



GP Biotec Annual Report 2017 for Natural Resources Wales

January 26th 2018

Contents

1	Introduction	3
2	General Performance.....	3
3	CHP Engine/Emissions Monitoring.....	4
4	Waste	4
	Waste Recovery	4
	Waste Storage	4
	Waste Generation.....	5
5	Biological Process of the AD plant	5
6	Water Usage.....	8
7	Dust, Noise & Pest Monitoring	8
8	Maintenance Overview	8
9	Animal and Plant Health Agency Monitoring (APHA)	9
10	Biofertiliser Certification Scheme	9
11	Spreading Activities and Records	9
12	Community Liaison Activities.....	10
13	Odour Complaints	10
14	ISO1400/Green Dragon.....	10
15	Health and Safety	11

1 Introduction

This report is produced to fulfil the requirements stated in GP Biotec's environmental permit (Permit number EPR/AB3233DW), section 4.2. The report details the performance of the permitted activities carried out by GP Biotec over the previous year (2017) by reviewing the results of the monitoring and assessments carried out in accordance with the permit including an interpretive review of that data.

The report will cover the following areas:

- General Performance
- CHP Engine Monitoring
- Waste Storage
- Biological Process of AD plant
- Waste Return Overview
- Maintenance Overview – Checks
- APHA Monitoring
- Water Usage
- Dust, Noise & Pest Monitoring
- Biofertiliser Certification
- Spreading Activities and Records
- Community Liaison Activities
- Health and Safety
- ISO1400/Green Dragon

2 General Performance

It is useful to have comparisons when discussing performance, so it's helpful that the environmental consultancy Aardvark have produced an AD benchmarking dashboard to share with AD operators. The output of the tool is a benchmarking report which enables individual operators to compare various measures of their plants performance against other plants.

It is hoped that through sharing this information it may lead to a better understanding of how best to maximise the efficiencies of AD plants.

Among other comparisons the report ranks each plant on a scale of 1 - 18 across three variables, income per kW installed, fuel to energy ratio and plant efficiency ratio. They then combine the scores for each of the criteria to give an overall benchmark score.

The latest report to be published was in December 2017, GP Biotec is Plant 'E' within the reports. Having climbed from fourth to third place in last year's report, GP Biotec remains in third position for efficiency out of the 18 plants.

The full report can be seen in Annex I.

3 CHP Engine/Emissions Monitoring

There are two Combined Heat and Power (CHP) engines on site, the first engine (an MWM engine) was commissioned in February 2013 and the second engine (MAN engine) was commissioned in March 2015. The engine oil from both engines is monitored and changed regularly – the condition of the oil reflects the condition of the engine. Service Reports, Condition Monitoring Reports and Oil Change records are kept in the Site Office.

Engine checks form part of the daily, weekly, monthly, quarterly, 6 monthly and annual checks and then there are additional services carried out (both by GP Biotec and external companies) - all engine maintenance records are kept in the Site office.

The annual emissions testing was carried out on both the MWM engine and MAN engine on 4th January 2018. Ideally this would have been carried out in November 2017, however a major repair to the MAN engine was undertaken in November 2017 and was not resolved until mid-December 2017, therefore delaying the emissions testing. There was also an issue that followed on from last year, with the company who provided the MAN engine, Cooper Ostlund. This issue has now been resolved and therefore GP Biotec are not reliant on Cooper Ostlund to make adjustments to the engine. These issues were reported to GP Biotec's NRW Environment Officer (David Willey), who was understanding of the situation and agreed with GP Biotec that the testing would be carried out as soon as the engine was repaired. The emissions testing was carried out on the 4th January 2018 and all parameters were below the limits set out in the permit. All results are presented in the Air1 Form in Annex II.

4 Waste

Waste Recovery

The total amount of waste received on site between October 2016 and October 2017 (the year agreed by GP Biotec and NRW as it was October 2013 when waste was first accepted) was 43,385.35 tonnes. Of the waste received on Site 81.38% is generated in Wales.

Waste Storage

Waste storage on Site is developing as a result of a new location for digestate storage having been developed. This has freed up a storh storage tank to be used as a pre-mixing tank for waste to be held. It is hoped that this will be commissioned at some point in 2018.

No odour issues or complaints associated with the blood storage tank have occurred since May 2015 (when shortly after the installation of the chiller there was a fault with the fan), this continues to demonstrate the effectiveness of the odour

control measures in place i.e. the carbon filter and chiller. The carbon filter is monitored as part of the Site daily checks and as soon as there is a rise of H₂S above 5ppm the carbon is refreshed. The chiller cools the blood to below 20°C and is serviced twice a year (once in the spring so that it is in good repair for the summer months). The combined effect of these measures has eliminated odour from the blood storage tank.

Waste Generation

Site Waste

GP Biotec has a trade waste contract with Powys County Council for the recycling of paper/cardboard, plastics and general waste – there is a two-weekly collection of 360 litre bin for cardboard/paper, 240 litre bin plastic/can recycling bin and 360 litre bin for general/mixed waste. This covers waste produced by the office and staff room. The contract is kept in the site office.

Spent Carbon

GP Biotec has planned for spent carbon from the carbon filters on site to be collected by Carbon Activated, and if appropriate recycled – details for Carbon activated are held in the site office.

Waste Oil

Waste oil from the engines is collected by an Environment Agency registered company Oil Monster – details of which are held in the site office.

5 Biological Process of the AD plant

The biological process is monitored daily, by means of a round of daily checks including a visual check in the digester tanks which would reveal any significant issues e.g. foaming, as well as constant monitoring of various parameters via the plants computer system. The substrate in the Digesters is checked monthly for FOS/TAC analysis and biannually a full analysis of the substrate is carried out.

