GERG
groupe européen de recherches gazières
the european gas research group

Energy with Future.
Environment and Responsibility.

DBI GUT
Gas- und Umwelttechnik GmbH

Methane Emission Estimation Method for the Gas Distribution Grid (MEEM)

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Final Presentation MEEM DSO

Status: June 2018

Danish Gas Technology Centre

by people for people

GasNet
Člen innogy

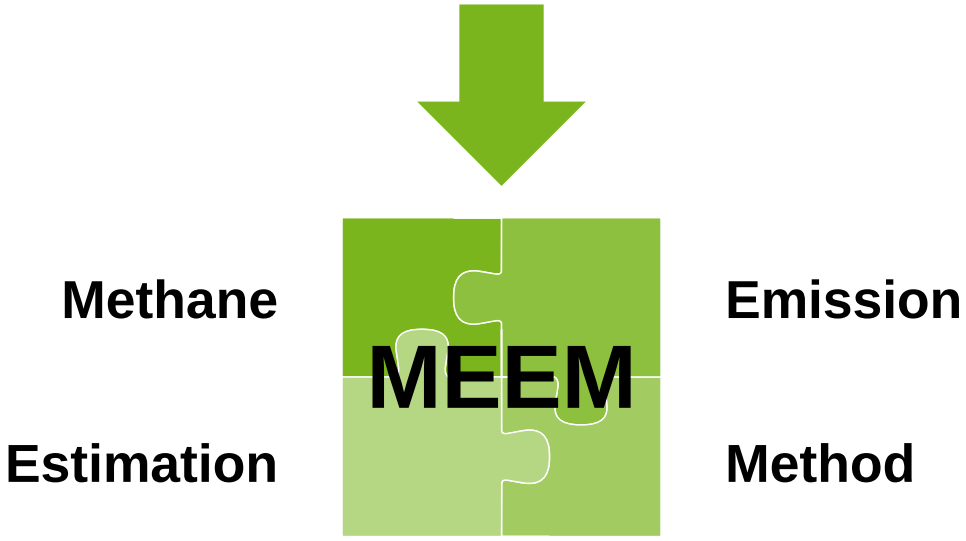
Italgas
Reti

Synergrid

WESTNETZ
Teil von innogy

Main Objective

Aim is to develop an accurate and consistent method for emission estimation of the gas grid.

