Regulation for On Farm AD and lagoon methane capture – enablers and barriers

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Summary

On-farm methane capture and anaerobic digestion (AD) are vital technologies to treat waste and produce renewable energy for use on site and in the local area. This is particularly important where the feedstock have high water content (e.g. slurry) and in areas with rural road infrastructure and sparse gas grid connections. In this context, on farm methane capture and AD can provide additional income to farmers and reduce methane emissions. Two types of technology are in development and use: small-scale anaerobic digesters and systems to capture emissions from slurry lagoons (referred to as passive AD). The Net Zero Methane Hub promotes the production and use of biogas/ biomethane in Cornwall, funded by Cornwall Council Shared Prosperity Fund, to support local environmental commitments and the rural economy.

The Hub has investigated regulatory enablers and barriers for the uptake of on farm methane capture and anaerobic digestion, reviewing relevant regulatory areas and conducting interviews with technology developers and other stakeholders. This stakeholder engagement revealed important regulatory barriers to both technology development and adoption by farmers. If these barriers persist, they will slow down the roll out of on farm systems and the environmental and financial benefits that they bring. This report summarises the outcomes of the work, including a high-level review of the relevant regulation, discussion of current regulatory barriers and enablers. Actions needed to remove regulatory barriers are summarised below and discussed in more detail in the full report.

Regulatory enablers for the roll out of on farm anaerobic digestion and methane capture:

Environment Agency

- Standard rules permit SR 2023 No 1, lagoon covering:
  - **Operator competency** – develop cost-effective training requirements for on farm projects
  - **Electricity generation** – examine feasibility of permitting electricity generation on site
  - **Maximum lagoon size** – extend size limit considering typical slurry lagoon volumes
  - **Bunding** – align permitting requirements for bunding with SSAFO requirements
- Regulatory position statement, trials for technology to treat waste – extend validity from six months to facilitate longer trials
- Exemption T24, on farm anaerobic digestion, retention time – allow flexibility for retention times under 28 days where efficacy of the process is proven

Natural England

- Biodiversity net gain - requirements proportionate to the impact of the project
- Habitat regulations - permit betterment for ammonia emissions

Planning

- Permitted development - clarify where permitted development is applicable for on farm AD and methane capture projects

Introduction

On farm Anaerobic Digestion (AD) or methane capture projects require consideration of a very wide range of regulation, from planning law and environmental permitting to health and safety. The purpose of this report is to communicate areas of concern within these regulations to policy makers to support the removal of barriers to adoption of this technology and the environmental benefits it can bring. Recommendations made are focused on actions needed to accelerate the roll out of the technology, particularly at small-scale[1].

Methodology

Public domain information has been used to generate a high-level review of regulatory requirements. Stakeholder interviews were then carried out to identify key areas of regulatory challenge. These areas then form the basis of the report's recommendations. Stakeholders from the following organisations participated in the work: Bennamann, Biolectric, Earthcare Technical, QUBE and WASE.

Scope

This report considers regulation for projects where digestion of the feedstock is active (in a conventional AD plant, referred to here as AD or active AD) or passive (such as gas captured from a slurry lagoon, referred to as passive AD) focusing on small on-farm installations. The scope of the report is limited to deployment in England and covers the following regulatory areas:

1. Planning
2. Habitat regulations
3. Environmental permitting
4. Animal by-product regulation
5. Waste duty of care
6. Health and safety
7. Digestate/slurry residue use
8. Standards governing CO_2 use

This document is intended as an overview, for more detail the relevant source documentation should be consulted, and expert advice should ideally be sought.

Regulation Review

1. Planning

In some cases, both active and passive AD infrastructure can be installed under Permitted Development (i.e. without planning permission), see below. Note that local councils should always be consulted for guidance, as local variations to these conditions may apply.

Passive AD
In some cases, lagoon methane capture projects can be carried out under Permitted Development, avoiding the need for full planning permission.