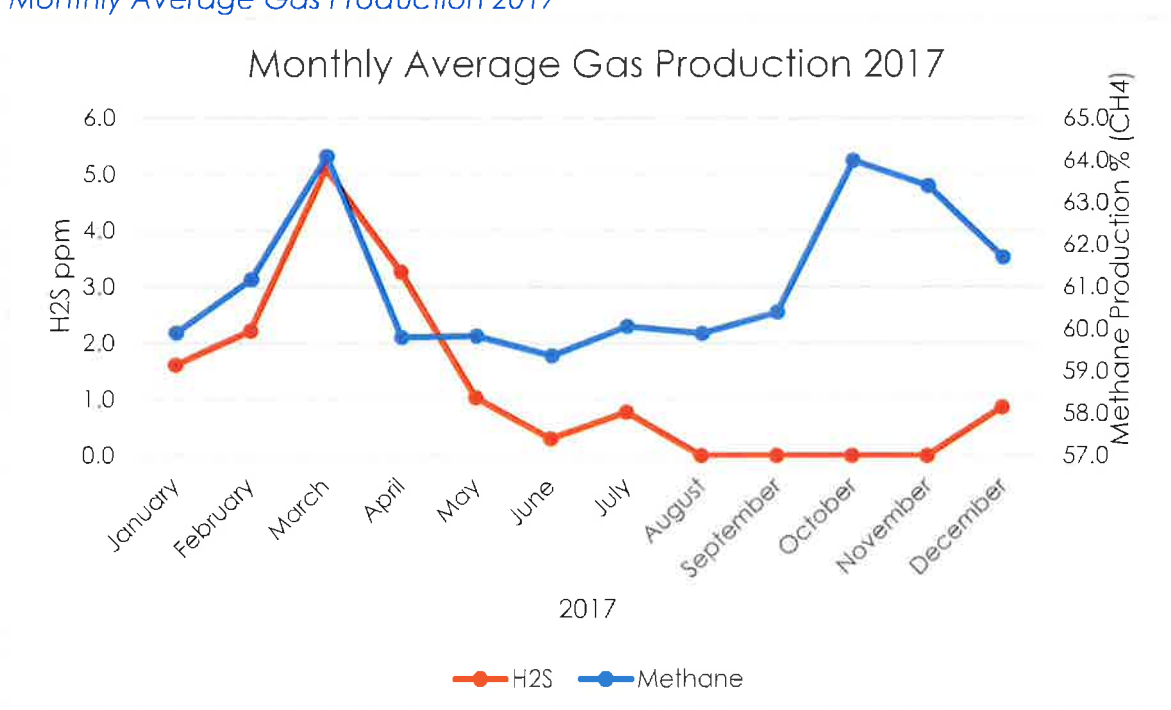
The Digesters have performed consistently well over the past 12 months. The gas production is continually high and the digestate produced is of a consistently good quality. The information below gives more details of how we measure and monitor the performance of the digesters, including:

- gas production and H₂S concentrations;
- FOS/TAC and pH;
- trace elements;
- ammonia levels;

5.1 Gas production and Gas H₂S concentrations

Methane production for 2016 has been consistently between 57 – 63% (see Chart 1.1 below) for the year, an indicator that the digesters are performing well. The H₂S level rose on two occasions in 2016, in February and April, in response to this increase the carbon in the engine carbon filter was replaced with fresh carbon. The reason for an increase in April so soon after the change in February was the fact the liquid waste tank had failed to feed during the night of the 24th April and the knock-on effect was a rise in H₂S.

Monthly Average Gas Production 2017



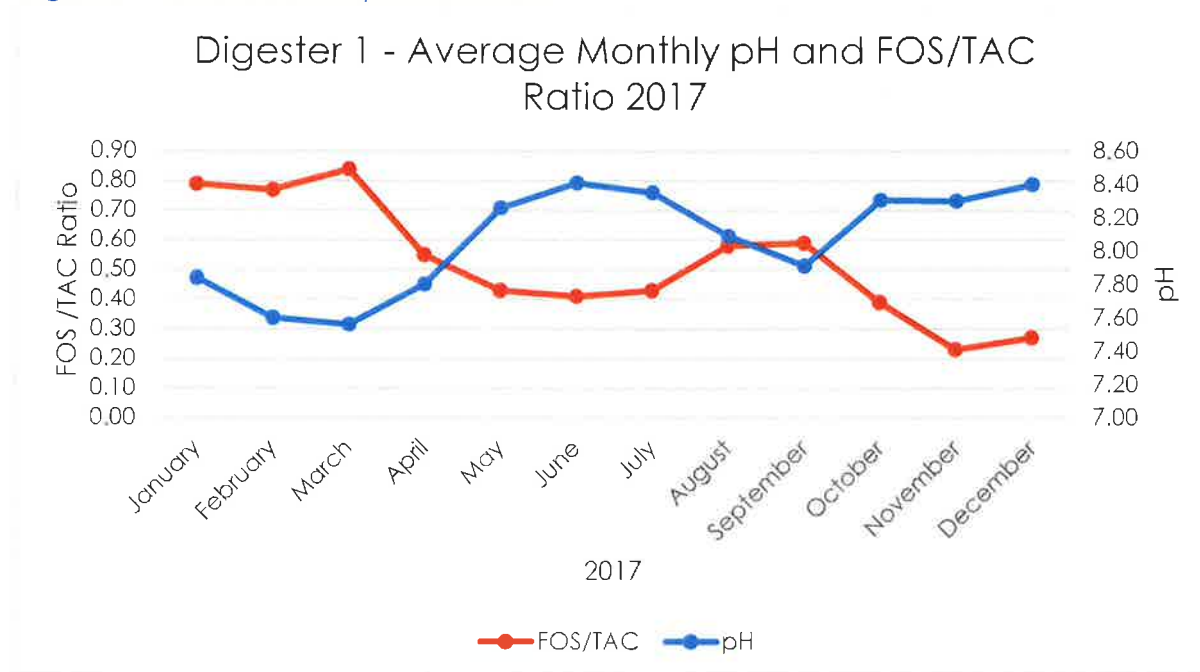
5.2 FOS/TAC and pH

The pH and alkalinity of Digesters 1 and 2 are monitored monthly, or more frequently if necessary. The pH for both digesters has been consistently at around pH 7.7 – pH 8 which is within the optimal range for the type of AD system at GP Biotec.

