anaerobic Digestion systems - bioQUBE and quickQUBE - produce biogas which can be used as a fuel in a combined heat and power generator to supply electricity and hot water.

powerQUBE is our small combined heat and power (CHP) generator, neatly packaged up into its own self-contained pod, complete with control panel, connections and noise attenuation.

Key features of powerQUBE are:

- Packaged plant for easy transport, deployment and use
- 100% biogas including being able to start on biogas alone
- Pre configured with heat and power take off points
- Power generation linked to grid connection or as island mode
- Robust and efficient technology up to 30% electrical with additional 50% heat recovery (hot water)
- Size range from 3.2kW to 30kW electrical
- powerQUBE can be used very easily with other anaerobic digestion biogas system.

What is biogas?

Biogas is produced by the process of anaerobic digestion; this is when biodegradable matter is broken down by bacteria in the absence of oxygen.

It comprises primarily of methane (CH_4) and carbon dioxide (CO_2). This gas can be combusted, and used as a fuel for a CHP generator.

What is grid connection or island mode?

The electrical set up in the powerQUBE system can operate in two modes:

- In **island mode** the powerQUBE is not connected to the local electricity grid, and supplies heat and power locally.
- In **grid mode** the system is connected to the local electricity grid to allow export. Generation is synchronous with the grid supply with the correct fail safes. The unit will automatically top up with electricity from the grid or export to the grid depending on demand.

powerQUBE

Tel: +44 (0) 1984 624989 Fax: +44 (0) 1984 623912
enquiries@quberenewables.co.uk www.quberenewables.co.uk

The **powerQUBE** unit generates electricity and hot water from biogas and is packaged in a neat pod.

Standard Specification

- Water Cooled cylinder head
- Water cooled exhaust gas heat exchanger
- Overheating protection via secondary circuit pump and radiator
- Wet sump lubrication for long service intervals
- 12 volt starter with 12 volt gas shut down solenoid, energised to open
- High inertia fly wheel
- Engine control unit (ECU)
- Single or three phase AC 230/400V generator
- Generator protection
- Fuel use 0.8m3/kW/hr based on 55% CH4
- Gas safety and sensing auto shut down
- Control panel and engine monitoring

Optional equipment

- Grid tie to link generator with grid, as per country specification
- Multiple generator synchronisation (daisy chain)
- Load share system
- Gas clean up system

PowerQUBEs are

- ✓ Modular
- ✓ Quiet
- ✓ Plug and Play
- ✓ Provide energy locally or to the grid
- ✓ Compatible with QUBE digesters or other biogas systems

+44 1984 624989 enquiries@quberenewables.co.uk www.quberenewables.co.uk #quberenewables

QUBE Renewables Ltd, Higher Ford, Taunton, Somerset, TA4 2RL, United Kingdom

7. Application to wetland material

- Discussions around the feed systems necessary to cope with wetland material. Once the material has been harvested a small as possible, ideally less than 8mm, then the system would need material to be macerated to less than 1-2mm particle size in a liquid form.
- It was anticipated that it would spend around 4 days in a hydrolysis unit, before being moved to the digester.
- The feed should probably be in the region of 8% dry matter (compared to the AMW 2%)
- Discussions around screw-pressing the material were had and it was thought by MC that due to the low gas yields of the material that it was preferable to put the whole biomass through the system rather than just the liquid fraction.
- It was then considered that the resulting digestate could still be pressed and the solid fraction remaining could then be briquetted and combusted. This material would be passed through a screen to screen out the solids, before they were pressed and dried.
- For the wetland material a 40 day retention time was anticipated
- Nutrients would be regularly added to the system to aid digestion.
- The possibility of moving units between reserves over the year was considered. MC explained that there would be a down time of 20 days after each move to allow the system to build up again and to get the microbes working. It could also be very expensive to move the equipment around due to the logistical requirements.
- Discussions were had around bottling the gas for use in vehicles etc, however this is considered as an expensive option with the gas cleaning set up at around £70K.