Slurry pits can be constructed under Permitted Development if they are less than 0.5 ha (5,000 m^2) in plan area unless they are less than 400 m from a protected building (a building unconnected to the farm operation, e.g. a house, school, church etc.). Covering a slurry lagoon may not require planning permission and can be installed under Permitted Development rights. Additionally, any equipment associated with the system (e.g. gas storage and processing) may be installed without planning permission, provided that:

- The compound area is less than 1,000 m^2
- Any equipment is lower than 12 m from ground level, or 3 m if you're near an airfield

In England, there is a requirement to notify the Environment Agency (EA) at least 14 days before a new slurry lagoon is constructed, or substantial modifications are carried out. The EA can require improvements to the project, so it recommended that the risk of constructing a store that is not compliant is reduced by involving the relevant agency at an early stage. In some cases, a council's prior approval would still be expected, despite not requiring a formal permission. Note that in certain council areas, Permitted Development rights may have been removed.

Active AD
Depending on the project, on farm active AD plant may be installed under Permitted Development. Planning guidance states that AD plant area should not exceed 1000 m^2 or a height of 12 m (or 3 m if within 3 km of an aerodrome), and that any building for storing fuel or waste from the AD plant should not be within 400 m of a protected building and store only products produced on site. Similar to passive AD projects, a council's prior approval would still be expected, despite not requiring a formal permission and in certain council areas, Permitted Development rights may have been removed.

2. Habitat Regulations

A Habitat Regulations assessment is required for a project where the site is designated as a Site of Special Scientific Interest, Special Conservation Area, Special Protection Areas or Ramsar wetland.

If a Habitat Assessment is required, the project will need to assess the level of damage that could be caused to the site as a result of the installation.

The assessment is carried out by competent authorities, which include the local authority, Environment Agency, Natural England and DEFRA.

3. Environmental Permitting

Environmental permitting (EP) is a scheme in England and Wales for regulating business activities that could have an impact on the environment and human health. All AD projects are required to obtain a permit or exemption to operate and a separate permit/exemption to spread digestate. Operational permits are prefixed with a 'T', indicating that it is Treatment; spreading permits are prefixed with a 'U' indicating Utilisation.

There are three levels of permitting for relatively simple through to complex installations: exemptions; standard rules (SR) permits and bespoke permits.

Permitting Exemptions
Exemptions are designed for small scale, low-risk facilities. Where an exemption applies, operators are required to register with the EA and provide some technical information, no charges apply.

Exemptions which apply to anaerobic digesters are:

T24 Exemption: for anaerobic digestion at premises used for agriculture and burning of resultant biogas. There are specific waste types that can be used under this exemption (including manures, slurries and plant tissue) and a total quantity of waste treated or stored at any one time must not exceed 1,250 cubic metres. The appliance used (e.g. a CHP or boiler) must have a net rated thermal input of less than 0.4 megawatts (MW).

T25 Exemption: anaerobic digestion at premises not used for agriculture and burning of resultant biogas. This exemption allows the treatment of food and other biodegradable wastes by anaerobic digestion to produce a digestate which can be used for providing benefit to land. The gas produced must be used for generating

energy. With this exemption, wastes that are animal by-products cannot be treated without an appropriate authorisation. Up to 50 cubic metres of waste can be stored or treated at any one time. Any biogas produced must be burned in an appliance with a net rated thermal input of less than 0.4 MW.

Standard Rules Permit – Active AD
A standard permit is issued for plants which comply with pre-defined Standard Rules, which cover aspects such as digester design, feedstock types, digester throughput, waste storage, emissions and digestate management. An application charge is applied, followed by a yearly permitting charge. Other charges include variations to the permit (minor, normal or substantial), transfer applications and a surrender application.