It can be seen in the chart below that the FOS/TAC in Digester 1 has been on a downward trajectory since November 2016 and is currently stable at around 0.25, which indicates that the digesters are performing well and that the process is stable. The FOS/TAC spiked in March 2017 due to an addition of whey, from a previously regular Supplier who GP Biotec had not taken any waste for quite some time. The Supplier was having issues with their current waste contractor and GP Biotec had

capacity to take to take the waste. The sudden introduction of these loads caused the FOS/TAC to become raised temporarily, before stabilising once again.

Digester 1 FOS/TAC and pH Overview



The FOS/TAC in Digester 2 is more consistent and over the course of the year the average was 0.19, which is indicative of a very stable process.

5.3 Trace Elements, Acids, Ammonia & Dry Matter

As usual the trace element levels have been tested twice this year (April and November) in both Digester 1 (DG301) and Digester 2 (DG302). The results of the analysis can be found in Annex III. The following analysis is derived from commentary and advice given to GP Biotec by Biogas Analytix and HOST.

In general the trace elements are all within the appropriate ranges so the bacteria have good conditions in which to thrive. The dry matter is in a very good range, as is the iron-sulphur ratio, meaning the H₂S levels are low. The levels of Ammonia within the digesters remain well below the limit of 6000mg/l (the yearly average for Digester 1 was 2858mg/kg and for Digester 2 it was 2992.5mg/kg) which would be the trigger point for an unstable situation in these types of digesters.

There were two things that both Biogas Analytix and HOST picked up on, firstly the levels of the trace element selenium was at the lower end of the minimum levels for both sets of analysis, however because the FOS/TAC was within a good range Biogas Analytix didn't think it was critically low – a trace element additive was advised and GP Biotec have been adding this on a two weekly basis.

Secondly the levels of carbonic acids; these have risen slightly in both tanks and so further investigation is being carried out to establish the cause of this.

6 Water Usage

GP Biotec is a farm based AD plant and uses water from the farms private water supply. A water meter was put in place towards the end of 2015 and the average daily water use is 0.015m³.

7 Dust, Noise & Pest Monitoring

7.1 Dust

The area surrounding the site has been in a state of flux for the as there is much building and groundworks going on, this often results in a slight increase in the levels of dust but it does not cause any major issues within the site or outside of the site. However, since the completion of the new office/education space and workshop have been completed this has again been significantly reduced. Once the new solid feeder system is in place the yard surrounding the Waste Reception Area will be tarmacked and this will further improve the situation.

Once the third and fourth digesters and all roadways are tarmacked there will be minimal dust.

7.2 Noise

Noise from the activities on site does not cause any issues in terms of pollution off site. Records for readings of noise levels can be found in the site office.

7.3 Pest Control

GP Biotec has an agreement in place with a pest control contractor who visits the site at six weekly intervals in line with Animal and Plant Health Agency (APHA) requirements. Full records of visits and details of control measures can be found in the site office. These records are checked quarterly by the APHA as part of their routine site inspection.

8 Maintenance Overview

GP Biotec carries out a variety of regular site checks and has a comprehensive maintenance schedule. Records of these checks and maintenance can be found in

the Site Office. GP Biotec hopes to employ a new maintenance manager this year to oversee this side of the business.

9 Animal and Plant Health Agency Monitoring (APHA)

GP Biotec carries out monthly monitoring of *E.coli* and *Salmonella* in samples from the two pasteurisers on site, the results have always been negative and can be found in Annex IV. APHA carry out quarterly site visits – during which they check various critical control points, including the maintenance of the 12mm cutting screen, vehicle cleaning records, pest control records, pasteurisation records and a spot check on waste transfer notes and weight tickets. All *E.coli* and *Salmonella* samples have always come back negative.

10 Biofertiliser Certification Scheme

The separated fractions (liquor and fibre) continue to be certified under the Biofertiliser Certification Scheme by the Organic Farmers and Growers (See Annex V for a copy of the current certificate). It was decided following a Management Review in January 2018 that because the whole digestate is not used as a product, i.e. all of it is separated for use, that there was no need to continue certifying the whole digestate under the BCS. A recertification audit/inspection will take place in February 2017.

11 Spreading Activities and Records

GP Biotec/GP Services continues to increase its available land bank as a priority moving forward to be able to manage the amount of digestate produced. The following information is recorded and stored in the Site Office:

- Signed land management agreements;
- Field numbers and maps;
- Acreage;
- Spreading rate;
- Signed dispatch Digestate (including batch number, in accordance with the Biofertiliser Scheme);

In the last six months GP Biotecs affiliated company GP Services which carries out the spreading of the digestate has been increasing on-site and off-site storage capacity, so that digestate is stored closer to the land where it will be spread.

GP Biotec/GP Services are working closely with NRW to ensure that all storage is WQE3 registered. A storage audit was carried out by NRW in October 2017, which

reviewed all current storage on and off site. Risk assessments were carried out for these and the full audit will be completed by the end of February 2018.

GP Biotec/GP Services are also working with Farming Connect to ensure that nutrient management plans are in place where digestate is being applied to land managed by GP Biotec/Services. Farming Connect have already provided funding and guidance for soil testing (including baseline PTE testing) and nutrient management plans for many of the farms with which GP Services has Land Management Agreements in place.

Staff also received the following training courses in 2017:

- Best Practice for Spreading Digestate with Chris Duller;
- Renewable Energy Association 'Understanding PAS110 in Full' Training.

12 Community Liaison Activities

The Community Liaison Group (CLG) has been running for almost three years now. The purpose of the group is to facilitate communication, share information and engage in balanced discussions about any environmental issues arising from GP Biotec's permitted waste recycling and disposal activities regarding GP Biotec's activities at Great Porthamel Farm, Talgarth.

Both GP Biotec and the Group members have found the meetings useful and informative and the general feeling is that a good and open relationship has developed.

It was mooted at the last meeting whether meeting were required to be so frequent, as attendance hasn't been as good as previously. Also there is a lack of response from members when organising the meetings and offerings for issues to discuss are at an all time low.

The next meeting will be held in April 2018, where the focus of the meeting will be the discussion of this annual report and the future of the group in terms of frequency of meetings.

