An Coimisiún um Rialáil Fóntais
Commission for Regulation of Utilities

High Efficiency CHP Clarification Note on Anaerobic Digestion Useful Heat

Clarification Note

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1. Background

In March 2012 the Commission for Regulation of Utilities (CRU) published its decision paper (CER/12/125) setting out the standardised process for applications from generators to be assessed for certification as High Efficiency Combined Heat and Power (HE CHP).

Since 2012, the CRU has considered several applications for HE CHP certification entailing demand for heat in Anaerobic Digestion (AD) Facilities. This clarification note sets out what is needed from applicants to demonstrate to the CRU that the heat loads in such cases are *useful heat* for the purpose of meeting the requirements of the Energy Efficiency Directive 2012/27/EU.

This clarification note should be read in conjunction with CER/12/125, specifically Section 3, which addresses the question of useful heat in the certification process for HE CHP.

It should be noted that the following clarification notes have been issued by the CRU for other heat uses:

- CER/12/184: Clarification on the assessment of space or water heating for domestic, public and commercial buildings in the certification process for HE CHP; and
- CRU17302: Clarification on the assessment of sorption chillers useful heat in the certification process for HE CHP.

2. Clarification on Anaerobic Digestion (AD) useful heat assessment of useful heat in AD facilities

2.1 Useful Heat

The purpose of Directive 2012/27/EU on the promotion of cogeneration based on a useful heat demand ('the Directive') is to increase energy efficiency and improve security of supply by promoting and developing high efficiency cogeneration of heat and power.

The Directive provides for certification of HE CHP when certain conditions are met. These requirements, and the relevant definitions of useful heat and economically justifiable demand, are reflected in CER/12/125. Therefore, in order for the CRU to certify that a given heat load is useful heat within the definition of the cogeneration Directive 2012/27/EU and relevant Irish legislation, the CRU must be satisfied that the heating demand does not

exceed that which would otherwise be satisfied at market conditions by energy generation processes other than cogeneration[1].

Specifically, the Directive defines useful heat as "heat produced in a cogeneration process to satisfy an economically justifiable demand for heat of cooling". The Directive defines economically justifiable demand as "*the demand that does not exceed the needs for heat or cooling and which would otherwise be satisfied at market conditions by energy generation processes other than cogeneration*".

Where there is a clear need for heating an anaerobic digestor, which would normally be met in the absence of CHP at prevailing climatic and market conditions, the CRU considers that there is a case for treating such heat as useful heat. Here, the intent of the Directive is deemed to be satisfied in that there is a genuine need for heat.

The application of CER/12/125, should not serve to frustrate outcomes that are in line with the purpose and aims of that Directive. A strict application of the criteria set out in relation to useful heat in Section 3 of CER/12/125, notably those set out in relation to the techno-economic feasibility study for the business that will use the heat, could serve to do so in the case of heating an anaerobic digestion process.

To ensure that the purpose and intent of the Directive is met, information requirements in relation to heating an anaerobic digestor are set out in the section below.[2]

2.2 Information considered

CRU has undertaken a high-level desktop study of available information on heat use within anaerobic digestion (AD) processes. In its desktop study the CRU considered all historic Irish AD HE CHP applications, other studies, available literature and theoretical calculations, and a recommended benchmark for acceptable heat use within AD processes. The scope of this desktop study was limited to plants in Ireland and the UK[3]. A summary of the key elements taken into the CRU calculation are described in Appendix 1.

[1] Section 3, page 15
[2] Please note that Section 3 of CER/12/125 applies in full for all other heat loads not covered in this clarification note.
[3] This was to allow for similar climatic factors and regulatory environments.

2.3 Recommended Caps

Applicants that claim heat generated in a CHP plant as useful heat in an AD process may be exempt from providing a full economic assessment in accordance with CER/12/125 Section 3 if they use less heat than that set out in this clarification note[4].

The acceptable heat caps for AD plants applying for HE CHP certification where heat produced from the CHP process is utilised within their process is as follows[5]:

1. Cap for plants with pasteurisation

- **For a plant that requires either pre or post pasteurisation, heat use within the AD process must not exceed 97 kWh/tonne of feedstock**[6];

The heat required for pasteurisation[7] is a factor of the amount of heat required to raise a given mass of feedstock from the ambient temperature 9˚C in Ireland to 70˚C or slightly higher for the duration of one hour, this is approximately 73 kWh/tonne. A typical tank type with 100mm of mineral wool insulation would require 10-15 kWh/tonne to maintain temperature of 37˚C for a year. Adding an allowance of 10% of additional heat use to these values, a total heat cap for a plant including pasteurisation of 97 kWh/tonne of feedstock.

