EVEMBI WEBINAR ON

MINIMISING METHANE EMISSIONS FROM BIOGAS PLANTS

26 January 2021,
10:00-11:30 CET
AGENDA

10:00 Welcome and introduction
10:05 EU Methane Strategy and follow-up legislation
   Malcom McDowell, DG ENERGY, European Commission
10:20 Measurements results and mitigation strategy to reduce emissions
   Viktoria Wechselberger, BOKU University
10:35 Q&A
10:50 Voluntary monitoring systems and benefits
   Mieke Decorte, European Biogas Association
11:05 Best practices: the Swedish system and its achievements
   Johan Yngvesson, RISE
11:20 State of the art of training concepts developed
   Johan Yngvesson, RISE
11:30 Q&A and closing remarks
Malcolm McDowell has been working at the European Commission in DG Energy for 10 years. He is Team Leader responsible for the methane strategy. He was previously responsible for renewable gases in the renewables unit and before that, he was responsible for the oil refining sector and worked as oil and gas analyst.
EU Methane Strategy and follow-up legislation

Malcom McDowell, DG ENERGY, European Commission

- Overview on EU Methane legislation
- Role of biogas and biomethane sectors in reducing methane emissions
Dipl.-Ing. Viktoria Wechselberger is a research associate at the Institute of Waste Management (University of Natural Resources and Life Sciences, Vienna) focusing on the quantification of methane emissions from biogas plants. Previously, she has worked in R&D in the field of steam explosion pretreatment of ligneous agricultural residues for the production of biogas.
Methane emissions at biogas plants: measurement results & emission reduction

Viktoria Wechselberger, Torsten Reinelt, Tina Clauß, Angela Vesenmaier, Johan Yngvesson, Katharina Meixner, Marcel Bühler, Deborah Scharfy, Lukas Knoll, Marion Huber-Humer, Marlies Hrad

University of Natural Resources and Life Sciences, Vienna
Department of Water, Atmosphere and Environment
Institute of Waste Management
The project **EvEmBi**

Evaluation of different technologies based on harmonized methods

**EvEmBi**

*Evaluation and reduction of methane emissions from different European biogas plant concepts*

(2018-2021)

Evaluation of measures for emission reduction

Voluntary systems & Operator workshops

36 biogas plants investigated
1. Identification of emission sources (leak detection)

2. Quantification of single sources
   - CHP/BUU (methane slip)
   - Not gastight digestate storage
   - Leakages
   - Double membrane
   - Ventilation air (processing halls, etc.)
   - Pressure relief valves

→ Component emissions
→ Deduction of measures for emission reduction
Results on-site approach

Component emissions

Sources: 7-13, EvEmBi

BUU:.. Biogas upgrading unit
CHP:.. Combined heat and power plant
Results on-site approach

Component emissions

Methane slip CHP units: **1.6 % (median)**

Sources: 10-13, EvEmBi
Methods remote sensing approach

Investigation of overall plant emissions

Inverse dispersion modelling method (IDMM) \(^1, 14-16\)

Measurement of methane concentration

Meteorological measurements

Dispersion model
Methods: remote sensing approach

Investigation of overall plant emissions

Tracer gas dispersion method (TDM) \(^1, \, 17-18\)

Controlled release of tracer gas

Gas concentrations measurements (methane, tracer gas)
Results remote sensing approach

Overall plant emissions

Methane loss: **0.4 % (±0.3) - 8.6 % (±0.5)** of methane production

Sources: 18, Klimoneff, MetHarmo, EvEmBi
Conclusions

Recommendations for the mitigation of methane emissions

- implementation of **best technology options** when constructing new plants, i.e.:
  - **gas-tight cover** for digestate storage and hydrolysis-mixing tanks
  - **chemical scrubber or exhaust gas treatment** for biogas upgrading

- **prevention/elimination of OTNOC** (*other than normal operating conditions*) events, i.e. by:
  - regular leak detection (self- and external inspection)
  - gas storage - pressure relief valves:
    - accurate measurement of filling level
    - adjustment of operational parameters (i.e. target value for filling level = 50%) if necessary
References (1)

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Time for questions!
Mieke Decorte is a technical expert on the analysis of biogas and biomethane markets.

