

Methane loss from biogas and upgrading plants

- A voluntary measurement scheme

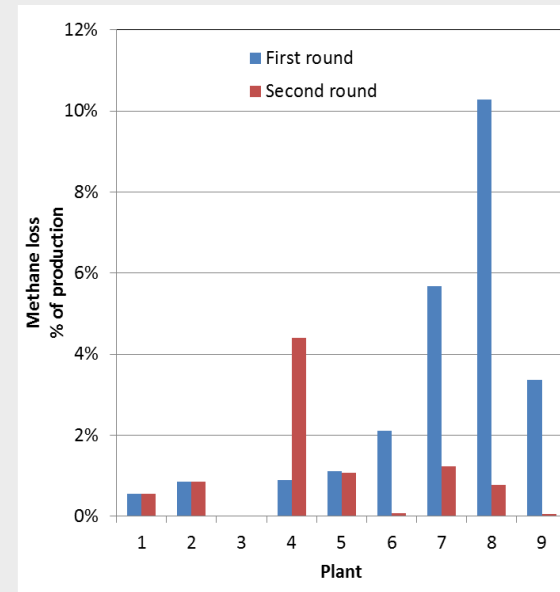
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Introduction and background

- Previous investigations have shown considerable methane loss from biogas production
- Therefore, a project was initiated by the Danish Energy Agency in cooperation with the biogas sector



Resultats from
earlier project

Main purpose of the project

To obtain better knowledge about

- Actual methane loss from biogas
- Quantification of methane losses

This knowledge is required in order to develop a voluntary measurement scheme to be applied by the biogas sector.



Involvement of participants

- Agricultural based biogas plants
 - 65 plants invited - 10 were interested in participating
- Wastewater treatment based biogas plants
 - 40 plants invited - 5 were interested in participating
- Measurement companies
 - Open invitation to tender, and 5 companies were invited directly
 - 4 companies were interested in participating

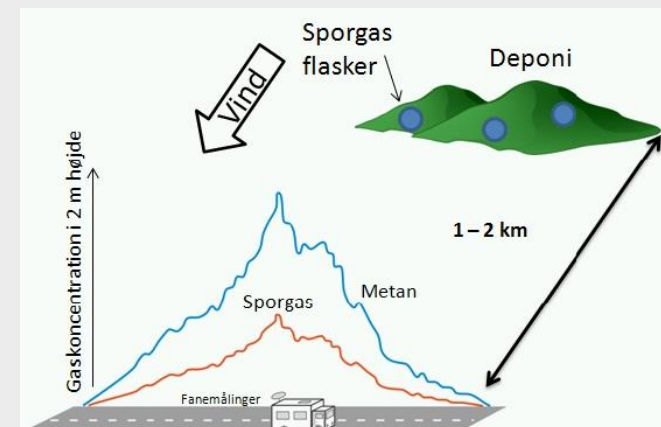
Selected plants and measurement companies

6 biogas plants

- 2 based on wastewater sludge
- 2 farm based plants
- 2 centralised plants
- 2 of these plants with upgrading

3 measurement companies

- 2 determine methane loss as sum of loss from individual sources
- 1 measures the total loss from entire plant

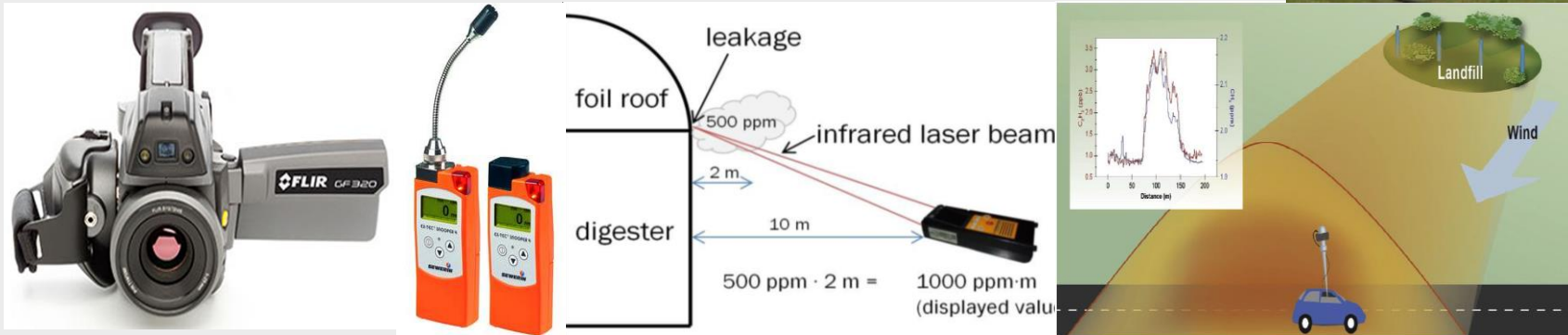


Measurement programme

The programme consists of two elements:

1. Scanning the plant for methane sources
2. Quantification of methane loss

Methods were recommended, but there was a certain degree of autonomy.