Please note that the cap does not allow for the heating of make-up water. This has been covered by a 10% allowance of additional heat use, when calculating the cap. CRU notes that there should be very little heat needed for pre-heating make-up water. In many AD plants, the liquid fraction of digestate is separated and reused as make-up water. This has the advantage of maintaining the chemistry in the digester as well as recirculating heat and reducing the volume of digestate for disposal. Even if digestate were not recirculated, it should be expected that a plant would use a basic form of heat exchanger to pre-heat feedstock from digestate. Plants that post-pasteurise digestate have an abundant source of heat in the form of 70˚C digestate that can be used to pre-heat incoming feedstock and make-up water. For plants that pre-pasteurise, they have feedstock at 70˚C available to

[4] It may not be practicable for some applicants to meet the recommended cap, in this instance, applicants must to supply economic assessment evidence as set out in CER/12/125.
[5] Plants should be encouraged to improve on these caps and utilise energy efficiency systems to ensure efficient heat use within their process.
[6] Please note that make-up water does not qualify as feedstock for this calculation.
[7] The Department of Agriculture, Food and the Marine (DAFM) require many AD plants to pasteurise their feedstock or digestate. This is detailed in DAFM document number CN11 titled "Approval and operation of biogas plants transforming animal by-products and derived products in Ireland", which states that "all the material within the biogas pasteurisation unit must be simultaneously held at 70 °C or above for 60 continuous minutes".

enter the digester. There should not be a requirement to add water in excess of that required to reduce the feedstock that has been pasteurised to that below the digester temperature.

2. Cap for plants without pasteurisation

For a plant that does not pasteurise either feedstock or digestate, heat use within the AD process must not exceed <u>54 kWh/tonne</u> of feedstock[8].

Substituting the heat required to reach 70˚C with a typical tank temperature of 37˚C, digestate pre-heating is approximately 32.6 kWh/tonne. A typical tank type with 100mm of mineral wool insulation would require 10-15 kWh/tonne to maintain temperature of 37˚C for a year. Adding an allowance of 10% of additional heat use to these values, a total heat cap for a plant without pasteurisation of 54 kWh/tonne of feedstock.

Please note that any plant that exceeds these caps and wishes to claim the heat as an economically justifiable demand must complete this assessment in full, as required by CER/12/125[9].

3. Innovative cases

If a plant is using an innovative solution and exceeds the caps above, then the plant must provide a full economic assessment as per CER/12/125[10].

4. Conditions for all AD plants

Applicants that claim heat generated in a CHP plant as useful heat in an AD process must separately meter any heat used in the AD process. If the site supplies heat to other users (perhaps a neighbouring building) each heat user will have a separate heat meter.

The useful heat claimed for the AD process will be that recorded by the calibrated heat meter. It is assumed that in most cases it will be under the cap reference in this document. Assuming it is, a full economic justification will not be required.

If the heat claimed is higher than the cap, a full economic justification will be required.

To qualify for assessment under this clarification note, applicants must provide the following information along with their application or annual report:

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[8] Please note that make-up water does not qualify as feedstock for this calculation.
[9] Section 3, page 15
[10] Section 3, page 15

- Details of the tanks used in the process:
  - The dimensions (e.g. height and diameter for a cylindrical tank); and
  - Description of the wall, roof and floor that describes the thickness of each building element (e.g. 10mm steel, surrounded by 100mm insulation and 5mm cladding).
- Details of the feedstock processed:
  - A monthly summary of feedstock, describing the tonnage of each type of feedstock and whether the feedstock was produced onsite or imported;
  - Confirmation that a more detailed breakdown of feedstock will be made available to the CRU if requested; and
  - If applicants added water to their AD process during the assessment period, documented evidence of this must be provided (e.g. from a water meter) along with a justification for its use.
- If an AD plant is to claim their material must be pasteurised, they must show evidence that the Department of Agriculture, Food and the Marine requires this for their site.

Appendix 1

The CRU reviewed available information from the Agri-Food and Biosciences Institute (AFBI) test site. ABFI operated a test AD site in Hillsborough, Co Down. In 2010 they undertook an 18-month performance test on the plant and published their findings[11]. In their report they noted that the plant used 31 kWh of heat per tonne of input slurry to pre-heat feedstock and to maintain a digester temperature of 37˚C. The plant used a 660m³ epoxy coated continuously stirred primary digester tank with 100mm of mineral wool insulation. The secondary digester was also 660m³ but was uninsulated and unheated. The plant did not require pasteurisation as it processed cattle slurry, and the digestate was spread directly on a farm owned by AFBI.

In addition to the AFBI reference, the CRU has considered a wide range of studies and reports which looked at the wider performance of AD plants, a significant number of which used some form of CHP plant. In none of these sites was there an additional heat source required to the CHP engine to run the AD process, and in many cases additional heat off takers were connected. This indicates that in any AD powered CHP plant, there will be excess heat to that required of the AD process. A useful reference list is published by the Anaerobic Digestion and Bioresources Association (ADBA) in the UK[12].

CRU has considered the level of insulation typically used on AD digester tanks. A typical digester tank construction would be a concrete base with a steel, or concrete, tank with 100mm of mineral wool insulation[13]. This equates to a U-value in the region of 0.4 W/m²K.

[11] P. Frost and S. Gilkinson (August 2010), First 18-month performance summary for anaerobic digestion of cow slurry at AFBI Hillsborough
[12] https://adbioresources.org/library/case-studies/case-study-planet-great-ynys
[13] Information on the insulation of approximately half a dozen digestors on the island of Ireland is publicly available.