She also works on the study and valorization of the positive externalities of biogas and biomethane, including the reduction of GHG emissions.

She coordinates EBA’s involvement in EU projects.
European Biogas Association

Voluntary monitoring systems and benefits

Mieke Decorte
EvEmBi workshop
26/01/2021
AD plays a major role in preventing methane emissions

... nevertheless, occurring emissions must be avoided
Benefits of avoiding methane emissions at biogas plants

• Abatement of climate change
• Increased income
• Safety aspects
• Avoidance of odour problems
Voluntary monitoring systems – 2 main parts

1. **Leak detection** and remedying of found leaks → plant’s own personnel
2. **Quantification** of emissions and loses → external and independent consultant
Voluntary monitoring systems – step by step

Step 1: Checklist for regular rounds
• Plant description with critical control points
• Requires no equipment
• E.g. plant operator checks if all safety valves are closed

• High frequency
• Low cost
Voluntary monitoring systems – step by step

**Step 2**: Performing leak detections
- The focus is self-control
- Third-party revision for credibility

- High frequency
- Medium cost
Voluntary monitoring systems – step by step

Step 3: Remedying of found leaks

• Leakages must be remedied with reasonable resources within a reasonable amount of time
• Inclusion in the plant maintenance program

• High frequency
• Medium cost
Step 4: Quantifying and reporting of methane emissions

- Third-party measurement consultant
- Measurement data gathered by a central party to enable reporting
- Frequency depended on the plant size

- Medium frequency
- High cost
Voluntary monitoring systems – step by step

**Step 5:** Short-term (2025) and long-term (2040) reduction targets

- Aiming at driving down the emission to a certain level
- Can be set at national and/or European level

- Low frequency
Preparatory work

- Follow-up of the EvEmBi project
- Investigate BAT especially on quantitative measurements
- Further synchronise the already existing (national) voluntary schemes

- Expected 2-3 years
Conclusion

Voluntary monitoring systems will:

• Further **improve the environmental performance** of biogas systems by indentifying and reducing methane emissions
• **Support plant owners** in performing structured inventory of their plant to detect possible methane emissions
• Help **build-up knowledge** and awareness of operators
• Provide better knowledge about methane emissions for the biogas and industry and thereby create **greater credibility**.
• **Assure the societal value** of biogas production with regard to GHG mitigation
EvEmBi deliverables

• **Methane emission mitigation strategies – information sheet for biogas industry**

• **Minimum requirements for European voluntary systems**
Thank you!

European Biogas Association

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Best practices: the Swedish system and its achievements

Johan Yngvesson, RISE

Project manager and expert on methane emissions. Measuring emissions on biogas plants since 2013. Benchmarking studies, methodology development and research within biogas and waste management. Background from working with quality, inspection, and maintenance.
Self inspection of methane emissions

A Swedish voluntary system since 2007

EBA Webinar 2021-01-26

Johan Yngvesson

RISE – Research Institutes of Sweden
Biogas production in Sweden

- Co-digestion plants: 36 (963 GWh)
- WWT plants: 138 (727 GWh)
- Farm plants: 44 (56 GWh)
- Industrial plants: 6 (143 GWh)
- Landfill: 55 (141 GWh)

- **Producing in total** ≈ 2 TWh biogas

- Upgrading plants: 70 plants in total

Source: Energigas Sverige
How the biogas is being used:

- **Upgrading – that is transport**: 63%
- **Heat**: 20%
- **Electricity**: 10%
- **Industry**: 3%
- **Other**: 2%
- **Flaring**: 1%
- **Missing data**: 1%

