

Determination of CH₄ emissions from biogas plants and reduction strategies

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Methane (CH₄) – Basics

- Built when organic material is degraded at anaerobic conditions
 - In marsh, at the bottom of lakes, in rumen
 - In landfills, in biogas plants,

(1)

- 50-75% contained in biogas
- Caloric value: 10 kW m⁻³
- Power and heat production – 565 GWh_{el.}; 170 GWh_{therm.}
(2018, Austria)
- purification and injection into gas grid – 170 GWh
(2018, Austria)

(2)

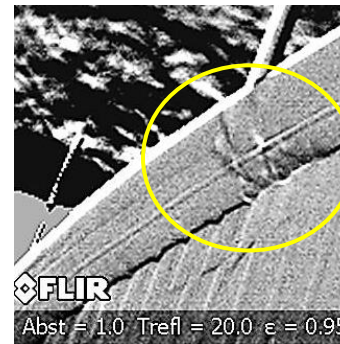


Methane – Green House Gas

- After CO₂ the 2nd largest contributor to global warming
- Short life time (~10 y) in the atmosphere
→ Reduction of CH₄-emissions can reduce rate of near-term climate warming (3)
- Production of renewable energy → avoidance of GHG emissions (4)
- CH₄ is the most important GHG at biogas plants
- Emissions depending on technology and operating mode
- → Research-projects aiming on the detection of CH₄-emission at biogas plants
 - 1) MetHarmo European harmonisation of methods to quantify CH₄-emissions from biogas plants
 - 2) EvEmBi Evaluation and reduction of CH₄-emissions from different European biogas plant concepts