13 Odour Complaints

There were no odour complaints in 2017 relating to the Site or spreading activities.

GP Biotec continue to have a dedicated mobile phone that can be used by members of the public to contact them if an odour is detected.

14 ISO1400/Green Dragon

GP Biotec has been reviewing its Standard Operating Procedures, Odour Management Plan and Accident Management Plan, along with the HACCP for the Site. Once these reviews are complete an application to the Green Dragon Environmental Standard will be made.

1.5 Health and Safety

GP Biotec chose to change their Health and Safety advisors, because it was felt that the service that was being provided wasn't fit for purpose. GP Biotec now has a consultant in place who is providing a much more comprehensive service. A new H&S policy has been developed for GP Biotec (and GP Services) and the company receives on-going expert support to fulfil its requirements. Much training has been carried out with regard to digestate spreading and production, along with health and safety health and safety. Staff have received the following over the past 12 months:

- Working Safely in Agriculture;
- Manual Handling;
- Working at height;

2.3 Site Development

It was hoped that a third digester would be installed in 2017, however, investment has been required in other areas of the business, including a heat exchanger to optimise the efficiency of the primary digester, increased storage for digestate, and a new control system for the engines. However, the construction of a third digester tank is planned for 2018.

It was hoped that GP Biotec would install three new carbon filters on site in 2017, to treat the following:

- the existing waste reception building to make the odour control system even more robust;
- the new building which will house the separator and will also link up to control odours from the post-pasteurisation holding tank;
- the new liquid waste storage tanks.

This work is now rescheduled for the early part of 2018, as the infrastructure that required the odour control was not completed.

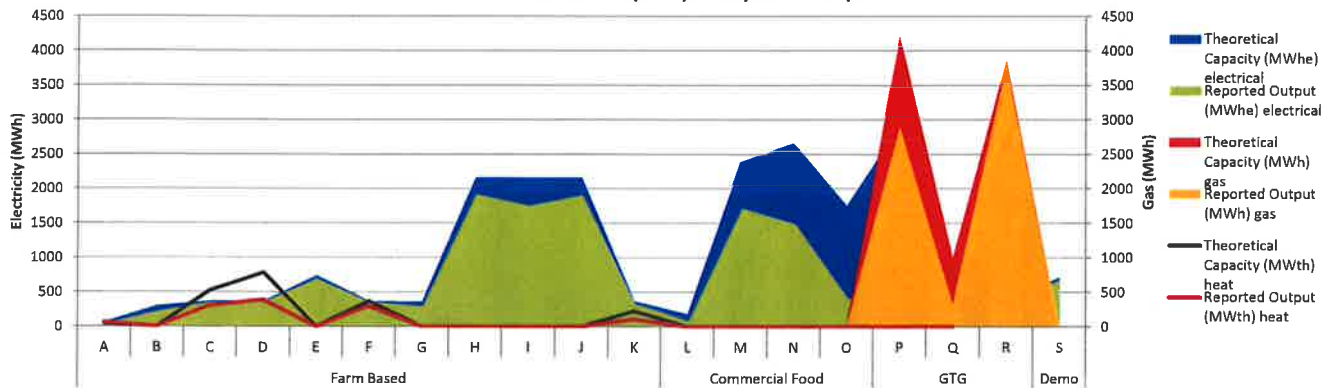
A supplementary solid feeding system is planned as well, to take the pressure off the current system and to provide back up during breakdowns or planned maintenance, this will also have odour control in the form of a carbon filter and again will hopefully be installed in 2018.

The heat generated by the plant continues to be used to heat the Site Office, canteen and new workshop for the affiliated haulage business, GP Services.

AD Operator Comparison Dashboard

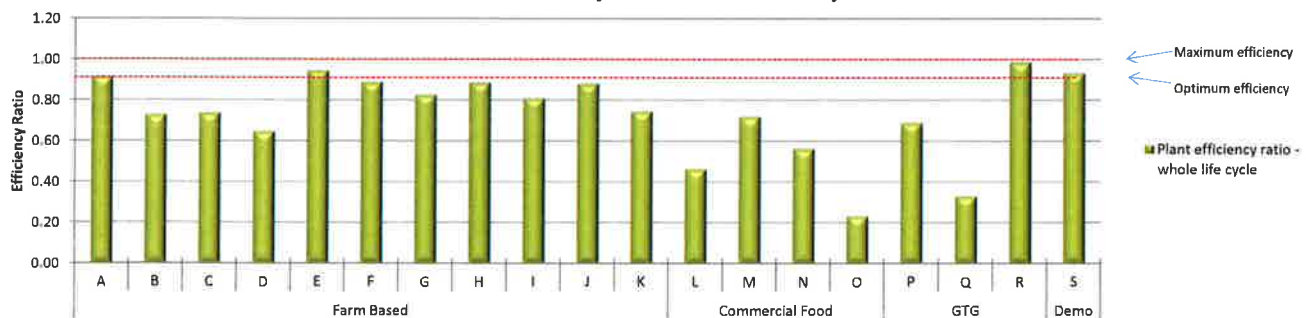
In this, our 4th issue of our benchmark report, we have expanded the group of participating plants to 18, of which 11 have provided actual data for this issue of the report. Where we do not hold actual data we reuse previously provided data and what information is publically available to us. The first chart shown compares theoretical output vs reported output. This chart shows the total MWh which could have been produced in the reporting month vs what was actually achieved. This analysis shows electrical, heat and biomethane outputs.

