Decarbonisation Readiness Report for a new Bespoke Installation Permit application – Devon Anaerobic Digestion (AD) Plant at Hide Market Road, Willand, Devon, EX15 2FP

On behalf of Acorn Bioenergy Operations Ltd

ETL981/2026

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29 September 2026

Document Control

Document Title:	Decarbonisation Readiness Report for a new Bespoke Installation Permit application – Devon Anaerobic Digestion (AD) Plant at Hide Market Road, Willand, Devon, EX15 2FP
Document Reference:	ETL981_DGPL_DRR_V1.0_DRAFT
Prepared For:	Acorn Bioenergy Operations Ltd
Project Reference:	ETL1010/2026
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Version Control

Version/Issue	Date	Revision details	Author (s)	Approved by
V1.0	29/09/2026	First Issue	A Trelawny	A Becvar

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Abbreviations

AD	Anaerobic Digestion/er
BUP	Biogas upgrading plant
CHP	Combined heat and power engine
CO_2	Carbon dioxide
EA	Environment Agency
ELV	Emission limit value
kWthi	Kilowatts of thermal input
TPA	Tonnes per annum

1 Introduction

This Decarbonisation Readiness Report (DRR) has been prepared by Earthcare Technical Ltd on behalf of Acorn Bioenergy Operations Limited in support of an application for a new bespoke Installation Environmental Permit for an anaerobic digestion (AD) plant including the use of resultant biogas for Devon AD Plant, at Hide Market Road, Willand, Cullompton, EX15 2FP, centred on National Grid Reference (NGR): ST 02980 11201, herein termed 'the Site'.

The AD facility will treat around 100,780 tonnes per annum (TPA) of liquid and solid feedstocks comprising livestock manures (poultry litter, pig and cattle slurry), energy crops and crop residues; as well as dirty water and non-hazardous liquid wastes to supplement process water use. The 3.3 ha of site area was previously developed brownfield and farmland. An AD plant has been operated on the Site since 2018.

The AD Plant infrastructure is being improved and updated to extend operational life to 25 years from construction in 2018. A Site Layout plan is provided as Figure 1.

The report has been prepared in response to the Environment Agency's Decarbonisation readiness in environmental permit applications[1] guidance and considers the decarbonisation readiness of the electricity-generating combustion plant proposed at the Site.

1.1 Current carbon profile

The Site's current carbon profile comprises of:

- Direct emissions: primarily CO_2 from biomethane and natural gas combustion plan
- Indirect emissions:0. 719 MWh/a grid electricity imports for AD Plant (Total electricity consumption: 15.424 MWh/a and electricity production from CHPs: 14.705 MWh/a)
- Avoided emissions: displacement of fossil fuel-derived electricity and CO_2 capture from biogas upgrading plant compressed to Liquid CO_2 for Export via road tanker.

1.2 Biogas Management and Processing

The 20,382,803Nm^3/y of biogas produced from the AD process will be upgraded into biomethane for injection to the National Gas Grid via the Grid Entry Unit. In addition,14,744 t/y of liquid carbon dioxide (CO_2) will be produced from the biogas when captured and upgraded to 99.9% purity. The treated CO_2 is suitable for almost all industrial and commercial applications in the UK. Upgraded liquefied CO_2 will be l transported by road to end users.

There are 2 No. Combined Heat and Power (CHP) engines. CHP1 is a Quanto 1200, 1,200 kWe unit currently fuelled by natural gas only. CHP2 is a Flexi 530 dual fuel 499 kWe unit fuelled by either natural gas or biogas. Subject to the site power management settings and the availability of natural gas, CHP2 is fitted with a battery-assisted ignition and control system which enables the unit to restart following a mains power interruption.

[1] Environment Agency (2026) *Decarbonisation readiness in environmental permit applications*. Updated 5 March 2026. GOV.UK.

Both CHP units are fitted with exhaust gas heat exchangers to recover thermal energy for use within the AD process. The recovered heat is used to maintain operational digester temperatures and to supply heat to the pasteurisation system (when installed).

Provision is also made within the permitted plant design for installation of a Vitoplex 200 dual fuel emergency boiler (599 kW). The emergency boiler may be installed at a later stage following permit issue and would be capable of operating on biogas or natural gas to provide supplementary heat to the AD process if one or more of the CHP units is unavailable.

