Minimum requirements for European voluntary systems for self and external inspection of possible methane emissions on biogas and biomethane plants

This document was built together with and reviewed by the project consortium from the research project “EvEmBi”- Evaluation and reduction of methane emissions from different European biogas plant concepts (funded within 11th ERA-NET Bioenergy Joint Call/ 1st add. Call of BESTF3). The project partners involved in the EvEmBi project are DBFZ, ISWA, FvB, BOKU, BE2020+, AAT, KBVÖ, ÖS-CH, FHB, Oester, RISE, Avfall Sverige, Svenskt Vatten, DTU and EBA.

Content

1. Preface

For a fast-growing technique, such as biogas and biomethane production, it is vital making progress in performance. Besides developing all kinds of efficiency improvements, one key puzzle is minimizing the unwanted releases of possible methane emissions. Therefore, reliable data concerning fugitive methane emissions at biogas and biomethane plants are necessary. Plant operators must be supported in obtaining better data and knowledge about potential emissions at their plants, how to avoid emissions and how to further improve the environmental performance of their biogas system.

This document lays down minimum requirements and recommendations, which support the development of national voluntary monitoring systems for self and external inspection of possible methane emissions on biogas and biomethane plants in European countries. Such systems are voluntary undertakings where biogas and biomethane plants commit to systemically identify and reduce their methane emissions. The introduction of a voluntary system for self and external inspection of methane emissions on biogas and biomethane plants will thus allow countries to reduce their emissions and further improve the environmental performance of their biogas and biomethane industry.

The purpose of these minimal requirements and recommendation is to facilitate the introduction and development of national voluntary monitoring systems throughout Europe. Lessons learned and knowledge build-up from existing voluntary systems in Europe (Sweden, Denmark and Switzerland) served as basis for the content of this document. It must be noted, however, that national voluntary systems may differ depending on specific national conditions.

The inclusion of the herein mentioned minimum requirements into new national voluntary monitoring systems should allow the comparison of results from European voluntary systems in the best possible way. It must be considered, however, that only the basis for the development of national voluntary systems is provided here. The comparability between methane emissions of biogas and biomethane plants of different countries increases further when system boundaries and measurement techniques are aligned.

This report ties in with the information sheet for biogas industry “Methane emission mitigation strategies” [1]. Within this information sheet, EBA states the importance of minimizing the methane emissions from biogas industry. For that, it summarizes potential emission sources and addresses how to minimize methane emissions from biogas plants. Additionally, several ongoing initiatives for reducing methane emissions in European biogas sector are introduced in this information sheet.

2. Purpose and goal of voluntary systems

The overarching goals of voluntary systems for the self and external inspection of possible methane emissions on biogas and biomethane plants are:

1. Further improvement of the environmental performance of biogas systems by identifying and reducing methane emissions.
2. Support for plant owners in performing a structured inventory of their plant to detect possible methane emissions.
3. Knowledge build-up and awareness of operators. Participating plants can compare their own plant within the overall sector, increase economic efficiency and improve the GHG balance of their plants.
4. Provision of better information about methane emissions for the biogas industry and thereby greater credibility. Confidence in the sector is build, as the biogas industry can provide reliable statistics and show development. It allows to set short-term and long-term goals on emission reductions.
5. Assurance of the societal value of biogas production with regard to GHG mitigation.

The existing voluntary systems (currently in Sweden, Denmark and Switzerland) consist of two main parts:

- Systemic **leak detection** work and remedying of found leaks, primarily performed by the plant's own personnel.
- Emission measurements at emission points with systemic emissions and/or whole site emissions to **quantify emissions** and losses, performed by an external and independent measurement consultant.

A national voluntary system should have the aim to reach a high level of plant participation. As many as possible plants should have access to the knowledge build-up through the voluntary system. It is therefore recommended that the system is broadly communicated and accepted by the industry before it launches. For a fast start-up, the system should focus, at least initially, on what is most useful for the industry as well as easy accomplished in the short run.