Source: ER 2019:23 Production and use of biogas and biofertiliser 2018
## Substrates for biogas production, 2018
(kilo tonnes wet weight)

<table>
<thead>
<tr>
<th>Substrate Type</th>
<th>Food waste</th>
<th>Sewage sludge</th>
<th>Industry sludge</th>
<th>Manure, food industry</th>
<th>Waste from houses</th>
<th>Slaughter</th>
<th>Crops</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wastewater treatment</td>
<td>52</td>
<td>6387</td>
<td>156</td>
<td>0</td>
<td>52</td>
<td>0</td>
<td>0</td>
<td>42</td>
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<tr>
<td>Co-digestion plants</td>
<td>405</td>
<td>0</td>
<td>0</td>
<td>709</td>
<td>185</td>
<td>156</td>
<td>32</td>
<td>208</td>
</tr>
<tr>
<td>Farm plants</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>339</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>8</td>
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<tr>
<td>Industry</td>
<td>0</td>
<td>0</td>
<td>2638</td>
<td>0</td>
<td>40</td>
<td>0</td>
<td>0</td>
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<td>Gasification</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>10^2</td>
</tr>
<tr>
<td>Total</td>
<td>457</td>
<td>6387</td>
<td>2795</td>
<td>1048</td>
<td>280</td>
<td>158</td>
<td>32</td>
<td>268</td>
</tr>
</tbody>
</table>

Source: ER 2019:23 Production and use of biogas and biofertiliser 2018
The Swedish voluntary system
Background to “EgMet”

• It started in 2007 by the Swedish Waste Management Association and their members
• Since 2019 co-owned by Swedish Water
• >200 measurements performed
• about 25 production plants and 30 upgrading plants participated
Organisation

Biogas industry
Project execution team
Reference team
Steering committee
Joint administrative office
System description published

The Swedish Waste Management Association
The Swedish Water and Wastewater Association

https://www.avfallsverige.se/fileadmin/user_upload/3_avfallshantering/Egenkontroll_metanemissioner_2019_eng.pdf
Four good reasons

- Environment
- Safety
- Health
- Economy
System set-up

- Participation form
- Annual fee (app. €500)
- Training, skill development
- (System development)

- The system consists of two main parts:
  - “detection” (of leaks)
  - “quantification”
1. Emission detection

- Self-control, involving leak detection & documentation
- Consider detection equipment, intervals and competence
- Should involve operators
- Increases knowledge & engagement
Emission quantification

- Measurements every three years by a third party
- Provides data for prioritization, benchmarking and credibility
- Incentive for setting reduction targets
- Methodology described in a measurement guide
What is the purpose?

- Provide a **structure** for inventorying possible methane emissions
- Give better **knowledge** about the size of the emissions
- Further improve the environmental performance of the biogas system
Main targets

- further improve the environmental performance of the biogas system
- give plant owners help in performing a structured inventorying of their plant to detect emissions
- give plant owners better knowledge about the size of the emissions from their plant
- identify and reduce any emissions
- give the biogas industry better information and thereby greater credibility in relation to emissions.
System boundaries in the Swedish system

Solid waste

Biogas plant

Pretreatment unit

Receiving tank

Hygienisation

Mixing tank

Digester

Torch

Bolier/Gas motor/Upgrading plant

Digestate

Digestate storage

Dewatering

Liquid waste

Receiving building

RISE — Swedish Voluntary Agreement
Achievements

Participating plants

- Red line: upgrading
- Green line: production

Photo by Johan Yngvesson
Production & emissions, between 2007 - 2018

RISE — Swedish Voluntary Agreement

Photo by Johan Yngvesson
Emissions in upgrading

- Chemical scrubber
- Water Scrubber
- PSA
- BUU + "RTO"

% of production

1st 2nd 3rd 4th
Correlation between methane emissions and plant size
Default values for sustainability criteria in Sweden