Selected participants

Plant	Measurement company		
	1	2	3
1		X	X
2	X		
3	X	X	X
4	X		
5	X		X
6	X	X	X

Company 1 og 2 determine the losses as the sum of losses from single sources.
Company 3 measures the total loss from entire plant.

Results

Including upgrading

Loss_{min} = 1.4 %

Loss_{max} = 4.5 %

Without upgrading

Loss_{min} = 1.0 %

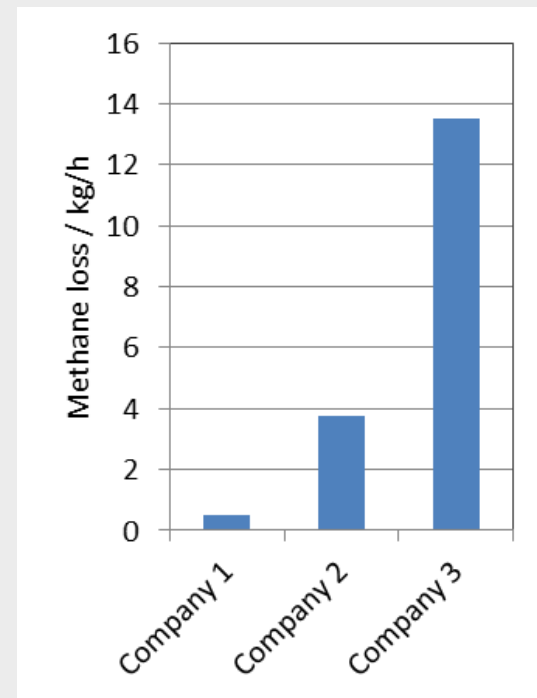
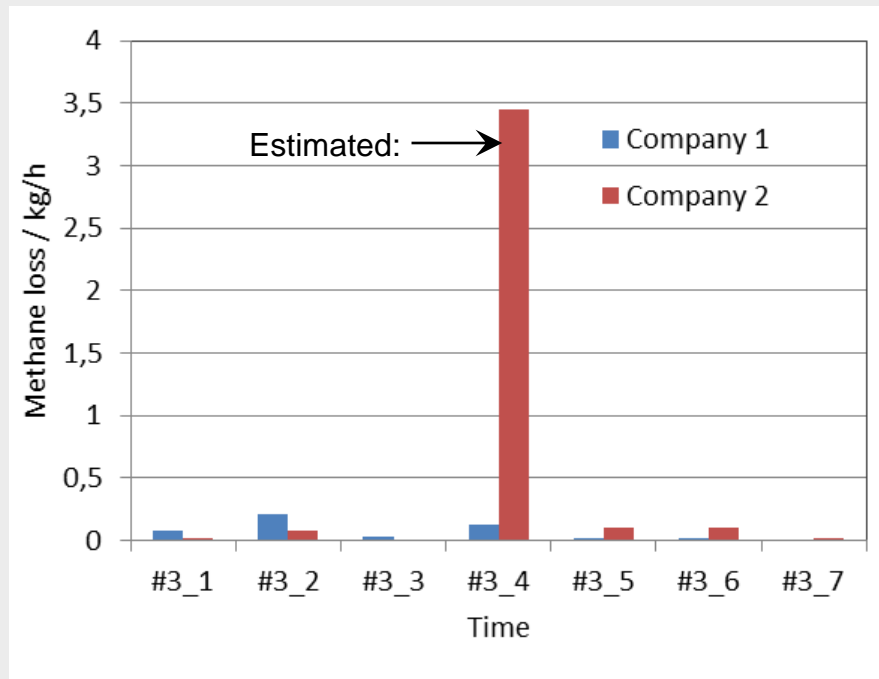
Loss_{max} = 3.1%

→ Considerable variations!