3. Minimum requirements for European voluntary systems for self and external inspection of possible methane emissions on biogas and biomethane plants

In the following, minimum requirements and recommendations are laid down for the introduction and development of European voluntary systems for self and external inspection of possible methane emissions on biogas and biomethane plants.

3.1 Ownership and purpose of the voluntary system

Minimum Requirements

- The voluntary system should have a clear ownership.
- The voluntary system should have a clear purpose.

Clarification and recommendations

National voluntary systems need defined commitments and responsibilities amongst different stakeholders. It is recommended that one party has the ownership of the system. The voluntary system could for example be owned by the national biogas or waste association. The commitments and responsibilities amongst plant operators, measurement consultants and the administrative office need to be agreed on.

3.2 System boundaries

Minimum Requirements

- The accepted boundaries of the system should be well described.

Clarification and recommendations

Well described system boundaries are important. The system boundaries do not necessarily need to be the same for every country.

The following basic boundaries are recommended: the system includes the whole gas producing facility, the on-site storages (substrate storage and digestate storage). Storage tanks or facilities which are not at the site should be excluded. Emissions generated inside the CHP container or caused by combustion should be considered separately. Also the emissions during upgrading process should be considered in a separated system.

As examples, the system boundaries of the Swedish, Danish and Swiss systems are listed:

- In the **Swedish** EgMet system[1], the system boundaries are defined with the following criteria in mind:
    - Only parts owned/are controlled by the plant owner shall be included
    - Only parts related to the production of biogas or refinement/upgrading of gas shall be included; emissions in connection with the use of the gas or digestate and emissions in connection with transport of substrate, digestate and gas are not included in the system.

[1] Details on the Swedish EgMet is described at the webpage of Swedish Waste Management Association [2] and Swedish Water Associations [3] who are the owners of the system.

The system is currently defined for co-digestion, wastewater treatment and gas upgrading plants, i.e. CHP units and boilers as well as gas storages of compressed biomethane (e.g. for distribution by truck to fuelling station) are outside the current boundaries of the system. However, storage of digestate and biogas are included but not the transport of these materials.

In **Denmark**[2], the gas producing facility includes reactors, on-site biomass and digestate storage, gas treatment as well as gas utilization (gas engine/gas upgrade), if present at site.

- In **Switzerland**, the following parts of an agricultural biogas plant are measured for leakages and accounted for quantification of unwanted emissions: pre-digestion storage tanks, hygienisation units, all digesters and post-digesters, digestate storage tanks, all gas-carrying elements such as gas pipelines, CHP container and instruments such as gas drying, compressors, condensation pits. CHP exhaust gases are not included as they are not considered as leakage.

3.3 Performing leak detections

Minimum requirements

- Self-control should be the focus of leak detection.
- Third-party revision for credibility is required.

Clarification and recommendations

Participating plants shall have a procedure for regular and systemic leak detection. A more extensive leak detection inspection is recommended to be performed annually, at which the entire plant is systemically inspected. Less extensive inspection, i.e. intermediate inspection, can be performed more frequently at several defined points at the plant. A leak detection record for each plant is recommended to use during leak detection inspections. This record together with the procedures can be used and reviewed by a measurement consultant.

It is recommended to have a clear agreement on methods and instruments for performing leak detection. Recommendations for detecting and determining emissions from biogas plants were published during the earlier MetHarmo project (funded within 9th ERA-NET Bioenergy Joint Call) [5]. This document can serve as a basis here. Every country is free to use this document, which is based on experience, and makes an own national handbook out of this. The owner of the voluntary system can choose to provide leak detection equipment for free, as in the case of the Swiss voluntary system.

3.4 Quantifying emissions

Minimum requirements

- An approved third-party measurement consultant shall carry out emission measurements and calculations to quantify emission losses.
- The methods to quantify emissions should be well described.
- The voluntary system should at least address methane emissions.