8. Site Visit – see photographs below

- Visit to see a BioQube and QuickQube in operation running at a local farm on horse manure, this system runs 10 hours a day (not run at night, due to planning restrictions).
- This system is run on a T24 exemption without the requirement for any bunding due to its operation under an exemption.
- Discussions around bunding were had and it was felt with an on farm system this could soon be dealt with, with all material being channelled into the slurry lagoon all contained in a simple bunded system made of concrete road barriers and a liner.
- This system was made up of a 20ft BioQube and a 20m3 QuickQube and takes 100kilos of horse manure a day (one barrow equivalent to 25kilos) and produces around 25kW of electricity a day.
- The heat is recycled back into the system to keep the AD warm.
- Feed systems were discussed and the use of macerators and conveyors would be considered, there are a number of established systems on the market that can be utilised. It would be fully automated.
- All Qube systems can be controlled and regulated electronically by Qube Renewables.
- Qube offer the technical assistance needed once the system is installed and would work with RSPB/communities to ensure the AD set was being maximised.

9. Actions

- MC happy to undertake modelling for the RSPB, this can either be done starting with a financial position or a tonnage, from each approach a system to suit RSPB needs can be developed.
- SM to provide MC with data on wetland material and energy usage so that he can model and costs an application to suit RSPB/conservation needs in Somerset.
- SM and DW to look into trialling the material from the Ouse Washes in a Qube Renewables set up to be installed at British Sugar Lakenheath in September 2015.


GVCT


quickQUBE


BE

QUBE renewables

Indicative Price List $_{V2}$ – January 2015

	Item	Unit Costs
	BioQUBE	
1	Primary Digester 16m^3	£56,671
2	Secondary Digesters 16m^3	£41,271
3a	Blend Tank 1m3 capacity standard non macerator pump	£17,268
3b	Blend Tank 4m3 capacity standard non macerator pump	£20,768
4	Fluids (Gas and Liquids) handling skid (per 4 digesters)	£10,761
5	Gas Store 18m3 bladder (PVC Type)	£3,900
	powerQUBE	
6	CHP 30kW	£40,000
7	CHP 15kW	£30,000
8	CHP 10kW	£25,000
9	CHP 7kW	£19,500
10	CHP 3.5kW	£15,000
	QuickQUBE	
3a	Blend Tank 1m3 capacity standard non macerator pump	£17,268
3b	Blend Tank 4m3 capacity standard non macerator pump	£20,768
11	5m^3	£53,193
	15m^3	£57,270
	20m^3	£60,465
	55m^3	£80,734
	107m^3	£100,422
	158m^3	£135,888
	200m^3	£147,412
	313m^3	£213,326
For QuickQUBE Add the components above: item 3 - feedstock dependent, 6 - 10 - CHP is output dependent		
	Optional Items	
9	Pasteuriser (indicative price depending on flow rate)	£13,000
10	Separator (indicative price based on volume/process requirements)	£9,100
11	Digestate Store 12m3	£2,400
12	Digestate Store 12m3 bunded	£3,500
13	Debagger/depackager (indicative but costs for 0.5 tonnes per hour)	£20,000
14	Biomethane Upgrade Plant	£POA

QUBE Renewables Limited, Higher Ford, Wiveliscombe, Taunton, Somerset, TA4 2RL
Telephone: 01984 624989, Facsimile: 01984 623912

15	Flare flow rate of 10m3/hour	£9,500
16	Install and training per digester (UK)	£POA
17	Shipping	£POA
18	Extra warranty per year	5% of installed costs depending on install

Prices EX VAT, Delivery and Installation

QUBE Renewables Limited, Higher Ford, Wiveliscombe, Taunton, Somerset, TA4 2RL
Telephone: 01984 624989, Facsimile: 01984 623912

Wyke Farms Anaerobic Digester meeting notes - 25th September 2015

Plant set up in September 2013, predominately to take the waste materials from their businesses. These include the pig and cow slurry and materials from the cheese making process. The system is made up of three 4,600 cubic metre digester vessels, from which they use the gas to supply a combined heat and power unit which generates electricity for their operations, with any spare gas being cleaned and fed into the gas grid.

The first two vessels are the primary digesters, which feed into the third for the final digestion.