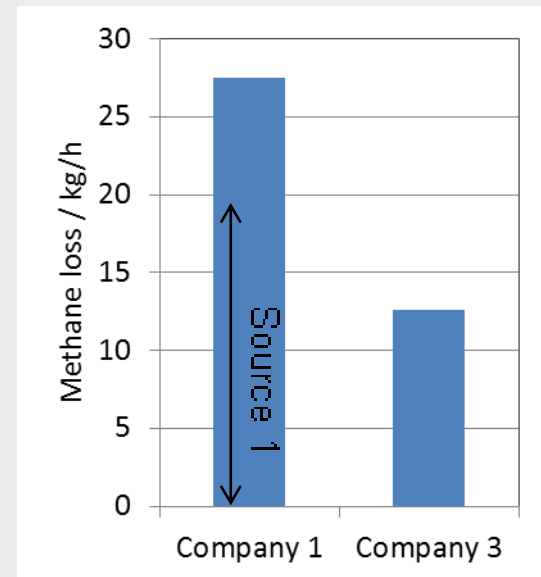
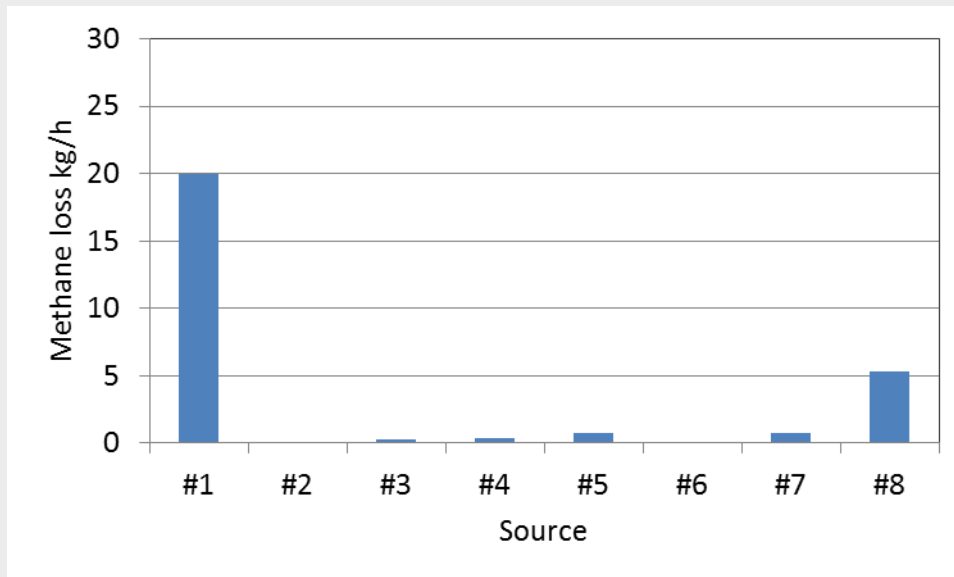
"Share" and "Lost earnings" are based on yearly production given by the plants

Plant	Methane loss			Measured by
	Amount	Share	Lost earnings	
	kg/h	% of prod.	1000 €/year	
#1	1.0	0.25%	10	#2
	3.3	0.84%	35	#3
	9.5	2.4%	100	#3
#2	0.13	0.27%	1	#1
#3	0.48	0.29%	5	#1
	3.8	2.3%	41	#2
	13.5	8.2%	142	#3
#4	1.1	4.0%	12	#1
#5	27	5.2%	290	#1
	13	2.4%	133	#3
#6	5.9	1.1%	62	#1
	15	2.9%	162	#2
	13	2.5%	141	#3

Measurements - plant 3



Measurements - plant 5



Measured the same day

Conclusions - measurement

- Few sources account for the main part of total loss (7 % of sources accounts for 80 % of total loss)
- New larger plants have not shown lower losses than others
- There are significant potential savings for plant owners
- The losses vary over time. Measured differences can be explained by
 - Variation in methane production, e.g. in mixing tanks
 - Whether pressure relief valves are activated
 - Whether blowers/boosters are operated during the measurement
 - Wrongly conducted measurements

The purposes of the voluntary scheme are to

- Help owners with a systematic way of focussing on methane loss
- Provide plant owners with better knowledge of the sources of methane loss
- Provide the biogas industry, researchers and authorities with better data in terms of actual losses

Elements in the voluntary scheme

- Self-monitoring every two months.
- External quantification every two years (if less than 1 million m³ per year: every three years).
- If quantification shows losses larger than 2 % of production or 50 tonnes per year:
 - Examination of sources of methane loss must be conducted
 - Quantification repeated in less than 1 year
- Anonymised data will be publicly available



