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LONDON I LEEDS I PLYMOUTH

Energy Feasibility Report – Rev B

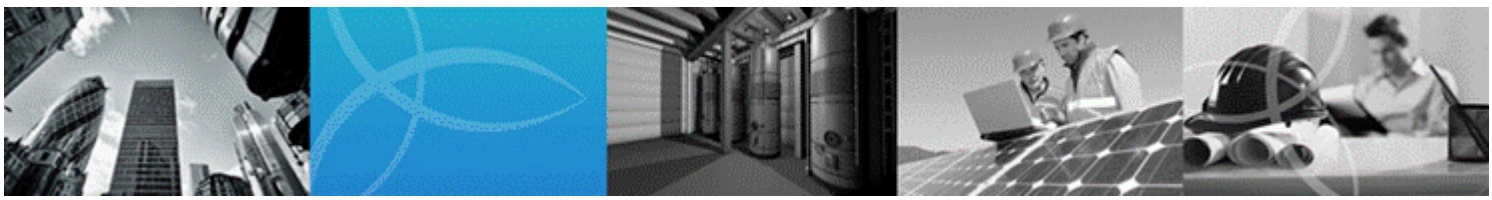
For

Hartnoll Business Centre Extension, Tiverton

For

Waddeton Park Ltd

June 2021



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A	13th May 2021	Amendments made in line with discussions and commentary
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1. Executive Summary

1.1 Introduction

Carbon Plan Engineering have been asked to provide a feasibility report to set out the low carbon strategy in support of a planning application for new employment area adjacent to Hartnoll Business Centre.

This feasibility study focuses on connecting the heating and hot water systems for the new employment area to an existing nearby Anaerobic Digestor system operated by the owner of the business park. The Anaerobic Digester is currently utilised for electric and heat generation on the site of the existing farm adjacent to the existing business Park. The objective of this report is to show whether the proposed new commercial development can utilise waste heat from the Anaerobic Digester system and to ascertain if there is sufficient spare capacity in the system to deliver the projected demands of the new site. This will support Mid Devon District Council in their Decarbonisation programme and significantly reduce the impact on global warming as a result of the operation of the new site.

The proposals will help meet the challenge of climate change by supporting a low carbon future incorporating energy efficiency features and with the inclusion of renewable energy systems which is a key development policy objective for the Council.

1.2 Summary Conclusions

We have carried out a review of the anticipated heating demands from the proposed new employment area and we have found that

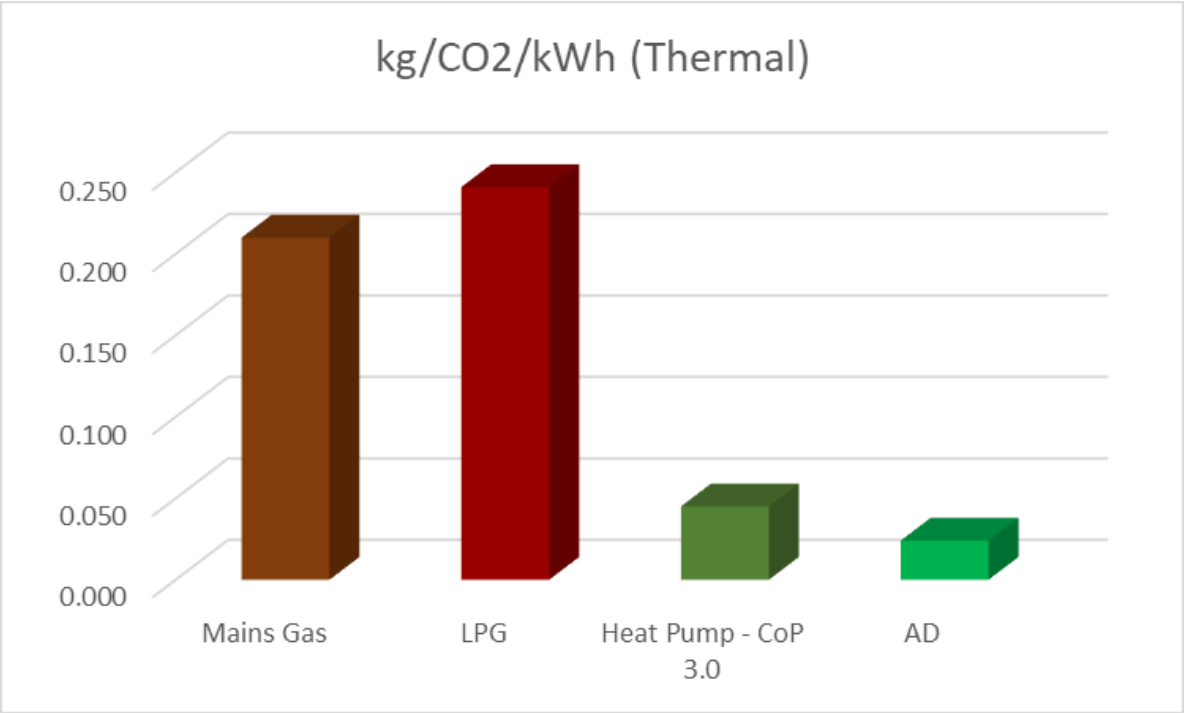
- **100% of the total annual energy demands can be provided by the spare heat from the existing Anaerobic Digestion system**
- **89% of the estimated peak thermal load for the proposed development could be delivered from the existing system with no modifications**
- **The future available capacity from the expansion of heat sources on the farm would deliver 100% of this peak thermal load**
- **100% of the electricity demands from the proposed site can be met by the current electrical generation**