1.3 Scope

The purpose of the assessment is to demonstrate that there are no known barriers that would prevent the relevant combustion plant from being converted to low-carbon operation during its operational lifetime.

The preferred decarbonisation pathway considered within this assessment is hydrogen conversion readiness (HCR). The assessment therefore considers the availability of sufficient space for future hydrogen conversion equipment, technical feasibility of conversion to hydrogen firing, future access to an adequate hydrogen fuel supply and economic feasibility of the proposed conversion pathway.

The DR plan has been written with consideration to the Hydrogen readiness technical study[2]

The level of assessment is considered proportionate to the scale and nature of the combustion plant at the Devon AD Plant. It is noted that the Department of Business, Energy and Industria Strategy (BEIS) is reviewing the implementation timeline for sites to be fully hydrogen fired, this report sets out a plan which will be updated in line with emerging technologies and Government policy over time.

[2] Decarbonisation Readiness – Technical Studies, Hydrogen Readiness, Department of Business, Energy and Industrial Strategy, Project Number 60677821, 30 June 2022

2 Combustion Plant

The principal new electricity-generating combustion plant at the Site which falls within the scope of the DR comprises the following units:

Table 1 Combustion plant details

Plant	Fuel	Electrical Output	Thermal Input
CHP1 – Quanto 1200	Natural gas	1,200 kWe	2,817 KWth
CHP2 – Flexi 530	Natural gas / biogas	499 kWe	1,248 KWth

The Site also includes a Viessmann Vitoplex 200 boiler and emergency generation equipment. The boiler does not generate electricity and is therefore not considered to constitute an in-scope generator for the purposes of this assessment.

The decarbonisation readiness assessment therefore principally relates to CHP1 and CHP2.

3 Selected Decarbonisation Pathway

The preferred decarbonisation pathway for the Devon AD Plant is conversion of the relevant combustion plant to operation using hydrogen as the primary fuel.

Hydrogen conversion readiness is considered a proportionate potential decarbonisation pathway for the scale and nature of the generating plant at the Site. Under the Environment Agency's decarbonisation readiness framework, hydrogen conversion is an alternative pathway to carbon capture and storage; the purpose of this assessment is therefore to demonstrate readiness for future hydrogen conversion rather than readiness for carbon capture.

The purpose of this assessment is not to demonstrate that hydrogen conversion will be undertaken immediately, but to establish that there are no known barriers which would prevent conversion during the operational lifetime of the combustion plant.

The suitability of this pathway will be reviewed during the lifetime of the plant in accordance with the requirements of the environmental permit and relevant Environment Agency guidance.

4 Space Test

The Environment Agency requires sufficient space to be available on or near the Site to accommodate equipment that may be required for future hydrogen conversion.

The Hydrogen Readiness Technical Study[2] notes "*For new build sites where hydrogen is the sole fuel, then the footprint required for the receiving facilities (isolation valves, remote shut-off valve and custody metering) will be comparable to that of a natural gas equivalent. While there will be a difference in pipe diameters as a result of the lower energy density, from a plot-wide perspective this has a negligible impact*."

Conversion could potentially require modifications or replacement of the existing combustion equipment together with associated fuel supply infrastructure a hydrogen fuel tank (7m^2) if hydrogen pipeline is not in place at the time of implementation, pressure regulation, and custody metering, replacement pipework, ventilation, gas detection and safety systems.

The existing Site accommodates the CHP units and associated gas and energy infrastructure. An indicative area for future hydrogen conversion infrastructure will be identified on the Site layout plan accompanying this report. In addition, higher NOx emissions may occur which require a Selective Catalytic Reduction System (SCR). This system may include ammonia/urea storage, reactant pumps and control skid, require Grid and housing occupying 1-2m^2.

At this stage, no permanent development is known to prevent the provision of the infrastructure required to facilitate future conversion but should only require up to 10m^2 in area.

Any future hydrogen installation would be subject to detailed design and the relevant environmental permitting, planning and health and safety requirements applicable at the time of conversion.