<table>
<thead>
<tr>
<th>configuration</th>
<th>EF (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste water sludge, excl. digestate</td>
<td>0,95</td>
</tr>
<tr>
<td>Waste water sludge incl. digestate</td>
<td>2,9</td>
</tr>
<tr>
<td>Municipal / industrial food waste, excl. digestate</td>
<td>0,22</td>
</tr>
<tr>
<td>Municipal / Industrial food waste, incl. digestate</td>
<td>1,4</td>
</tr>
<tr>
<td>Upgrading BAT (amin scrubber or upgrading with RTO)</td>
<td>0,19</td>
</tr>
<tr>
<td>Upgrading other</td>
<td>2,0</td>
</tr>
</tbody>
</table>
EgMet benefits

Voluntary System

Bench-marking
Detection
Quantification
Reduction

$\text{CH}_4$
Some of the success factors!

✓ Relevance for the industry

✓ Low threshold to take part

✓ Simple to understand

✓ Useful for operators

Foto: Johan Yngvesson
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Project manager and expert on methane emissions. Measuring emissions on biogas plants since 2013. Benchmarking studies, methodology development and research within biogas and waste management. Background from working with quality, inspection, and maintenance.
Training concepts for minimizing methane emissions from biogas plants
Germany

• Course: 23.09.2020 in Stadtroda Germany
  – Basic training "Biogas production for plant operators"

• Course: 05.11.2020 in Dresden Germany
  – Refresher training operator qualification, "Plant safety on biogas plants, incl. TRGS 529 and TRAS 120"

• Course: 23.11.2020, Pilot-online-course
  – Refresher training operator qualification, “Plant safety on biogas plants, incl. TRGS 529 and TRAS 120”

  • Organized by Schulungsverbund Biogas - with the aim to uniform national education and training of biogas plant operators
  • But also for biogas companies (planning, construction and maintenance/service)
  • It was included in existing operator trainings
  • About 16-18 participants / course
  • Feedback: Not concluded yet. But methane avoidance is an important issue for operators.
  • Operators already do a lot, however, since the mandatory requirements in Germany.
  • Therefore little interest in a voluntary system
Swedish training day

• the 12\textsuperscript{th} March 2020

• Co-organised by the “Swedish Waste Management Association” and “Swedish Water”

• Invitations was sent mainly to their members (biogas plant operators).

• Lectures by experts in methane emissions, representative for “EgMet”, and a representative from the industry.

• 57 participants registered for the event, well above expectations.

• Feedback: much appreciated, some ideas for future trainings.

• A follow up webinar is planned to the 27 January 2021, that will focus on examples on mitigation activities from the Evembi project. (+100 registered)
Agenda of training day

- European outlook
- Self inspection of methane emissions – EgMet (the Swedish voluntary system)
- Emission objects
- Methods measuring methane slip
- Calculation methods for methane emissions
- Experiences from an biogas operator point of view
Austrian operator workshop

• Organized by Kompost & Biogas Verband Österreich

• Three workshops in the scope of existing operator meetings/workshops

• 37 participants

• Feedback: very positive!
On the agenda

• Overview of relevant Austrian regulations
• Presentation of the Evembi project
• Measurement results
• Emissions mitigation measures
• Presentation of Voluntary system
• Biogas plant visit
• Discussion
Schweiz
No specific training day organized yet. Plan to do this in summer 2021.

• Ökostrom Schweiz

• Individual talks and site visits and emission measurements with our biogas operators

• 2019: 3 biogas plant operators

• 2020: 18 biogas plant operators

• Content: We checked together with the operators for leakages with the on-site equipment and talked about emissions and how to avoid or reduce them.

• Feedback: Positive! The leakage detection was especially valued.

• (Some operators prefer the use of m³ biogas, or methane, in explanations. Other units are difficult to relate to.)
Thank you!

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Time for questions!
Thank you!

More info

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