BEST
Bioenergy and
Sustainable Technologies

Determination of CH_4 emissions from biogas plants and reduction strategies

Graz, 24th January 2020

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Methane (CH_4) – 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)

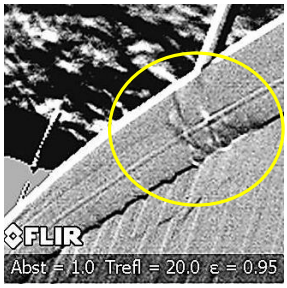
(2)

Methane – Green House Gas

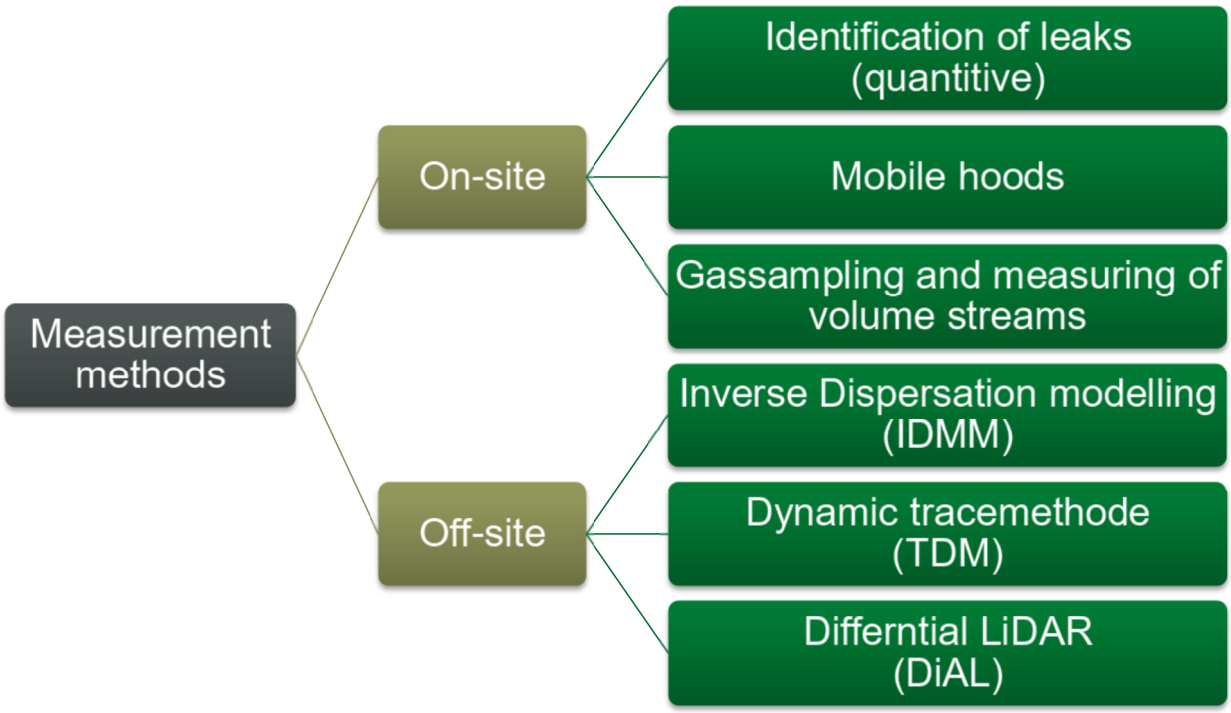
- After CO_2 the 2nd largest contributor to global warming
- Short life time (~10 y) in the atmosphere
  → Reduction of CH_4-emissions can reduce rate of near-term climate warming (3)
- Production of renewable energy → avoidance of GHG emissions (4)
- CH_4 is the most important GHG at biogas plants
- Emissions depending on technology and operating mode
- → Research-projects aiming on the detection of CH_4-emission at biogas plants
  1) MetHarmo European harmonisation of methods to quantify CH_4-emissions from biogas plants
  2) EvEmBi Evaluation and reduction of CH_4-emissions from different European biogas plant concepts