In our opinion this is an exciting opportunity to develop a very low carbon business park in a suitable location in the heart of Devon. The co-location of the existing Anaerobic Digestor, its capacity for growth and the potential for the significant heat demands of a new business park to be delivered in such a way is both innovative and forward thinking having a clear regard for climate change objectives.

In terms of reductions in CO_2 emissions the table and chart on the following page shows the current (SAP 10.1) carbon factors for typical thermal energy and shows what level of reduction in CO_2 emissions could be achieved through connection to the various systems discussed in this report.

Table 1.1 SAP 10.1 Carbon Factors

	Mains Gas	LPG	Heat Pump - CoP 3.0	AD
kg/CO2/kWh (Thermal)	0.210	0.241	0.045	0.024
Change against mains gas		115%	79%	89%



If these figures are mapped onto the heating demands of the site – estimated as being circa 1,900MWh per year then:

- **The baseline impact using natural gas for heating = 317.3 Tonnes CO_2 per year**
- **The impact if heated with the AD system = 36.3 Tonnes CO_2 per year**

The use of the AD system would likely provide a saving of up to 281Tonnes CO_2 per year – equivalent to an estimated 88% reduction on CO_2 emissions. The exact level of reduction would be determined during the detailed design stages and is largely dependant upon the final mix of end uses.

1.3 Site Description

Hartnolls Business Centre is a successful existing rural business hub located on Uplowman Road, Tiverton. It is well connected to the M5, is served by an existing bus route and only 2 miles from Tiverton town centre. The development proposals being put forward are to expand the site for both residential and employment purposes.

This analysis focusses on the proposed extension to the employment area – as connections and metering to these future buildings will be relatively straightforward.

Existing Buildings

The existing business park has employment spaces with a total utilised area of circa 25,000m^2, although only circa 9,010m^2 currently has uses which require heating and hot water. We have assumed the following ratios in our analysis to calculate its heating and hot water demands.

- 63% of space is untreated i.e. it has no heating and minimal DHW (Domestic Hot Water) demands
- 37% of space therefore has space heating requirements

The areas with space heating on the existing site have been evaluated and broken down approximately as shown in Table 1.2 on the following page.

Table 1.2 Breakdown of existing uses

Description	Units	Area (m2)	% age
Total Office Area	15	3,221	35.7%
Total Warehouse / Industrial Area	7	3,322	36.9%
Total Manufacturing Area	5	1,688	18.7%
Total Retail Area	2	550	6.1%
Gym	1	230	2.6%
Totals	**30**	**9,010**	

It is known that the client's business case predicts a similar breakdown of occupiers to the existing site and based upon identified market demand. This means that the buildings uses and the energy consumption of the new site will be roughly proportional to the increase in utilised area.

Existing Anaerobic Digester

The existing Anaerobic Digester (AD) is approximately 100m west of the proposed development and has a maximum output of 1,498kW. Of this a total of 426kW of peak thermal energy is available for export from the system as it is currently run, however gas production could be increased to provide 675kW of peak capacity.

In addition, we have been advised that the available heat will be increased in the near future through the provision of a new Ground Source Heat Pump (GSHP) to deliver additional heat to the farm processes. There is likely to be be some additional capacity in this system as well; increasing the potential total capacity available to circa 1 MW over time as the GSHP comes on stream.