Standard Rules permits are available for anaerobic digestion facilities, including those on farm. Permit types (some of which may supersede older SR permits) include:

- **SR 2021 No 6** Anaerobic digestion facility including the use of the resultant biogas installations
- **SR2021 No 7** Anaerobic digestion facility including the use of the resultant biogas waste recovery operation
- **SR 2021 No 8** On farm Anaerobic digestion facilities using farm wastes only including the use of the resultant biogas installations
- **SR 2021 No 9** On farm Anaerobic digestion facilities including the use of the resultant biogas waste recovery operation

These permits are suitable for AD sites with a treatment capacity of less than 100 tonnes per day, accepting no more than 35,000 tonnes on site each year for SR 2021 Nos 7 & 9, 100,000 tonnes for SR 2021 Nos 6 & 8. The site may:
- accept, prepare, store and carry out anaerobic digestion of specified biodegradable wastes
- treat and use the resulting biogas
- treat the resultant digestate

These rules do not allow vehicle fuelling stations.

Standard Rules Permit - Lagoon methane capture (passive AD)
An updated Standard Rules permit has been released in 2024, following a public consultation - **SR 2023 No 1** "Capture, treatment and storage of biogas from lagoons and tanks"

The new permit allows the operator to:
- receive and store biowastes in an engineered lagoon or tank
- collect and store biogas from an engineered lagoon storage or tank, or from an existing lagoon, which meets the criteria specified in these rules
- upgrade biogas to biomethane in an engineered system in a static or mobile unit

at the place of production
- store upgraded biomethane
- fuel vehicles at the site of production
- inject biomethane to the national grid at the place of production
- flare excess biogas or biomethane in an emergency, or to protect life and equipment, or during maintenance

Note that this permit does not allow combustion of biogas or biomethane in a spark engine, i.e. a combined heat and power plant (CHP). Additionally, a maximum of 10 T of biogas and biomethane may be stored on site.

Emissions monitoring
Standards Rules permits for lagoon methane capture and AD include a requirement for monitoring of fugitive emissions. Requirements vary by emissions and plant type, for example: for on farm AD methane emissions, Standard Rules Permits SR 2021 Nos. 7 and 9 require at a minimum methane leak detection and repair (LDAR) activities at least annually; for lagoon methane capture, SR2023 No1, methane LDAR activities are required every 6 months, or as otherwise agreed.

Bespoke Permit
If a facility cannot meet the exemption or standard rules requirements, then it falls under a bespoke permitting regime which can be costly, not least due to the time required to communicate the nature of the variation and the costs associated with the EA's assessment. Most on-farm digesters of the scale discussed here are covered by an exemption or standard rules permit.

Regulatory position statement/Local Enforcement Position
A regulatory position statement or local enforcement position allows a specific activity to be carried out without a permit. An example is carrying out research or trials on treating waste without a permit. The regulator will consider innovation projects and, where necessary, allow operation under certain conditions until the need and rules for a further permit type can be established, such as in the passive AD case.

Staff training
To apply for any environmental permit, operators must demonstrate their technical competence. There are currently two approved schemes for England and Wales; the CIWM/WAMITAB scheme and the ESA/EU Sector Skills scheme.

4. Animal Byproduct Regulations

Animal byproduct regulations (ABPR) govern the handling of byproducts such as carcasses, eggs and milk where they are not intended for human consumption and manure. Waste is classified depending on the level of risk, and manure is classed as

Category 2, high risk. Processing and handling regulations depend on the category of the waste. Some types of waste require preprocessing prior to anaerobic digestion. If required, EU or UK standards specify heating requirements and particle size. Manure and milk products do not need preprocessing prior to digestion.

5. Waste duty of care

The duty of care specifies that an operator must take all reasonable precautions to keep waste safe. This is a legal responsibility to produce, store and transport waste without harming the environment. The Duty of Care applies to household, industrial and commercial waste; note that it does not apply to waste that is covered by Animal Byproducts Regulations.