Emission sources at biogas plants

- Combined heat and power units (CHP units – CH_4-slip)
- Open and non-gastight containers
- Leaks
- Overpressure protections
- Biofilter (exhaust air of operation halls)



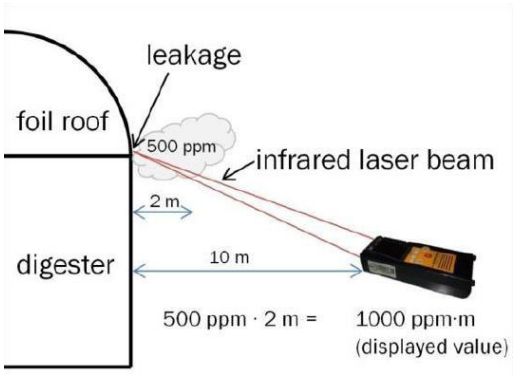
Measurement methods



Measurement methods – on-site

Quantification of individual emission sources

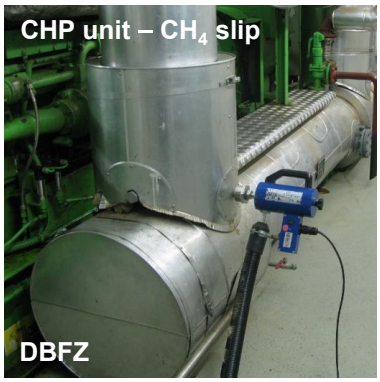
- Identification of individual sources (leakage search) (5-11)

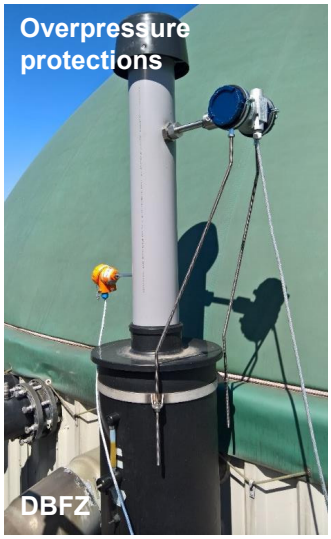


Measurement methods – on-site

Quantification of individual emission sources

- Quantification of individual sources (5-11)



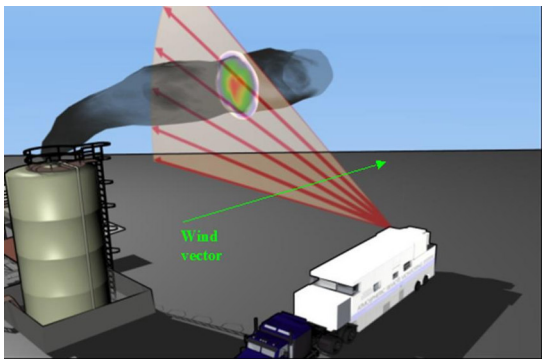


- Summation of the individual sources to total emission
- Development of emission reduction measures

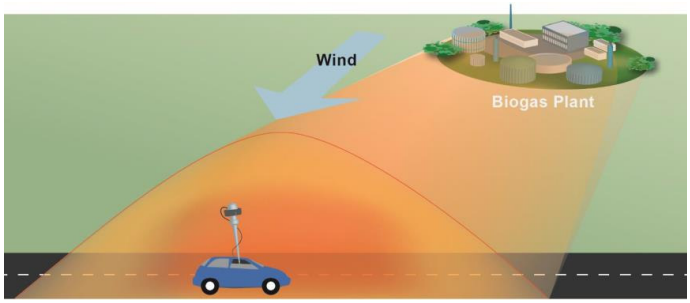
Measurement methods – off-site

Measurement of whole AD plant

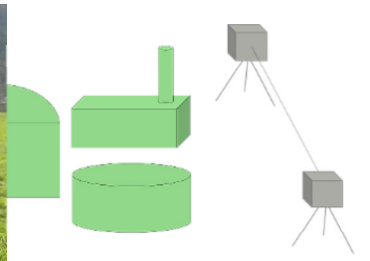
- Differential Absorptions-LIDAR (DIAL)