The system is predominately liquid feed, in the form of slurry, but approximately 20 tonnes a day of other materials such as silage and straw is combined. Bread waste, apple pumice, and grain, the latter to aid digestion are also used. The retention time is around 60 days.

The plant is capable of producing 800m^3 of gas and 1MW of electricity when operating to its full capacity

The solid feeds are fed into a large mixer approximately 8m x 2m, which are then released via a trap door on to an augur. This feeds the material into a pipe, where it is mixed with the liquid feed before being macerated and fed into the digester.

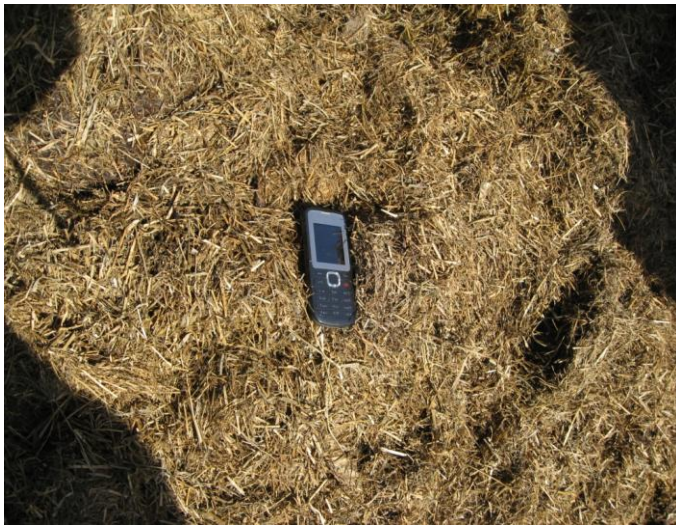
Pipe feed into the macerator and then on into the digester.

Solid feeds currently being used

Straw

Straw

Silage



Silage

Straw

Storage

Visit to see a Farm 2000 boiler
Fordgate Farm Bridgwater
2nd November 2015

Boiler location, in outdoor barn, with a solid end wall and enclosed on 2 sides by bales and open at one end, as illustrated below.

The boiler was a Farm 2000 Big Bale Batch Boiler, model BB154, which is located at Fordgate Farm and used to provide heat and hot water to six 3 bedroom houses (considered to have medium levels of insulation) and occasionally an indoor pool. It was installed in September

The boiler is fuelled using bales of oilseed rape and linseed oil, which are bought it by the farmer. Originally he intended to use potato boxes – a waste from his current business, but preparing the material to be burnt was found to be too time consuming.

The quality of the fuel is very important, particularly from a boiler performance point of view but also from the perspective of the needing to refuel and the efficacy of the combustion – which in turn effects the emissions and smells through the flue.

Last year the farm burnt 130 tonnes of fuel. The bales vary (depending on size) from 150kg to 250kg each.

Fuel use will increase as the weather gets colder and when exceptionally cold (less than -10°C) the boiler can be burning up to 5 bales a day.

Feeding the boiler when it needs more than two bales a day means that it can be a tie as someone needs to be present at the farm.

The boiler is fed by a forklift which simply lefts the bale and pushes it with the forks into the back of the boiler. If the boiler is still alight when loading care needs to be taken that the increase in air once the door is opened doesn't cause a back draft and force flames out. It is better to let the fuel burn right out before loading another bale.

The boiler has a jacket of water around it, which heats up and is controlled by a thermostat; this is currently set to 80°C.

There are two header tanks near the top of the flue.Once the water is heated to 80°C it is then fed into the main tank. The water is held at a slightly lower temperature of 60°C in the main tank and from here it is pushed out to the properties.

Thermostat

Flue with header tanks

Pipes taking water to and from the properties

The boiler is lit easily by hand and the air is supplied by an external fan, which is electric. The fan is set on a timer to coincide with the fuel burn time. If left on the fan will continue to blow cold air once the bale has finished burning.

The fan pushes air through perforated vessels in the boiler. The main one sits up through the middle of the base of the boiler and needs to be replaced annually.

Electric fan providing air.

Perforated air vessel, which sits in the bottom of the boiler,

The whole system cost in the region of £50,000, the underground pipe alone was in the region of £12,000.