Theoretical Capacity vs Reported Output



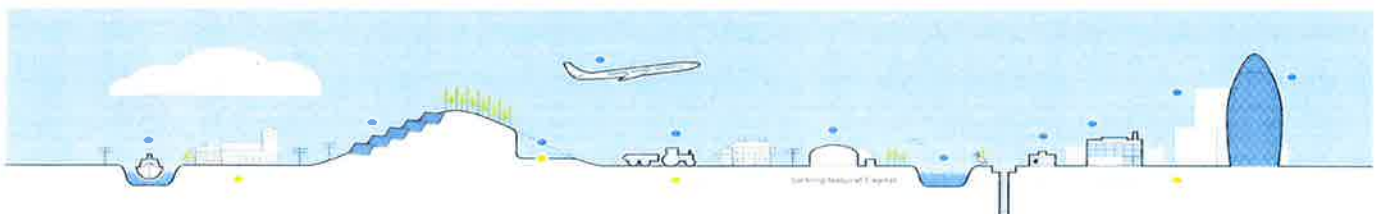
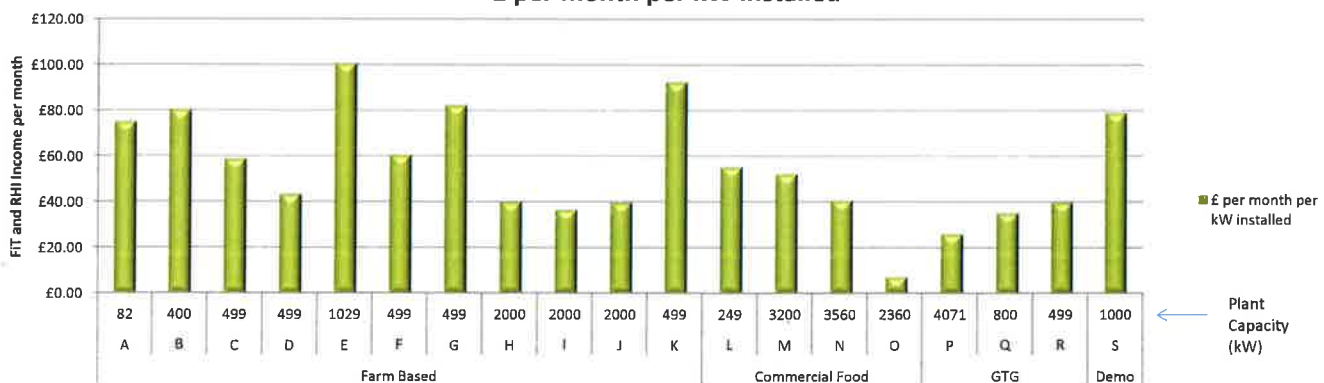
From the above data we calculated a plant efficiency ratio which better demonstrates the efficiency of each plant against maximum and optimal levels. This is kWh produced vs the theoretical maximum achievable and is shown below. As a group the average efficiency is 72%. Within the group the farm based plants are the most efficient achieving an average of 82%. The food waste plants achieve only 49% and the biomethane plants 67%. This is the key metric for the group and we hope to be able to drive this figure upwards in future.

Plant efficiency ratio - whole life cycle



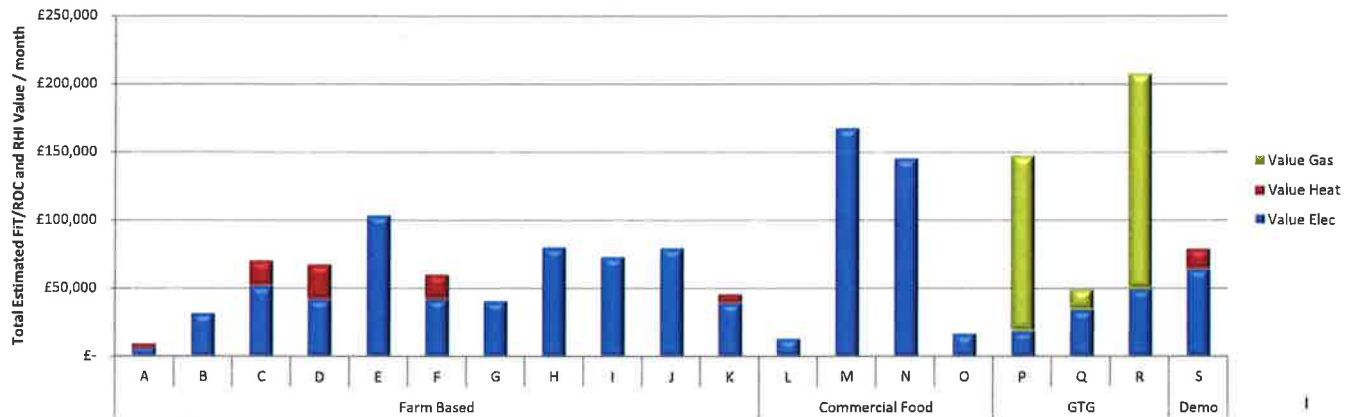
Using the known output values we have calculated the income per month per kW of installed capacity for each plant. This is shown in the below chart. The income shown is derived solely from Feed in Tariff, ROC's and/or Renewable Heat Incentive Subsidies. This data does not take in to account any export tariffs, PPA's / GPA's, energy saving offsets or gate fee income. Those achieving the highest yields are farm based plants benefitting from FiT and RHI subsidies or early adopters on high FiT tariffs alone.

£ per month per kW installed



Analysis of the various subsidies each plant is eligible for shows that ten plants are currently only benefitting from the Feed in Tariff or ROC's. 3 plants have received RHI for biomethane and five have received RHI for combustion of biogas. Finding eligible uses for heat has enabled the farm based plants to make more efficient use of their biogas and access new revenue streams. The challenge however has been making consistent use of the available heat which has seen drying /heating capacity underutilised in some cases.