- Dynamic Tracer Methods (TDM)



- Inverse Dispersion Modelling (IDMM)



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EvEmBi – Evaluation and reduction of CH_4-Emissions from different European biogas plant concepts

DBFZ

Universität Stuttgart

Fachverband BIOGAS Service GmbH

ABF BOKU

AAT BIOGAS TECHNOLOGY

kompost & biogas verband

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Berner Fachhochschule

OESTER MESTECHNIK

RI. SE

Svenskt Vatten

AVFALL SVERIGE

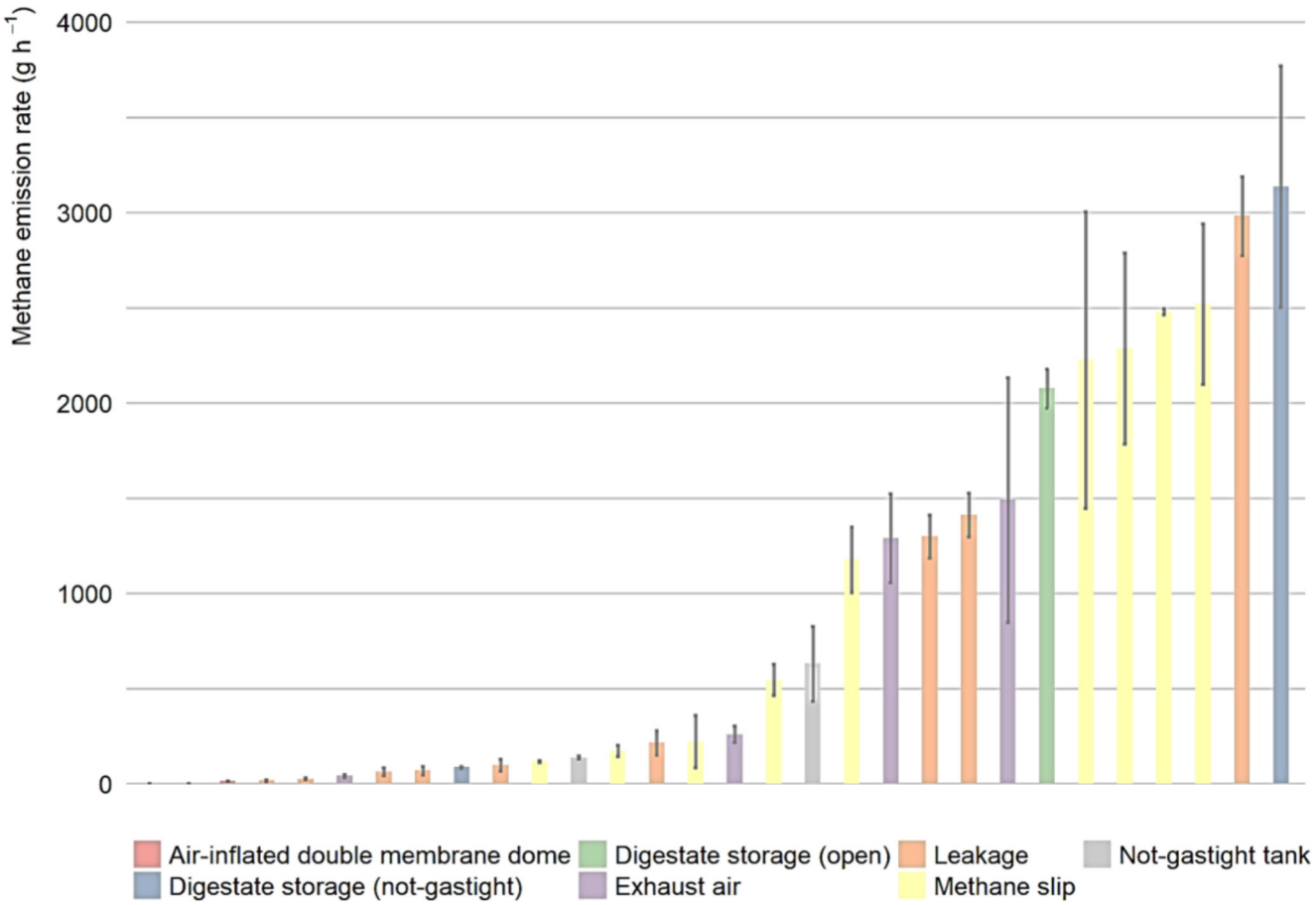
DTU

EBA European Biogas Association

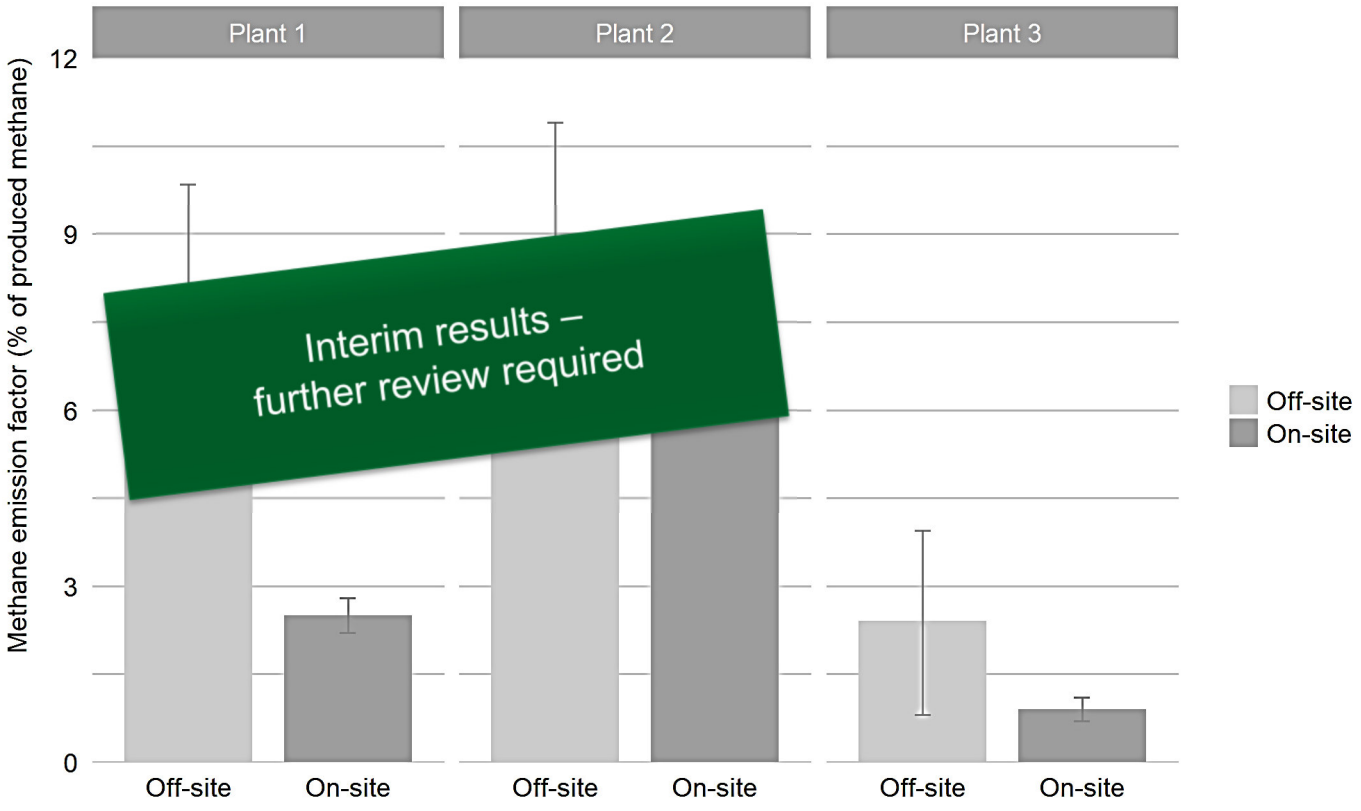
Aims

- 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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