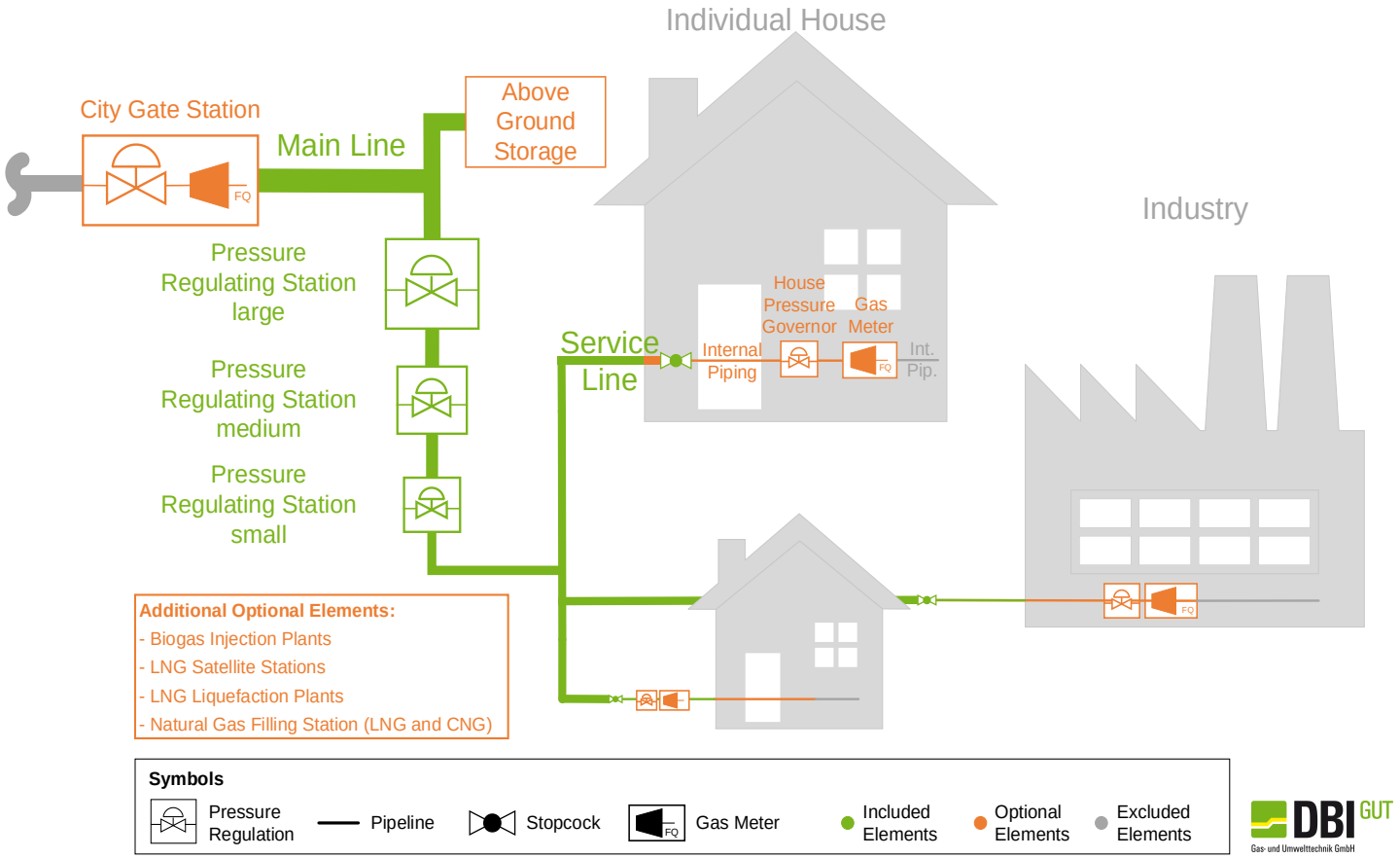


Background and Motivation

- Estimation and publication of **methane emissions** from the gas distribution grid is an **obligation** for the national authorities within the United Nations Framework Convention on Climate Change (UNFCCC)
- Methane emissions are **increasingly meaningful** in public debates for **political, administrative, and public stakeholders** and can have significant (economic) **impact on the future** of gas (it also might be included in the EU Emission Trading Scheme).
- The **different approaches/methods** for emission estimation in place **cause difficulties** to identify the methane emissions in the countries correctly/consistently and put the gas industry in a **difficult situation**.

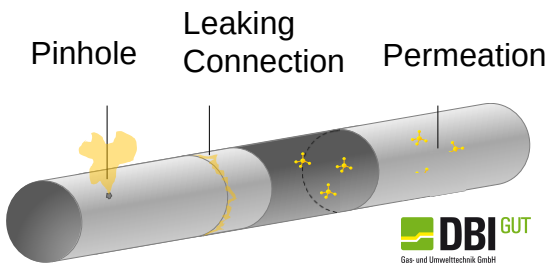
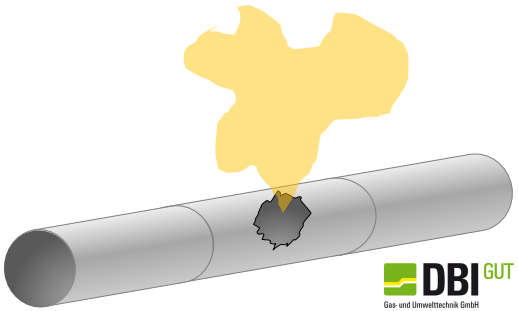
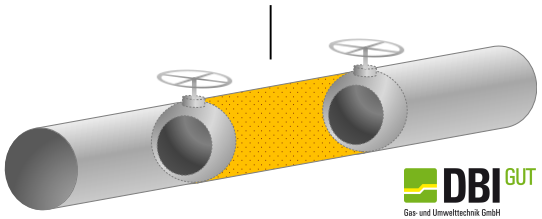
Consistent and accurate method that also unveils the positive effect of recent improvements is the fundament for a reliable, flexible, transparent and complete emission estimation from the gas infrastructure.