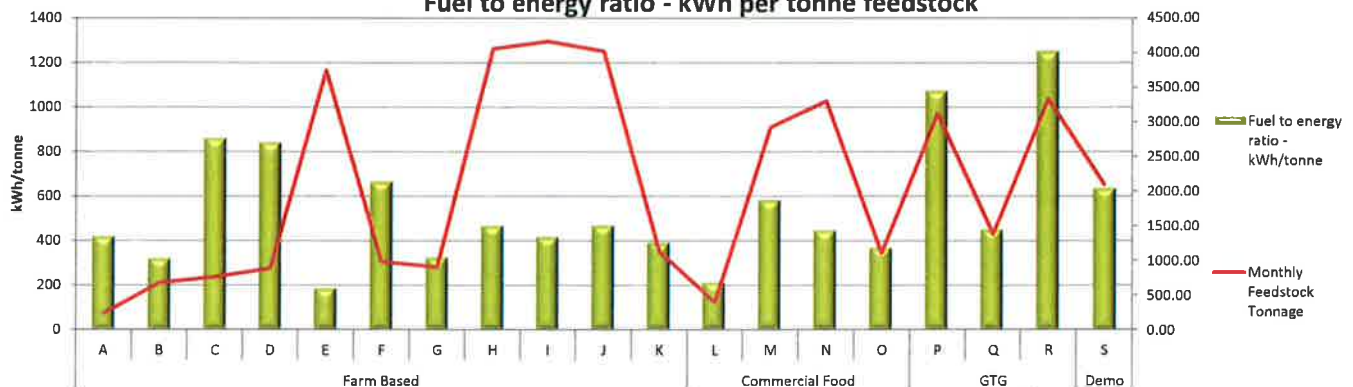
Income Source per Plant



We have record feedstock quantities within our benchmarking tool in order to show kWh produced per tonne. Since our last report we have seen the average for the group improve by 17% moving from 458kWh/tonne to 553kWh/tonne.

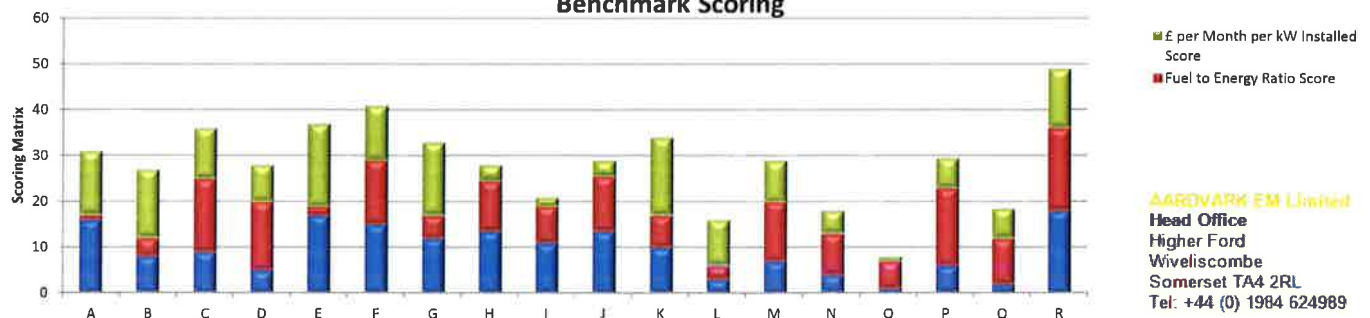
The farm based plants seem to show quite consistent results with plants C, D & F being the exception due to a high installed capacity of heat generation enabling them to maximise energy value of their biogas. The GTG plants are consistently efficient as almost all energy potential within the biogas is converted to revenue as it is exported off site in the form of biomethane with little energy loss. Unfortunately the efficiency of CHP based plants is always limited to the efficiencies of the CHP engines.

Fuel to energy ratio - kWh per tonne feedstock



As per previous publications, we have ranked each plant on a scale of 1 - 18 across 3 variables, income per kW installed, fuel to energy ratio and plant efficiency ratio. We have then combined the scores for each of the criteria to give an overall benchmark score. This has shown us that within this reporting period, plant R has been the best performing plant overall for the month with plants F & E coming a very close 2nd and 3rd in this period.

Benchmark Scoring



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 Wiveliscombe
 Somerset TA4 2RL
 Tel: +44 (0) 1984 624989





Analytical & Consultant Chemists & Microbiologists

Date received: 5 May 2017

Parameter	DG301	DG302	Units	Method Reference
pH	7.8	8.2	pH units	BS EN 13037
Oven dry matter	6.07	4.73	%m/m	BS EN 14346
Organic dry matter (Volatile solids, VS)	4.59	3.52	%m/m	BS EN 15169
Organic carbon (calculated)	2.67	2.05	%m/m	calculation
Total nitrogen (N)	0.505	0.555	%m/m	BS EN 13654-2
Ammoniacal Nitrogen (NH ₄ -N)	2263	2742	mg/kg	SOP Z/004
Nitrate Nitrogen (NO ₃ -N)	89	132	mg/kg	colorimetry
Total Phosphorus (P)	964	840	mg/kg	BS EN 15587-1
Total Potassium (K)	1306	1275	mg/kg	BS EN 15587-1
Total Magnesium (Mg)	191	121	mg/kg	BS EN 15587-1
Total Sulphur (S)	343	339	mg/kg	BS EN 15587-1
Total Sodium (Na)	1431	1564	mg/kg	BS EN 15587-1
Cadmium (Cd)	<0.05	<0.05	mg/kg	BS EN 15587-1
Chromium (Cr)	1.1	0.24	mg/kg	BS EN 15587-1
Copper (Cu)	2.5	1.8	mg/kg	BS EN 15587-1
Lead (Pb)	0.73	0.19	mg/kg	BS EN 15587-1
Mercury (Hg)	<0.05	<0.05	mg/kg	BS EN 15587-1
Nickel (Ni)	0.63	0.51	mg/kg	BS EN 15587-1
Zinc (Zn)	16	9.6	mg/kg	BS EN 15587-1
Iron (Fe)	1205	1042	mg/kg	ICP-OES
Molybdenum (Mo)	0.19	0.16	mg/kg	ICP-OES
Manganese (Mn)	13	11	mg/kg	ICP-OES
Selenium (Se)	<0.05	<0.05	mg/kg	ICP-OES
Cobalt (Co)	0.09	0.11	mg/kg	ICP-OES



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Brecon
Powys LD3 0DL

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LABORATORY TEST REPORT

Report ref. ATLL35301#2 page 2 of 2
Report date: 26 May 2017
Purchase order ref. TBA
Laboratory sample ref. 166197 and 166198
Description: **Digestate (ABP) - Samples DG301 and DG302**
Date sample taken: 4 May 2017
Date received: 5 May 2017

Results of analysis: Volatile Fatty Acids

Parameter	DG301	DG301	Units	Method Reference
Acetic Acid	2.129	0.154	g/litre	Gas Chromatography
Propionic Acid	0.173	0.067	g/litre	Gas Chromatography
Isobutyric Acid	0.050	<0.001	g/litre	Gas Chromatography
Butyric Acid	<0.001	<0.001	g/litre	Gas Chromatography
Isovaleric Acid	<0.001	<0.001	g/litre	Gas Chromatography
Valeric Acid	<0.001	<0.001	g/litre	Gas Chromatography
Isocaproic Acid	0.020	0.017	g/litre	Gas Chromatography
Caproic Acid	<0.001	<0.001	g/litre	Gas Chromatography
Heptanoic Acid	<0.001	<0.001	g/litre	Gas Chromatography

Results are on sample as received basis.