1.4 Methodology

To understand the likely thermal demands from the site we have undertaken the following 3 steps: **review, modelling and analysis**. This allows us to effectively understand the benefits of the potential connection to the existing AD system and to ascertain whether it is feasible and desirable to make such a connection.

1.4.1 Review

The first stage of this work is to establish the likely mix of buildings on the site and to discuss with the client team how the buildings are likely to be used and operated. To allow this we have reviewed the existing site uses and superimposed these onto the proposed commercial spaces. This enables us to:

- Establish existing heating and hot water demands in terms of peak and annual loads
- Review the electrical infrastructure requirements

1.4.2 Modelling

Modelling outcomes, reference benchmarks and our experience have then been used to determine the loads from the entire site and to model these against the existing waste heat profile from the AD system.

1.4.3 Analysis & recommendations

Through the above process we have modelled the energy for each building and combined these into a site wide model. We can then use this data to inform recommendations on whether the connection is technically feasible and financially viable.

1.5 Review of uses and Energy Demands

The current proposals at Hartnoll Business Centre are for 32,640m^2 (Gross) of new commercial / employment space. With treated spaces proposed of approximately the same areas as those noted in Table 1.2 this gives:

- 23,350m^2 of untreated space (71%)
- 9,290m^2 of treated space (29%)

The mix used for this analysis is presented in Table 1.3 however this would be subject to change.

Table 1.3 Breakdown of new uses

Description	Area (m2)	% age
Total Office Area	3,321	35.7%
Total Warehouse / Industrial Area	3,425	36.9%
Total Manufacturing Area	1,740	18.7%
Total Retail Area	567	6.1%
Gym	237	2.6%
Totals	**9,290**	

To understand the peak and annual energy demands, the proposed total areas (m^2) for each type of proposed building are multiplied by the most appropriate energy density benchmarks available. These are summarised in Table 1.4 below along with the areas for each use type.

We have assumed that the buildings energy consumption will be “Good Practice” as far as energy benchmarks are concerned. We have also assumed that hot water demand in the untreated buildings will be minimal and so have added in an additional 10% requirement to the total while for electrical demands we have used the same figures as for the Manufacturing / 12 Hr warehouse.

Table 1.4 Benchmark source are overall area for analysis

Zone	Benchmark	Area m^2	% age
Office	Office CIBSE TM46	3,321	35.7%
Manufacturing	Manufacturing CIBSE Guide F Table 20.1	3,425	36.9%
Suppliers Depot	Distribution warehouse CIBSE Guide F table 20.6	1,740	18.7%
Retail	DIY Stores CIBSE Guide F Table 20.1	567	6.1%
GYM	Dry sports centre local CIBSE Guide F	237	2.6%

From the above we have utilised the benchmarks set out in Table 1.5 and to predict the peak and annual site energy usage.

Table 1.5 Benchmark values

Benchmark Figures		
Zone	Fossil Fuels (heating/hot water) kWh/m^2/year	Electricity kWh/m^2/year
Office	120	95
Manufacturing	175	29*
Suppliers Depot	114	53
Retail	149	127
Gym	158	64
Untreated Storage	10% of total	29

*we have used this electrical demand for the untreated storage.

1.6 Modelling Outcomes

The next step is to evaluate the overall and peak energy demands for the site and the outcomes of this are presented in the tables below.

The total annual energy demands are presented below in table 1.6.

Table 1.6 Total energy demands

Zone	Fossil Fuels (heating/hot water) MW/year	Electricity MWh/year
Office	399	316
Manufacturing	599	99
Suppliers Depot	198	92
Retail	84	72
Gym	37	15
Untreated Storage	193	677
Totals	**1,511**	**1,271**

The total peak loads are presented below in Table 1.7 taking account of diversity in consumption.

Table 1.7 Peak energy demands

	Peak	
Zone	Fossil Fuels kW	Electricity kW
Office	217	172
Manufacturing	326	54
Suppliers Depot	76	35
Retail	32	28
Gym	10	4
Untreated Storage	131	460
Totals	**793**	**753**

1.7 Analysis and recommendations

Thermal Energy

From the above we can see that the estimate peak thermal load is around 796kW and the likely energy demand is circa 1,511MWh per year.

As noted above there is 675kW of spare thermal capacity in the current system which would deliver:

- 89% of the total peak demand
- 1,919 MWh of heat running 10 hours per day or over 100% of the total energy requirements

As we would expect on any system there is an imbalance between the size of the peak demand and the total annual consumption.