6. Health and Safety

Anaerobic digestion can be regarded as a chemical process with a range of associated risks: flammable atmospheres, fire and explosion, toxic gases, confined spaces, asphyxiation, pressure systems, COSHH, etc. In addition, it also incorporates gas handling and gas storage. Therefore, it is essential that thorough hazard and risk assessments are carried out at each stage of a project from design to installation to commissioning to implementation and operation, including HAZOP and DSEAR assessments. Equipment for use in areas where a flammable gas may be present should have an appropriate ATEX rating.

Storage of biomethane and biogas is governed by guidelines from the British Compressed Gas Association (BCGA). Where cylinders of biomethane are stored, consideration should be given to the need to secure the cylinders (e.g. with a security cage to avoid tampering and theft) and also to avoid the cylinders falling over and causing injury. Site conditions should also be considered e.g. the surface and proximity to vegetation to minimise fire risk. Distances from other site features are governed by standard separation distances, note that separation distances for methane are different from those for LPG, e.g. 5 m between the store and the property boundary is required for compressed methane, compared to 3 m for LPG.

7. Digestate

PAS110 is a voluntary Publicly Available Specification for digestate, so that producers and users can check that digestate meets a certain quality requirement. If digestate meets PAS110, it is no longer considered a waste and so can be spread without an environmental permit or waste management license exception. There are a range of requirements that a producer must meet to comply with PAS110, including requirements on input feedstocks, digestate quality, quality management, testing, documentation, a requirement to pasteurise digestate is made from most materials.

PAS110 works hand-in-hand with the quality protocol (QP) which provides the guidance on how to meet end of waste by ensuring elements such as traceability, compliance/audit and digestate use.

Permits for Spreading Digestate
Two exemptions (U10, U11) apply to the need for PAS110 for spreading digestate where the production of the digestate took place under a Standard Rules exemption (T24 or T25), i.e. anaerobic digestion at premises used for agriculture and burning of resultant biogas, or at premises not used for agriculture. Spreading exemptions relate only to digestate produced under T24 or T25 with a quantity limit of 50 tonnes per hectare and a storage limit of 200 tonnes, at any one time.

U10: spreading of digestate from pre-defined feedstock on agricultural land to confer benefit

U11: spreading of digestate from pre-defined feedstock on non-agricultural land to confer benefit.

There is a Standard Rules permit for spreading waste material to land (if the criteria for an exemption do not apply). Standard permit SR2010 No. 4 allows the spreading of no more than 250 tonnes per hectare and dictates that no more than 3,000 tonnes of waste material is stored at any one time and for no longer than 12 months. For each spreading of material to land, there is a charge related to the type of material being spread, depending on whether the material is categorised as lower risk, medium risk or high risk.

8. CO_2 Use

Stringent purity requirements exist for the use of CO_2 from AD for food and drink, the gas must comply with E290 and additional guidance from the European Industrial Gas Association (EIGA). This guidance states that leading manufacturers only accept liquified CO_2 from a source they have analysed, considering the risks associated with the feedstock and digestion processes used and chemical analysis of each batch of CO_2, and comply with European Implementing Regulation 142/201156 on CO_2 quality for the food and beverage sector.

For other carbon capture and utilisation (CCU) applications, quality requirements depend on the application, EIGA guidelines tend to be the guiding specification, so all (large) CO_2 producing plants are generally designed to deliver one quality of liquefied CO_2. Considerations around transport of CO_2 also lead to the adoption of one quality standard. For carbon capture and storage (CCS), some standards are proposed but not binding at the time of writing.