SCOPE
SYSTEM BOUNDARIES



Note: Optional elements are not considered in general within the distribution grid. Each country has to decide if these elements belong to the distribution grid or to transmission grid/ end customers. If being considered, country-specific emissions should be assessed.

SCOPE
EMISSIONS TYPES

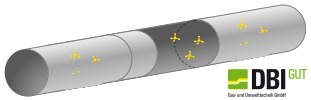
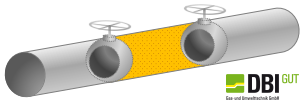
Intrinsic Emissions	Incident Emissions	Operational Emissions
	Gas escape due to damage (e.g. digging) 	Amount of gas which is vented or section which is purged 
Emissions arising from: minor holes or cracks which are detected by survey, all technical leaks, as well as permeation	Emissions arising from: incidents/ accidents occurring e.g. due to landslide or third party damage and reported by third-parties or staff of DSO	Amount of gas which is vented or section which is purged Emissions arising from: venting and purging during commissioning, renewal, and decommissioning

Main activities carried out

- **Benefit/Effort Analysis**
  - A questionnaire was prepared and sent to the DSO in the participating countries. The results of the questionnaire showed which data are already available in several countries, and gave an indication on the effort for providing additional data.
- **External requirements** (e.g. for the UNFCCC reporting) were collected and included in the development of the method
- **Validation of the Method**
  - A model was developed in MS Excel, which includes a generic grid makes the effect of certain assumptions visible and gives an indication on the contribution of individual emission categories to the total emissions.
- **Preparation of the Verification Process**
  - The requirements for a verification of MEEM via the European Committee for Standardization (CEN) were collected and the MEEM report was structured in accordance to a CEN Technical Report. The initiation of the process is open and should be guided via Marcogaz. Before, it is recommended to test the method by several DSO and countries for verification of the intended effects.

RESULTS
OVERVIEW

- The new developed method **(MEEM) provides equations and suggests input parameters and assumptions** to support a consistent use of the method.

Emission Type		
Intrinsic and Incident Emissions 	**Permeation** 	**Operational Emissions** 
Basic Equation		
$E_{CH4} = q_v \cdot t \cdot n \cdot x_{CH4}$	$E_{CH4} = P_{CH4} \cdot \pi \cdot SDR \cdot p_i \cdot l \cdot t$	$E_{CH4} = EF_{vent} \cdot n \cdot x_{CH4} + EF_{purge} \cdot n \cdot x_{CH4}$
Description		
Given in the report	Given in the report	Given in the report

RESULTS
DETERMINING EMISSION RATES

Nr.	Option	Application
1	**Direct measurement** of the emission rate (e.g. by suction method)	Underground leaks detected by survey, emissions of gate valves on pipelines, intrinsic emissions of facilities
2	**Determination of soil coefficients and calculation** of the emission rate from leak size and pipeline pressure:	Underground leaks detected by survey, other incident
3	**Calculation of the emission rate** from leak size and pipeline pressure (subsonic flow)	Above ground leaks detected by survey, incidents reported after third-party damage and other incidents, incident emissions of facilities
4	**Calculation of the emission rate** from leak size and pipeline pressure (supersonic flow):	Above ground leaks detected by survey, incidents reported after third-party damage and other incidents, incident emissions of facilities