Inside the boiler

Maintenance costs annually are in the region of £1,000. All maintenance is undertaken by the farmer himself, however Farm 2000 do provide a good backup telephone service.

Ash removal is undertaken once a week when currently burning 2 bales a day. The amount of ash this creates equates to approximately 2 to 3 wheel barrows. The ash has to be shovelled out by hand using a long handled shovel. This reaches the large percentage of it, but for the remainder you have to get inside the boiler, with the appropriate PPE to shovel the rest. Ash can also collect at the base of

Air vents in the top of the boiler need to be cleaned twice a year – which is quite a dirty and difficult job. The frequency of this would increase if the fuel was greater than 15% moisture.

The boiler is registered for RHI, which was originally very expensive to get accredited for, with the meters alone costing £7,000. Costs of running the boiler work out cheaper than buying in oil at 60p a litre, but not at 40p a litre. Linseed typically costs £35 a tonne, with miscanthus coming in at £75 a tonne.

NFU Farm Visit
Manor Farm Dairy, Shepton Mallet
4th November 2015

The 125kW anaerobic digestion system has been set up to deal with the wastes resulting from the dairy farm, namely cow slurry and waste food that is not eaten by the animals during the day.
The AD unit is located adjacent to the cow sheds to reduce handling and movement of material. As a

result all the slurry is pumped and the only material that has to be loaded via a tractor and bucket is the waste animal feed.

The system was set up to serve the farm, owned by John Yeoman, but to operate independently and was the initiative of the previous estate manager Roddy Stanning. The build started in August 2014 and was completed by 23rd December 2014. Jan/Feb 2015 was spent getting the system sorted and by March 2015 it was running at 99% efficient.

The system runs on 40m^3 of slurry and 5m^3 of waste animal feed a day. All the materials are loaded into the outside feeder tank, shown below, the slurry is pumped in and the waste feed put in with a loader.

The outside feeder tank is 7m diameter by 3m deep, circular, with an agitator and made of concrete. This tank has capacity to hold 2 days worth of feed for the digester

Feed in the outside feeder tank

The waste animal feed provides approximately 25% of the gas yield, however 5m^3 of solid material mixed with the liquid slurry is about the maximum that the pumps can cope with.

Slurry lagoon situated adjacent to the digester (behind the fence)

As the digester receives more feed the digestate it displaces flows into the slurry which is adjacent. Any surplus slurry not needed for the system flows straight into the slurry pit.

The pumps pump about 1.25m^3 of feed every hour, operating on a retention time of 25 to 28 days. The pumps can be reversed to empty the digester into the slurry pit if needed. The digester has a mechanical agitator which mixes for 2 minutes every 30 minutes.

The plant and installation cost £750,000 and was installed by Biogest, an Austrian company, with a supplier in Cheltenham – AWS Power.

Finance was raised through the following means:

- 25% loan from Biogest.
- 40% from AWS Power.
- 35% self financed.

However it was felt that in the current climate with the uncertainties around the incentives that this offer would not currently be on the table.

The system produces 124kW of electric and 170kW of heat. The plant has about 3 to 4% parasitic load, the farm uses about 50% and the remainder of the electric is sent to the grid. The plant is a mesophyllic and needs to be kept at 40°C; the remainder of the heat is currently used for the drying of logs.

Operation time is estimated at 15 minutes morning and evening to visually check the system, with an addition 45 minutes to load the solid feed.

The feed in the digester sits approximately 80cm off the top of the tank. On top of this there is a supported net, on which sits a membrane to hold the gas, with a further membrane to hold the outer cover rigid.

The system does not have provision for cleaning the feed of grit and it was felt that as a result grit may build up to unacceptable levels within maybe 4 to 5 years time. If this happened the digester would need to be emptied and cleaned.

The whole system falls within the permitted 500m^2 and was built under permitted development rights and so no planning permission was needed. It operates under an Environment Agency exemption.

The plant is all automated and electronically run and can be operated remotely. It has a flare to burn off any of the excess gas and a scrubber unit (cost of 1,200 Euro) to clean the gas before going to the CHP.

Contact: Roddy Stanning - 07989 423658
roddy@rzfarmenergy.com