Analysis status: GN

Report by S. Johnson
Alliance Technical Laboratories Limited
Tel. 01449 721192

Method of reporting: email

Sample provided by customer and analysed as received.

Analysis Status

U - Analysis is UKAS accredited
N - Analysis is not UKAS accredited
G - Analysis was carried out by Alliance Technical Laboratories Limited
S - Analysis was sub-contracted to another laboratory
Any opinions or interpretations are outside the laboratory's UKAS accreditation


S. Johnson

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ATLL35301#2

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LABORATORY TEST REPORT

Report ref. ATLL37226#1 page 1 of 2
Report date: 28 November 2017
Purchase order ref. TBA Site: Great Porthamel, Talgarth, Powys LD3 0DL
Laboratory sample ref. 172941
Description: Digestate - GPBDG301 08.11.17
Date sample taken: 8 November 2017
Date received: 9 November 2017

Results of analysis:

Parameter	Result	Units	Field application rate to apply Total Nitrogen at 250 kg N/ha = 46.6 tonne/ha, and applies:	Pass or Fail	Method Reference
pH	8.2	pH units	-	N/A	BS EN 13037
Oven dry matter	5.43	%m/m	2,533 kg DM	N/A	BS EN 14346
Organic dry matter (Volatile solids, VS)	4.18	%m/m	1,950 kg ODM	N/A	BS EN 15169
Organic carbon (calculated)	2.43	%m/m			
Total nitrogen (N)	0.536	%m/m	250 kg N	N/A	BS EN 13654-2
Ammoniacal Nitrogen (NH ₄ -N)	3453	mg/kg	161 kg NH ₄ -N	N/A	SOP Z/004
Nitrate Nitrogen (NO ₃ -N)	<10	mg/kg		N/A	Colorimetry
Total Phosphorus (P)	803	mg/kg	86 kg P ₂ O ₅	N/A	BS EN 15587-1
Total Potassium (K)	1274	mg/kg	72 kg K ₂ O	N/A	BS EN 15587-1
Total Magnesium (Mg)	124	mg/kg	10 kg MgO	N/A	BS EN 15587-1
Total Sodium (Na)	1563	mg/kg		N/A	BS EN 15587-1
Total Sulphur (S)	397	mg/kg	46 kg SO ₃	N/A	BS EN 15587-1
Parameter	Result	Units	PAS 110 Limits	Pass or Fail	Method Reference
Cadmium (Cd)	<0.05	mg/kg	max limit 0.72	Pass	BS EN 15587-1
Chromium (Cr)	0.32	mg/kg	max limit 48	Pass	BS EN 15587-1
Copper (Cu)	2.4	mg/kg	max limit 96	Pass	BS EN 15587-1
Lead (Pb)	0.81	mg/kg	max limit 96	Pass	BS EN 15587-1
Mercury (Hg)	<0.05	mg/kg	max limit 0.48	Pass	BS EN 15587-1
Nickel (Ni)	0.43	mg/kg	max limit 24	Pass	BS EN 15587-1
Zinc (Zn)	12	mg/kg	max limit 192	Pass	BS EN 15587-1
Iron (Fe)	1197	mg/kg	-	-	ICP-OES
Molybdenum (Mo)	0.18	mg/kg	-	-	ICP-OES
Manganese (Mn)	13	mg/kg	-	-	ICP-OES
Selenium (Se)	<0.05	mg/kg	-	-	ICP-OES
Cobalt (Co)	0.18	mg/kg	-	-	ICP-OES
Volatile Fatty Acids	1.76	g COD/kg	-	N/A	Gas Chromatography
Volatile Fatty Acids	0.042	g COD/g VS	guideline max 0.774	Pass	Gas Chromatography

Results are on sample as received basis.

Test methods are outside the laboratory's UKAS scope of accreditation (analysis status GN).

Report by S. Johnson

Alliance Technical Laboratories Limited

Method of reporting: email

Sample provided by customer and analysed as received.

Analysis Status

U - Analysis is UKAS accredited

N - Analysis is not UKAS accredited

G - Analysis was carried out by Alliance Technical Laboratories Limited

A - Analysis was carried out by Microbiology Division of Alliance Technical Laboratories Limited

S - Analysis was sub-contracted to another laboratory

Any opinions or interpretations are outside the laboratory's UKAS accreditation

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GP Biotec
Great Porthamel
Talgarth
Brecon
Powys LD3 0DL

ALLIANCE TECHNICAL LABORATORIES
Analytical & Consultant Chemists & Microbiologists

LABORATORY TEST REPORT

Report ref. ATLL37226#1 page 2 of 2
Report date: 28 November 2017
Purchase order ref. TBA Site: **Great Porthamel, Talgarth, Powys LD3 0DL**
Laboratory sample ref. 172941
Description: **Digestate - GPBDG301 08.11.17**
Date sample taken: 8 November 2017
Date received: 9 November 2017

Results of analysis: Volatile Fatty Acids

Parameter	Sample amount	COD equivalent	Units	Method Reference
Acetic Acid	1.324	1.412	g/litre	Gas Chromatography
Propionic Acid	0.036	0.054	g/litre	Gas Chromatography
Isobutyric Acid	0.160	0.290	g/litre	Gas Chromatography
Butyric Acid	<0.004	<0.007	g/litre	Gas Chromatography
Isovaleric Acid	<0.002	<0.004	g/litre	Gas Chromatography
Valeric Acid	<0.002	<0.004	g/litre	Gas Chromatography
Isocaproic Acid	<0.002	<0.004	g/litre	Gas Chromatography
Caproic Acid	<0.002	<0.003	g/litre	Gas Chromatography
Heptanoic Acid	<0.002	<0.004	g/litre	Gas Chromatography
Totals	1.52	1.76		

Results are on sample as received basis.