Electrical Energy

The overall peak demands of the proposed site is circa 753kW which is broadly equivalent to 1,000kVa of supply requirements.

In addition to this the Anaerobic Digestor generates around 7,927MWh of electricity which is exported each year to the national grid. This would provide sufficient electricity for both the current site and the future proposals.

Conclusions

This development proposal is a genuine example of utilising a low carbon CHP system.

The existence of the AD in close proximity to the proposed development site (fed by a locally sourced green fuel supply) offers a unique opportunity that, to the best of our knowledge, cannot be replicated elsewhere in Mid Devon.

This marks the development proposal out from other forms of CHP (for example at Cranbrook or Pinhoe) that are fuelled by gas.

The under-utilisation of the existing system offers an opportunity to link the new commercial development to a connection and supply to the new commercial floorspace, and the opportunity to retro-fit the existing commercial units. So long as the new development is designed to be connected to the existing heating supply on the site Anaerobic Digestor system it then this would achieve a genuine low carbon business park. It would be an exemplar of low carbon business practice.

Recommendations

The following recommendation should be taken forward once initial approval for the site is given through the outline application process.

The peak load could, and should, be managed with local DHW (Domestic Hot Water) storage, system wide controls and energy efficient building design to help flatten out the peak thermal and electrical demands.

Once the mix of units is better defined more work should be carried out to ascertain a better view on heating demands and profiles. This should also be mapped onto a build and occupation programme to ensure that sufficient peak capacity is provided as the site develops.

A high level design should be developed for the heating distribution network. This will allow a firm cost to be determined and allow for predictive energy and financial modelling to be undertaken.

The electrical infrastructure of the existing site should be provided on a ‘private wire’ basis so that the electricity generated by the Anaerobic Digestor system can be directly wired to the new development.

Appendix A – Anaerobic Digester – Existing data

System Capacity

The gas from the AD system is used to furl the following systems with a total capacity of 1,498kW

- Biogas CHP 1 → 499kW Thermal
- Biogas CHP 2 → 599kW Thermal
- Biogas Boilers (2 No) → 200kW Thermal

Of the above capacity the system currently has 426kW of heat available based on existing patterns and feed stock. It has been confirmed that with some additional feedstock this could be increased to 675kW.

Electricity Generation

Currently around 85% of the electricity generated by the system is exported to the national grid equating to roughly 7,927MWh of electricity per year.

Operating Hours

The Anaerobic Digestion system is a continuous process and so the CHP engines can run 24 hours a day, other than when servicing is required.

Approximately 4% of the total hours are lost due to maintenance, but this could be scheduled to suit the energy demands in the future.

The demands from the driers are also consistently 24 hours per day.

Servicing

Each of the CHP engines is serviced once a month and this takes around 8 hours

In addition, every 12,000 hours (17 months) each of these need a rebuild which takes about 4 days

It will be necessary to ensure continuous heating supply while these works are undertaken.

Appendix B – Existing site uses

The existing site has office, retail, manufacturing, depot, gymnasium, and outdoor storage. Each unit and its respective usage, area, and proportion of site are listed in the following pages.

Table 3.1 Existing site uses

Offices

Unit	Area m^2	Proportion of site
Ground Floor Meriel Suite	60	0.2%
1st Floor	71	0.2%
Unit 20 & 24	488	1.5%
Unit 25	186	0.6%
Unit 8C	91	0.3%
Unit 7A	266	0.8%
Unit 8 Offices	35	0.1%
Unit 19	395	1.2%
Unit 23	120	0.4%
C3	463	1.4%
C5	465	N/A
C1	186	N/A
C4	232	N/A
Unit 5A and C2	93	N/A
Unit 2 Ground Floor Willox Suite	504	1.5%

Manufacturing

Unit	Area m^2	Proportion of site
Unit 4A-4C	494	1.5%
Unit 1	422	1.3%
Unit 18	960	2.9%
Unit 7B	177	0.5%
Unit 15 and 16	537	1.6%
Unit 5	298	0.9%

Retail

Unit	Area m^2	Proportion of site
Unit 21	395	1.2%
Unit 2A	155	0.5%

Outdoor Storage

Unit	Usage	Proportion of site
Unit 18	Automatic Saw Manufactures	31.6%
Unit 5A and C2	Roofers	3.7%
C1	Office	6.1%
C3	Tractor sales and repair	15.3%
C4	Roofing contractors	7.7%
C5	self-storage	15.3%

Other

Unit	Area SQM	Proportion of site
Unit 8a b	230	0.7%