Clarification and recommendations

The measurement and calculation methods for the consultant to follow shall be described in mutual agreement with the national biogas industry. The national biogas industry, e.g. represented by the biogas associations, should agree on the definition of system boundaries, the definition of gases

[2] • Details on the Danish program are described in [4].

covered, emission objects to be included and in general on well described methods and references to describe emission quantification. The recommendations from MetHarmo [5] can be served as basis for agreements on equipment and instruments for performing emission quantification, keeping in mind measurement techniques are always evolving. Additionally, requirements of competence for measurement consultant can be described. To ensure quality, third party measurement consultant should be approved by the owner of the voluntary system. For each emission point being quantified, it is recommended that the measurement consultant provides suggestions for reducing emissions. In a quantification record, the emissions can be added together to estimate the total methane losses in the plant.

Emission measurements and quantifications can take place with a frequency between 1 and 3 years or occasion related.

3.5 Remedying of found leaks

Minimum requirements

- A remediation plan should be developed addressing found leaks.

Clarification and recommendations

To reduce emissions, leakages must be remedied with reasonable resources within a reasonable amount of time. It is beneficial to handle such remediation in the plant maintenance programme. Remediation methods can be provided by the measurement consultant to the plant operators.

3.6 Reporting of emissions data

Minimum requirements

- The reporting should be simple.
- Data of participating plants should be handled anonymously.
- There should be an easy access to annual or periodical results with benchmark possibilities.
- Short term and long-term goals on leak detection performance and emission reduction should be set.
- Cost versus usability of data should be taken into consideration.

Clarification and recommendations

The establishment of a joint administrative office to manage a follow-up of the voluntary system is recommended. The main task of the administrative office is to address statistics and knowledge building. Participating plants have to send the quantification records together with planned remediation measures and target emission level to the office. Next, the office compiles the received information on average emissions from the participating biogas plants. From that, the administrative office can use the data externally for information purposes or provide benchmarking. All data that the plants submit to the administrative office shall be handled confidentially, so that it will never be possible to relate specific data to individual plants in the materials used for external communication. The administrative office would thus be able to communicate about the development of methane emissions of the biogas and biomethane industry and therefore helps building trust for this technology. It is highly recommended to have a common understanding on confidentiality of the data processed by the administrative office and a clear agreement on communication to external parties. To build

resources for the administrative office, a fee for participating in the voluntary systems can be introduced.

3.7 Knowledge buildup and skills development

Minimum requirements

- Training courses for introducing and maintaining leak detection programs should be organized.

Clarification and recommendations

The organization of regular trainings is of utmost importance. Support is needed for plant operators for introducing and maintaining leak detection programs. The trainings can be organized by the administrative office or by other stakeholders of the industry. The training activities may include information on emissions in general and their impact on the climate change, a description of different measurement methods, a description of leak detection methods, quantification of emissions, information of the voluntary systems (e.g. updates and documentation) and a discussion on best practices regarding emission mitigation measures. During these training courses, plant operators can learn about new reduction methods, both from other plant operators as well as from information provided by the administrative office.

4. References

[1] European Biogas Association (2020): Methane emission mitigation strategies – information sheet for the biogas industry: https://www.europeanbiogas.eu/methane-emission-mitigation-strategies-information-sheet-for-biogas-industry/

[2] https://www.avfallsverige.se/fileadmin/user_upload/3_avfallshantering/Egenkontroll_metanemissioner_2019.pdf

[3] https://www.svensktvatten.se/globalassets/avlopp-och-miljo/2018-egenkontroll-metanutslapp.pdf

[4] DGC, 2016. Pilotprojekt til et frivilligt måleprogram for metanudledning fra biogas- og opgraderingsanlæg. Dansk Gasteknisk Center. ISBN: 978-87-93180-21-5. URL: http://www.mynewsdesk.com/dk/energistyrelsen/documents/rapport-fra-dgc-pilotprojekt-til-et-frivilligt-maaleprogram-for-metanudledning-fra-biogas-og-opgraderingsanlaeg-59506

[5] Clauß, Tina; Reinelt, Torsten; Liebetrau, Jan; Vesenmaier, Angela; Reiser, Martin; Flandorfer, Claudia et al. (2019): Recommendations for reliable methane emission rate quantification at biogas plants. Leipzig: DBFZ (DBFZ-Report, 33). URL: https://www.dbfz.de/index.php?id=837.