Thank you for your attention

Sources leading to methane losses excl. upgradering

Type	Numbers	Share of losses
Pressure valves	19	13 %
Ventilation from buildings	7	7 %
Compressers/boosters	8	5 %
Penetrations	7	0,3 %
Streams to biofilter (Mainly two tanks)	3	61 %
Open storages	4	8 %
Other leaks	8	4 %

Measurements - plant 1

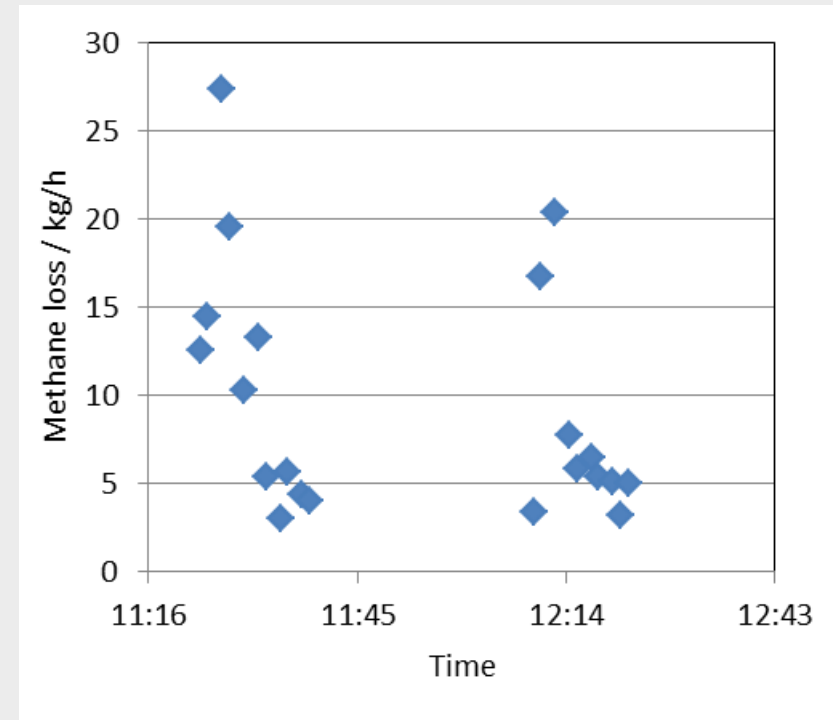
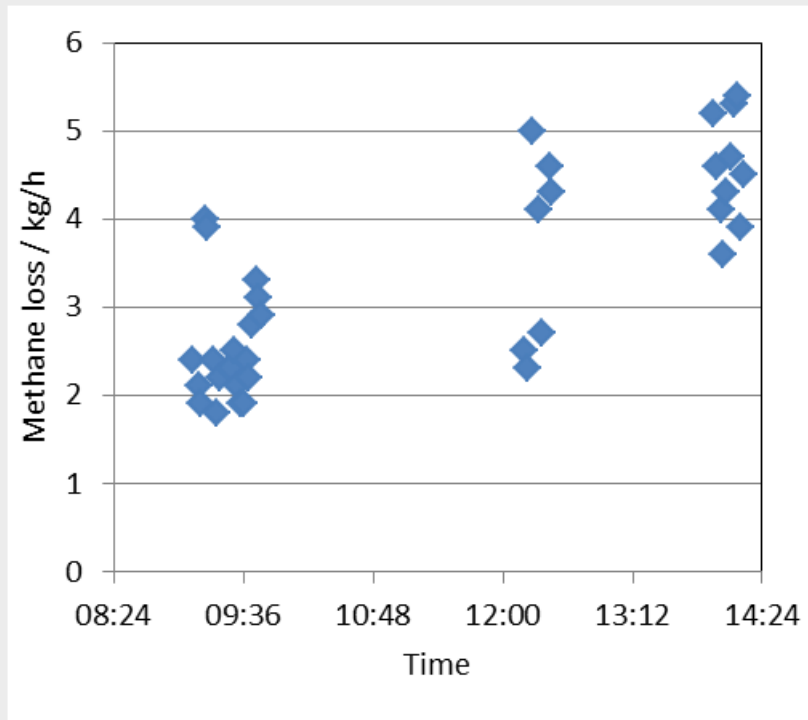
Company 3 - the tracer gas method

25.10.2015

3.3 kg/h

06.11.2015

9.5 kg/h



(Company 2 measured 1.0 kg/h 26.10.2015 and 05.11.2015)

Quantifacation loss - digestate storage, plant 3



Company 1 measured:
=0.13 kg/h

Company 2 estimated:
=3.4 kg/h

Other external measurement:
=1.2 kg/h (average)