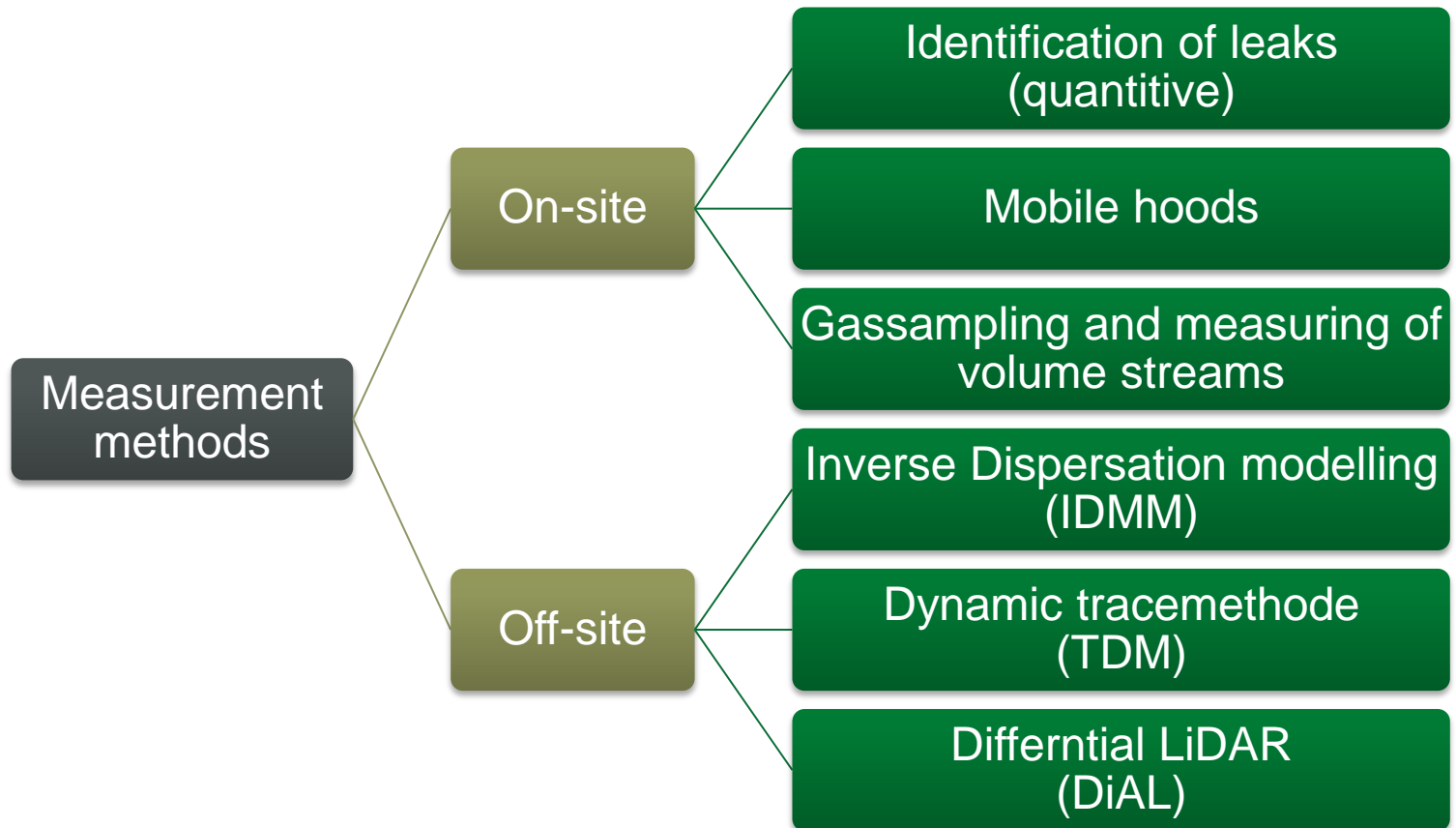
Emission sources at biogas plants

- Combined heat and power units (CHP units – CH₄-slip)
- Open and non-gastight containers
- Leaks
- Overpressure protections
- Biofilter (exhaust air of operation halls)





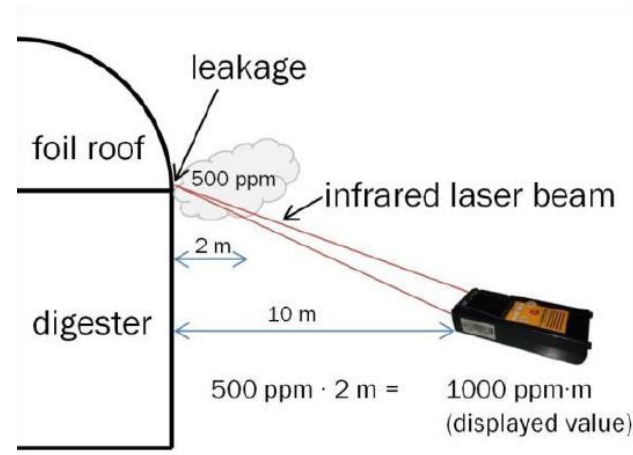
Measurement methods



Measurement methods – on-site

Quantification of individual emission sources

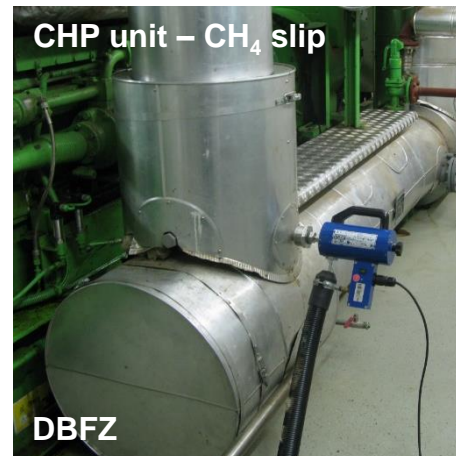
- Identification of individual sources (leakage search) (5-11)



Measurement methods – on-site

Quantification of individual emission sources

- Quantification of individual sources (5-11)