4.1 Conclusion – Space Test

Subject to confirmation of the indicative area identified on the Site plan, there are no known spatial constraints which would prevent future conversion of the relevant generating plant to hydrogen operation.

5 Technical Feasibility Test

Hydrogen has different combustion, storage and handling characteristics from natural gas and biogas. Conversion would therefore require detailed technical assessment and potentially modification or replacement of elements of the existing generating and fuel supply equipment.

Relevant considerations would include the capability of the combustion engines to operate using hydrogen as the primary fuel; hydrogen fuel flow and volumetric requirements; modifications to fuel delivery, pressure regulation and metering systems; compatibility of materials and the potential for hydrogen embrittlement; combustion characteristics; potential effects upon NOx emissions; ventilation and hydrogen leak detection; safeguarding and emergency shutdown arrangements; start-up and shutdown arrangements; and any consequential changes to emissions control requirements.

ABL will seek confirmation from the relevant Original Equipment Manufacturer(s), where available, on whether the installed generating equipment can be converted to hydrogen operation and what principal modifications or replacement equipment would be required.

It is recognised that hydrogen combustion technology and associated generating equipment are continuing to develop. Future conversion could therefore comprise either modification of

the installed equipment, where technically feasible, or replacement with hydrogen-compatible generating equipment within the existing generating area.

Any future conversion would be designed to ensure that environmental permit requirements applicable at that time will continue to be met, including relevant emission limit values. Consideration would be given to potential NOx emissions associated with hydrogen combustion and the requirement for additional abatement, if necessary.

5.1 Conclusion – Technical Feasibility Test

Subject to confirmation from the relevant equipment manufacturer(s), no fundamental technical constraint has presently been identified that would prevent the generating plant from being converted or replaced to allow hydrogen to become the primary combustion fuel during the operational lifetime of the Site.

6 Hydrogen Fuel Access Test

The Environment Agency requires the operator to have reasonable grounds to believe that sufficient hydrogen could be accessed during the lifetime of the generating plant.

There is currently no requirement for a hydrogen supply to be available at the time of the environmental permit application.

Potential future hydrogen supply options could include import from off-site hydrogen production facilities by pipeline or by road for storage on site. Any hydrogen used to implement the decarbonisation pathway would be required to meet the applicable UK Low Carbon Hydrogen Standard.

The UK hydrogen production and distribution sector is developing and the availability and most appropriate method of supplying hydrogen to the Site cannot reasonably be determined at this stage in the operational lifetime of the plant.

The Site's decarbonisation readiness assessment will therefore be reviewed periodically to take account of the development of regional and national hydrogen infrastructure, technological developments and changes in the availability of low-carbon hydrogen.

No known feature of the Site has presently been identified which would inherently prevent future access to hydrogen, subject to the development of an adequate commercial hydrogen supply and associated infrastructure.

6.1 Hydrogen Fuel Access Self-Certification

Acorn Bioenergy Ltd. considers that there are reasonable grounds to believe that it will be possible during the lifetime of the relevant generating plant to obtain access to a sufficient supply of qualifying hydrogen to implement the proposed hydrogen conversion pathway.

7 Economic Feasibility Test

The timing and cost of future conversion to hydrogen will depend upon a number of factors which cannot presently be predicted with certainty, including the development and cost of hydrogen-compatible generating equipment; availability and cost of low-carbon hydrogen; development of hydrogen distribution infrastructure; modifications required to the existing CHP and fuel systems; future energy market conditions; and environmental and regulatory requirements applicable at the time of conversion.

The proposed approach does not require hydrogen conversion to be undertaken immediately. Rather, the Site must retain a technically and spatially feasible pathway to future conversion.

Given the continuing development of hydrogen combustion technology and hydrogen supply infrastructure, ABL considers that there are presently no known economic barriers which would make the proposed pathway inherently unviable over the operational lifetime of the generating plant.

Economic feasibility will be reconsidered as part of the periodic review of the Site's decarbonisation readiness assessment.

7.1 Economic Feasibility Self-Certification

Acorn Bioenergy Ltd. considers that there are reasonable grounds to believe that conversion of the relevant generating plant to hydrogen operation could be economically feasible during its operational lifetime.