Analysis status: GN

Report by S. Johnson
Alliance Technical Laboratories Limited
Tel. 01449 721192
Method of reporting: email
Sample provided by customer and analysed as received.

Analysis Status

U - Analysis is UKAS accredited
N - Analysis is not UKAS accredited
G - Analysis was carried out by Alliance Technical Laboratories Limited
S - Analysis was sub-contracted to another laboratory
Any opinions or interpretations are outside the laboratory's UKAS accreditation



Alliance Technical Laboratories Limited

Gateway House Ipswich Road Needham Market Suffolk IP6 8EL

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ALLIANCE TECHNICAL LABORATORIES

Analytical & Consultant Chemists & Microbiologists

LABORATORY TEST REPORT

Report ref. ATLL37226#2 page 1 of 2
Report date: 28 November 2017
Purchase order ref. TBA Site: Great Porthamel, Talgarth, Powys LD3 0DL
Laboratory sample ref. 172942
Description: Digestate - GPBDG302 08.11.17
Date sample taken: 8 November 2017
Date received: 9 November 2017

Results of analysis:

Parameter	Result	Units	Field application rate to apply Total Nitrogen at 250 kg N/ha = 44.2 tonne/ha, and applies:	Pass or Fail	Method Reference
pH	8.2	pH units	-	N/A	BS EN 13037
Oven dry matter	5.45	%m/m	2,412 kg DM	N/A	BS EN 14346
Organic dry matter (Volatile solids, VS)	4.20	%m/m	1,858 kg ODM	N/A	BS EN 15169
Organic carbon (calculated)	2.44	%m/m			
Total nitrogen (N)	0.565	%m/m	250 kg N	N/A	BS EN 13654-2
Ammoniacal Nitrogen (NH ₄ -N)	3243	mg/kg	143 kg NH ₄ -N	N/A	SOP Z/004
Nitrate Nitrogen (NO ₃ -N)	<10	mg/kg		N/A	Colorimetry
Total Phosphorus (P)	790	mg/kg	80 kg P ₂ O ₅	N/A	BS EN 15587-1
Total Potassium (K)	1210	mg/kg	65 kg K ₂ O	N/A	BS EN 15587-1
Total Magnesium (Mg)	119	mg/kg	9 kg MgO	N/A	BS EN 15587-1
Total Sodium (Na)	1510	mg/kg		N/A	BS EN 15587-1
Total Sulphur (S)	390	mg/kg	43 kg SO ₃	N/A	BS EN 15587-1
Parameter	Result	Units	PAS 110 Limits	Pass or Fail	Method Reference
Cadmium (Cd)	<0.05	mg/kg	max limit 0.72	Pass	BS EN 15587-1
Chromium (Cr)	0.45	mg/kg	max limit 48	Pass	BS EN 15587-1
Copper (Cu)	3.1	mg/kg	max limit 96	Pass	BS EN 15587-1
Lead (Pb)	0.69	mg/kg	max limit 96	Pass	BS EN 15587-1
Mercury (Hg)	<0.05	mg/kg	max limit 0.48	Pass	BS EN 15587-1
Nickel (Ni)	0.56	mg/kg	max limit 24	Pass	BS EN 15587-1
Zinc (Zn)	9.3	mg/kg	max limit 192	Pass	BS EN 15587-1
Iron (Fe)	1192	mg/kg	-	-	ICP-OES
Molybdenum (Mo)	0.16	mg/kg	-	-	ICP-OES
Manganese (Mn)	13	mg/kg	-	-	ICP-OES
Selenium (Se)	<0.05	mg/kg	-	-	ICP-OES
Cobalt (Co)	0.16	mg/kg	-	-	ICP-OES
Volatile Fatty Acids	2.04	g COD/kg	-	N/A	Gas Chromatography
Volatile Fatty Acids	0.049	g COD/g VS	guideline max 0.774	Pass	Gas Chromatography

Results are on sample as received basis.

Test methods are outside the laboratory's UKAS scope of accreditation (analysis status GN).

Report by S. Johnson

Alliance Technical Laboratories Limited

Method of reporting: email

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Analysis Status

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A - Analysis was carried out by Microbiology Division of Alliance Technical Laboratories Limited

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ATLL37226#2



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ALLIANCE TECHNICAL LABORATORIES
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LABORATORY TEST REPORT

Report ref. ATLL37226#2 page 2 of 2
Report date: 28 November 2017
Purchase order ref. TBA Site: **Great Porthamel, Talgarth, Powys LD3 0DL**
Laboratory sample ref. 172942
Description: **Digestate - GPBDG302 08.11.17**
Date sample taken: 8 November 2017
Date received: 9 November 2017

Results of analysis: Volatile Fatty Acids

Parameter	Sample amount	COD equivalent	Units	Method Reference
Acetic Acid	1.672	1.782	g/litre	Gas Chromatography
Propionic Acid	0.025	0.038	g/litre	Gas Chromatography
Isobutyric Acid	0.121	0.219	g/litre	Gas Chromatography
Butyric Acid	<0.004	<0.007	g/litre	Gas Chromatography
Isovaleric Acid	<0.002	<0.004	g/litre	Gas Chromatography
Valeric Acid	<0.002	<0.004	g/litre	Gas Chromatography
Isocaproic Acid	0.002	0.005	g/litre	Gas Chromatography
Caproic Acid	<0.002	<0.003	g/litre	Gas Chromatography
Heptanoic Acid	<0.002	<0.004	g/litre	Gas Chromatography
Totals	1.82	2.04		

Results are on sample as received basis.

Analysis status: GN

Report by S. Johnson
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