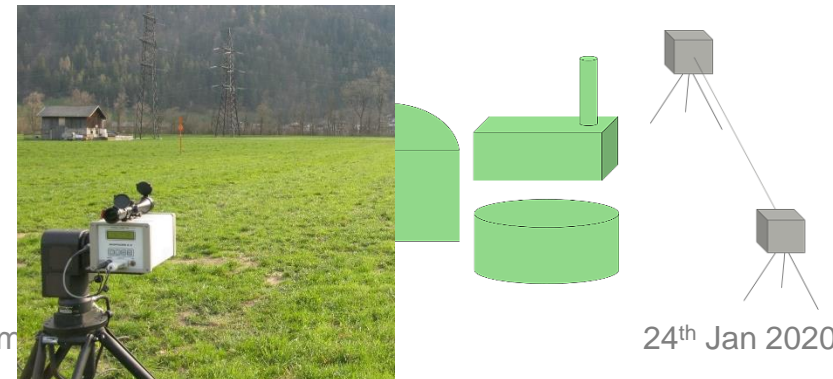
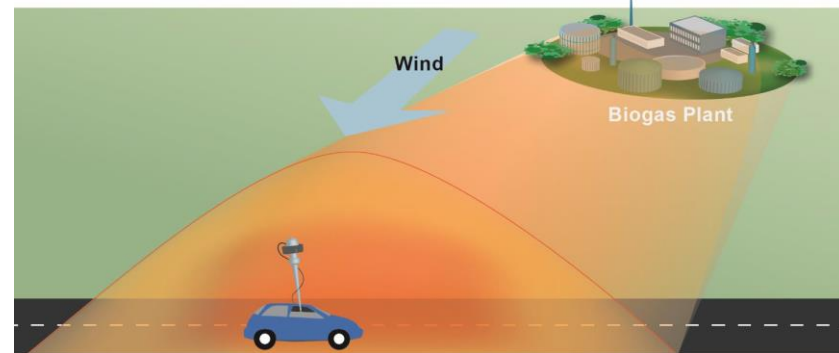
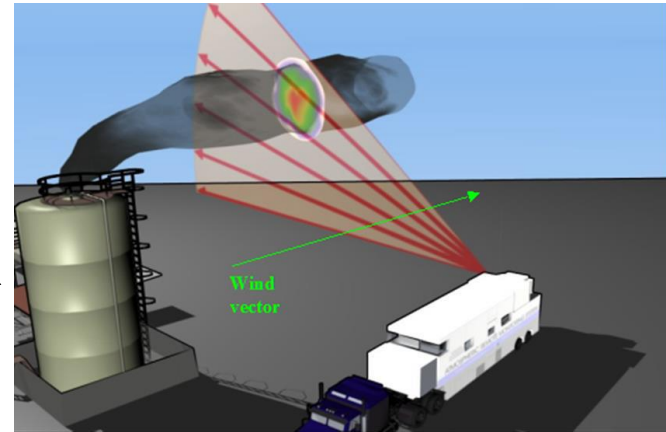
- Summation of the individual sources to total emission
- Development of emission reduction measures

Measurement methods – off-site

Measurement of whole AD plant

- Differential Absorptions-LIDAR (DIAL)
- Dynamic Tracer Methods (TDM)
- Inverse Dispersion Modelling (IDMM)

(11)



EvEmBi – Evaluation and reduction of CH₄-Emissions from different European biogas plant concepts



Universität Stuttgart



Fachverband
BIOGAS
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kompost
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OESTER



