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DBI GUT
Gas- und Umwelttechnik GmbH

Management Summary

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

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Project Partners:	DBI Gas- und Umwelttechnik | Germany (Performing Partner) Bursagaz | Turkey DGC | Denmark E.ON Technologies | Germany Gas Natural Fenosa | Spain Gasnet | Czech Republic GRDF/ENGIE | France ITALGAS RETI | Italy Kiwa Technology B.V.| Netherlands Schweizer Verein des Gas- und Wasserfaches SVGW | Switzerland Synergrid vzw /Eandis | Belgium Westnetz | Germany
Project Duration:	01-10-2016 to 30-06-2018

BURSAGAZ
DGC Danish Gas Technology Centre
ENGIE by people for people
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Italgas Reti
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Management Summary

Methane Emission Estimation Method for the Gas Distribution Grid

The project *Methane Emission Estimation Method for the Gas Distribution Grid (MEEM)* is the second phase of the project *Analysing the Methods for Determination of Methane Emissions of the Gas Distribution Grid* which was initiated in November 2014 by members of the European Gas Research Group (GERG). The aim of the project was to improve the accuracy and reliability of national emission estimations, to increase the transparency of the associated results, and to provide a basis for a consistent methane emission estimation.

Background and Motivation

The first project phase was finished in October 2015 and developed the fundamentals of the MEEM project. Best practices and optimization potential of existing methods of determining methane emissions of the gas distribution grid were identified. System boundaries have been aligned for the scope of the gas distribution grid, and sources as well as categories of emissions were defined. It was found that some of the methods in place are very detailed and require a high effort to collect input data. Other methods, which are less detailed and easier to apply, lead to less accurate and more conservative results. Ideally, a pan-European method for the determination of emissions from the gas distribution grid should combine the advantages of the different methods depending on their relevance to different emission categories. Another finding of project phase I was that emission reduction measures, which have already been conducted by the natural gas industry for several years, are not always rewarded by the emission estimation methods in place.

Research Approach

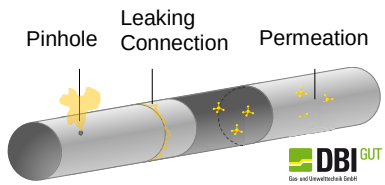
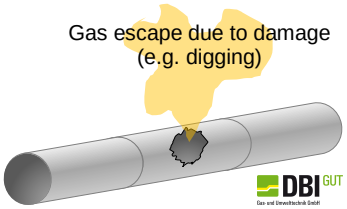
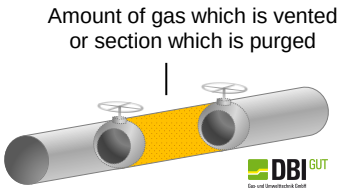
The project's committee of phase II comprises eleven representatives from grid operators, research institutes and associations of ten European nations: Belgium, Czech Republic, Denmark, France, Germany, Italy, the Netherlands, Spain, Switzerland and Turkey. Supported by representatives from Marcogaz and Eurogas (who joined selected meetings and contributed to the discussion of important documents) the partners provided information and practical expertise as a basis for the development of a method for the estimation of methane emissions of the gas distribution grid. External requirements (e.g. for the reporting of greenhouse gas emissions for the United Nations Framework Convention on Climate Change) were collected within the project by contacting national environmental agencies and were considered for the development of the method.

To evaluate the effort of promising methods for the emission estimation, a questionnaire was prepared and sent to multiple distribution system operators (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. The benefit of combining elements from existing methods was investigated with a model in MS Excel, especially developed for the MEEM project. This model includes a generic grid and calculates the results of different emission estimation methods. It makes the effect of certain assumptions visible and gives an indication on the contribution of individual emission categories to the total emissions.

Results of the Present Report

Methane emissions of the distribution grid originate from pipelines (main lines and service lines) and gas facilities (e.g. pressure regulating stations). Since many different names exist for the same categories of emissions, the partners of the MEEM project agreed to use the terms *Intrinsic Emissions*, *Incident Emissions*, and *Operational Emissions*. According to the definition in this project, *Intrinsic Emissions* include minor holes or cracks which are detected by survey, all technical leaks (e.g. leaking connections), as well as permeation. *Incident Emissions* are the result of damage to the pipeline and are reported by own staff of a DSO or third-parties (e.g. the public or staff of companies working near pipelines or facilities). *Operational Emissions* occur during commissioning and decommissioning, as well as during the renewal and maintenance of existing pipelines or facilities (Table 1).

Table 1: Categories of Emissions and Emission Types Covered by the Categories

Intrinsic Emissions	Incident Emissions	Operational Emissions
		
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	Emissions arising from: venting and purging during commissioning, renewal, and decommissioning

Source: Own Illustration DBI Gas- und Umwelttechnik

For some emission types (e.g. permeation) an accurate emission estimation is possible without high effort and the best available method is already applied by many countries in Europe. For operational emissions (e.g. venting during pipeline maintenance) an accurate emission estimation is also rather easy, since only parameters which are exactly known by the DSO are considered. Nevertheless, the data collection for event-based approaches can be time-consuming.

For other emission types (e.g. leaks detected by survey) the estimation is challenging. Basically, the emissions can be estimated by defining the amount of gas escaping in a certain time span, and by defining a duration of gas escape as well as the number of leaks detected per year by survey. The number of leaks is known to the DSO. The emission rates are not known and different approaches exist for their determination. On the one hand, emission rates can be determined by direct measurements. On the other hand, it is possible to determine soil coefficients and calculate the emission rates with the help of leak size and pipeline pressure. Both approaches have advantages and disadvantages. Other challenges occur in the determination of the duration of gas escape for leaks detected by survey, since the exact time period between start and detection of a leak is unknown.

To sum it up

The new developed method (MEEM) provides equations and suggests input parameters/default values and assumptions for all types of emissions mentioned in Table 1 to support a consistent use of the method. MEEM combines best practice approaches of individual countries and is the starting point of an Europe-wide trusted emission estimation. With MEEM it is possible to make emission estimations for countries, e.g. for national emission inventories, but also for individual DSO, e.g. for sustainability reports. Moreover, MEEM helps DSO to identify and show already achieved emission reductions, to coordinate further measures and to visualize further improvements.

The requirements for a possible 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. However, the decision if this scientific work from GERG will be transferred to CEN, remains open and subject to the partners. The process should be guided via Marcogaz after the finalization of MEEM. Before, it is recommended to test the method by several DSO and countries for verification of the intended effects.

Conclusions, Recommendations and Outlook

The key findings of the MEEM project can be summarised as:

- 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.

The following post-project activities are in discussion and are partly already initiated:

- 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.