Regulatory barriers and enablers to the adoption of on farm AD/methane capture

Identified Barriers

Planning permission
Permitted development
- Consistency – the approach to permitted development for lagoon capture and anaerobic digestion can be unclear and varies by planning authority
- Permitted area - uncertainty over to what extent gas processing equipment is included in the plan area for the slurry lagoon

Where planning permission is required, the following issues were identified:
- Biodiversity net gain – the requirement to improve biodiversity where small AD plants are installed seems disproportionate given the plant typically has little impact on biodiversity (i.e. installed in a yard that was previously concreted).
- Habitat regulations, ammonia levels – permitted ammonia emissions are based on an absolute level rather than an improvement on current levels (i.e. no betterment is permitted), which means that acceptable emissions can be challenging to achieve where local background emissions are high. The approach to ammonia emissions seems to vary between authorities.
- Application time – timescales for responses from authorities seem unreasonably long, adding significant delays to projects, for example, those to construct new slurry lagoons
- Consistency – there seems to be inconsistencies in approach between different planning authorities

Environmental Permitting
Application time and cost – In general, where permits are required for an activity that is part of a research project, the application time can be prohibitive for a grant funded project with a defined end point. In general, profit margins for small digesters tend to be smaller than larger digesters, therefore any increases in permitting prices can have a more detrimental effect on small digesters where there is a much lower rate of return, so any rises should be considered carefully in this sector.

Regulatory Position Statement
Permit duration – Regulatory Position Statement for Trials for technology to treat waste has a time limit of six months, which may not be sufficient time to complete required trials.

Exemption
Retention time – Exemption T24, on farm anaerobic digestion, specifies a minimum

retention time of 28 days, which reduces the permitted feedstock throughput rate for some advanced technologies with faster digestion rates.

Standard Rules permits
The following challenges were identified with SR 2023 No 1 Capture, treatment and storage of biogas from lagoons and tanks:

- Electricity generation – Biogas generators are not permitted on site
- Competent operator – The permit requires that the operator is on site 20% of the time. However, it is not feasible for the installing company to be on site 20% of the time for all customers, and current training to be designated a competent person is too onerous for farmers, including content with is not relevant to on farm digestion.
- Maximum lagoon size – slurry stores are limited to a maximum volume of up to 500 m^3 which, given the requirement for six months storage, limits the permits applicability to farms with less than 450 cows (approximately).
- Bunding – permitting requirements for 110% bunding for slurry tanks adds additional cost and complexity to the system which may discourage adoption, given SSAFO regulations do not include a requirement for bunding.

PAS 110
Whilst adherence to the Quality Protocol is possible at small farm digester scale, the cost of end of waste is likely to be prohibitive at this scale which would preclude small digesters from making revenue from digestate off farm.

Other challenges

Electricity Grid connection
Where electricity is generated from biogas or biomethane made on farm, a range of issues were identified around electricity export:

- Local grid capacity – may limit the quantity of electricity that may be exported
- Cost of connection – high price of installation of equipment to export electricity (e.g. export meter £10k-£15k, 3-phase connection up to £200k)
- Connection time – time delays in installing a connection
- Commercial export tariff – some electricity companies offer an export tariff for small scale renewable generation, however while electricity companies are familiar with providing payments for domestic solar producers, some lack experience with small AD so payments can be time consuming to set up, further delays have been experienced in receiving payments

Insurance
Due to the relatively small number of insurance providers in the industry, involving them at the design stage is recommended as design criteria can be stringent.

Enablers

Environment Agency

- Standard rules permit SR 2023 No 1, lagoon covering:
  - Operator competency – develop cost-effective training requirements for on farm projects
  - Electricity generation – examine feasibility of permitting electricity generation on site
  - Maximum lagoon size – extend size limit considering typical slurry lagoon volumes
  - Bunding – align permitting requirements for bunding with SSAFO requirements
- Regulatory position statement, trials for technology to treat waste – extend validity from six months to facilitate longer trials
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Natural England

- Biodiversity net gain - requirements proportionate to the impact of the project
- Habitat regulations - permit betterment for ammonia emissions

Planning

- Permitted development - clarify where permitted development is applicable for on farm AD and methane capture projects

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[1] Defined here as typically less than 100 kW electric (or equivalent). This equates to slurry from approximately 1000 full-grown dairy cows.

Section 1

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Section 6

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