8 Review of Decarbonisation Readiness

The Decarbonisation Readiness Report will be maintained as a controlled document within the Site's Environmental Management System.

The assessment will be reviewed at intervals not exceeding two years and updated where appropriate to reflect developments in hydrogen combustion technology; availability of hydrogen-compatible CHP or generating equipment; development of regional or national hydrogen infrastructure; changes in the economic feasibility of hydrogen conversion; changes to the generating plant or Site layout; and relevant changes in environmental legislation or Environment Agency guidance.

The preferred decarbonisation pathway may be reconsidered during these reviews where technological or infrastructure developments indicate that an alternative pathway, including carbon capture and storage, would be more appropriate.

9 Conclusion

The preferred decarbonisation pathway for the Devon AD Plant is future conversion of the relevant electricity-generating combustion plant to operate with hydrogen as the primary fuel.

The assessment has considered the four tests required by the Environment Agency: space, technical feasibility, hydrogen fuel access and economic feasibility.

Subject to confirmation of the available land allocation and the technical position of the relevant CHP Original Equipment Manufacturer(s), no fundamental barriers have been identified which would prevent the generating plant from being converted or replaced to enable hydrogen operation during its operational lifetime.

Acorn Bioenergy Ltd. therefore considers that there are reasonable grounds to conclude that the relevant generating plant can be maintained as decarbonisation ready.

The assessment will be reviewed at least every two years and updated as necessary to reflect technological, infrastructure, economic and regulatory developments.

Figure 1: Devon AD plant Site layout plan

AS NOTED ON A1 FRAME



Reference Table	
1	Site Office / Staff Welfare
2	Site Workshop
3	Weighbridge
4	Site Parking
5	Switchgear and site storage section of building
6	DNO Transformer Kiosk
7	CHP No1
8	CHP No2
9	Biogas Upgrade Unit
10	Emergency Generator
11	(a) Manure Reception Building with (b) Separation Hall
12	Emergency Boiler container
13	CO2 Recovery Unit and CO2 tanks
14	Odour Abatement
15	E-Comm containers
16	Liquid Feedstock Tank 1 - Volume 400m³
17	Liquid Feedstock Tank 2 - Volume 400m³
18	Liquid Feedstock Loading area
19	Digestate offtake area
20	Separated Liquid Storage Tank - Volume 1508m³
21	Post Digester 3 - Volume 2172m³
22	Pump Room
23	Pump Room
24	Post Digester 2 - Volume 1508m³
25	Post Digester 1 - Volume 2172m³
26	3 No. Pasteurisation tanks (25m³ each)
27	Dirty Water Process Tank - Volume 100m³
28	Existing tank Not in Use
29	Primary Digester 3 Tank - Volume 4455m³
30	Primary Digester 2 Tank - Volume 4618m³
31	Primary Digester 1 Tank - Volume 4618m³
32	Emergency Flare
33	Control Panel Kiosk
34	Grid Entry Unit Kiosk
35	Covered Storage Clamp - Volume 21,500m³
36	Silage Leachate catchment sump
37	Process Water Lagoon - Volume 1150m³
38	Feed Hoppers - 170m³ Volume and 115m³ Volume
39	Propane Tank - Volume 24tonne
40	Oxygen dosing Unit
41	Pump Room
42	Biogas Booster and Chiller
43	Pump Room
44	Gas Treatment System
45	Underground Cellular Storage Crates
46	Indicative area for future hydrogen conversion/storage infrastructure subject to hydrogen availability, technology development and government policy

SITE PLAN
Scale: 1:750 @ A1

NOT FOR CONSTRUCTION

NOTES:-

Permitted Area Boundary (3.34ha)

Two Sisters Food Group effluent discharge pipe

N

Rev	Date	Description	DR	CH
C	03/06/26	Revised Layout	SJC	
B	01/05/26	Revised Layout	HG	SJC
A	11/03/26	Preliminary Issue	SJC	–

acorn BIOENERGY

Job Title
AD Plant.
Devon Green Power

Drawing Title
Devon Green Power
Site Layout & Permit Plan

Status
Approval

Scale	Date
As Shown	Mar '26

Drawn By	Checked	Approved
HGJ	SJC	–

Drg. No.	Rev
DGP–ABE–LAY–112	C