RESULTS
DETERMINING DURATION OF GAS ESCAPE

Nr.	Option	Application
1	**Duration is exactly known**, since the operator knows when the gas escape started	Incidents reported after third-party damage and other incidents
2	**Continuous** leakage (=8,760 h/yr)	Emissions of gate valves on pipelines, intrinsic emissions of facilities
3	A maximum duration of **48 h is assumed**	Emissions after gas smell in urban areas
4	**Recent events** (e.g. ground movements or recent works near the incident) can be taken into account	Other incidents (e.g. gas smell in rural areas)
5	**The last survey/monitoring** can be considered	Other incidents
6	Duration is determined with the **monitoring period and with the permitted repair time**	Leaks detected by survey
7	Duration is not exactly known but can be estimated by **verified expert assumptions** (depending on the size of the leak/incident, pipeline pressure, location, etc.)	Leaks detected by survey and all incidents

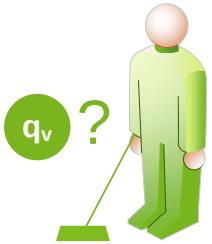
Conclusions & Outlook

- MEEM (the method) addresses all the relevant sources and types of emissions in the gas distribution grid within the boundaries as defined in the project.
- MEEM is as accurate as possible with reasonable effort, enabling a pan-European application.
- MEEM provides the potential for a very detailed emission estimation. Some countries in Europe already have the capability to apply a more sophisticated and complete emission estimation with elevated number of input data and advantages e.g. in terms of accuracy and transparency. Additionally, MEEM provides opportunities for a less complex emission estimation if data is not available at the required level of detail.
- Some challenging input parameters have been identified. Those parameters are currently estimated by expert assumptions from the group and should be validated in future follow-up research.
- Not all relevant input parameters are available in every country, the need for further measurements, updating of statistics, etc. has been identified.
- MEEM contributes to a more consistent methane emission estimation within Europe, also with an excel model, which includes all relevant equations and assumptions to support national or company emission estimates.

Need for Further Research

Emission rates of leaks detected by survey

- The available measurement data do not provide full information on all identified influencing parameters (e.g. pressure level, soil, material). Preliminary investigations should be made (in field or laboratory) which can identify the attributes that have to be taken into account for the sampling in large measurement programmes to avoid biased sampling and to get representative EF.



Duration of gas escape for leaks detected by survey

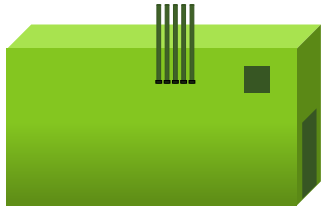
- The lifetime of leaks detected by survey ranges between the beginning and the end of a monitoring period plus the permitted repair time and is therefore currently assumed with $t=(t_{mon}+t_{rep})/2$. Experts assume that leaks do not exist longer than one year without being detected as an incident. This assumption should be evaluated.

Need for Further Research

- **Emission rate of incidents reported after gas smell**
  - No measurement data is available for emissions rates of incidents which were recognized by a gas smell outside. Assumptions have been developed within the experts of the project group but there is further need for research, since many influencing factors exist.

- **Duration of gas escape for incidents reported after gas smell outside houses**
  - No data is available for the duration gas escape of incidents which were recognized by a gas smell outside. Assumptions have been developed within the experts of the project group but there is further need for research.

- **Intrinsic emissions of PR(M)S**
  - The correlation of intrinsic emissions with the flow rate of a facility and the pressure level is not clear by now and should be subject of further research.



FOLLOW UP ACTIVITIES

- A decision of the GERG Board in the Autumn 2017 Board Meeting: task force to plan actions on methane emissions research needed in follow-up to the MEEM-project,
- GERG/ Kiwa Technology (Netherlands) project proposal on suction measurements on underground gas leaks and a coordinated European measurement program,
- DVGW project on methane emissions of the gas distribution grid in Germany, including measurements on above and underground gas leaks,
- Gas Natural Fenosa/ SEDIGAS project on intrinsic emissions of PE gas distribution network in Spain.

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Thank you for your Attention!

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DVGW