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Svenskt Vatten



AVFALL SVERIGE

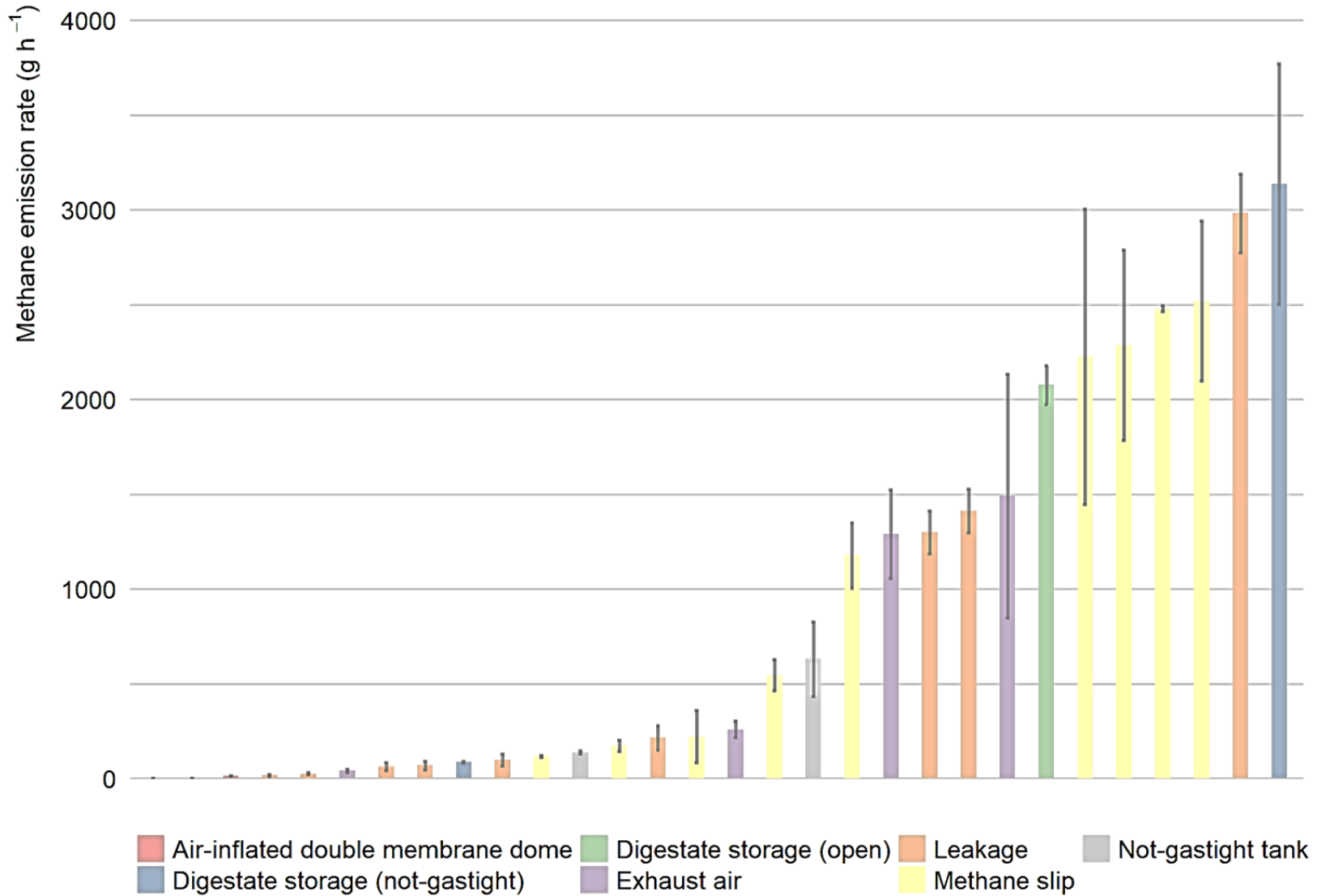


EBA
European Biogas Association

Aims

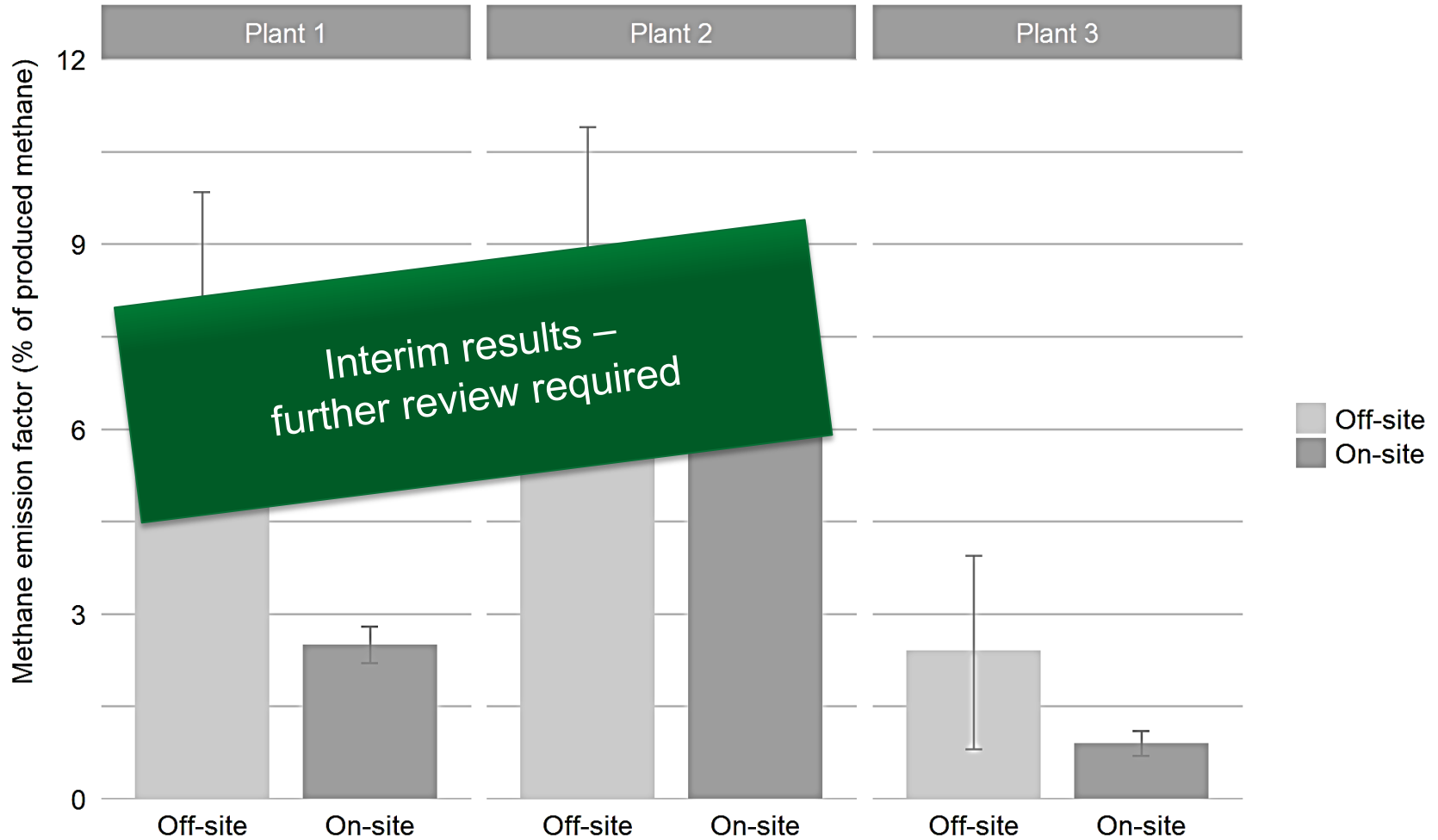
- Identification and quantification of **emission sources**
- Elaboration of a **general European position paper**
 - On GHG emissions
 - Mitigation strategies
- Development of a **general European voluntary system**

Current results – on-site





Current results – off- and on-site



Mitigation measures

Technical measures

- Seal leaks
- Regular renewal of gas storage membrane
- Monitoring of overpressure safety devices
- Correct dimensioning of gas pipes
- Installation of a thermal afterburning system
- Gastight covering of containers
- ...

Organisational measures

- Leak detection/emission measurements after renewing plant components
- Adaptation of feeding regime
- Regular maintenance of cable grommet
- Regular maintenance of the CHP unit(s)
- Analysis of residual gas potential
- ...



Outlook

- Implementation of mitigation measures
- Development of voluntary system
 - Based on the system in Sweden and Denmark
 - Improve environmental performance of biogas system
 - Identify and reduce any emissions
 - Give plant owners help and knowledge about leakage detection and emission size
 - Give the biogas industry better information and thereby greater credibility in relation to emissions
- Development of international and national position papers
 - on GHG emissions and mitigation measures



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