GAZ-SYSTEM S.A. activities on methane emissions reduction

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AGENDA

1. GAZ-SYSTEM S.A. – brief introduction
2. International and national cooperation
3. Projects on methane emissions
4. Daily actions
5. Summary
1. GAZ-SYSTEM S.A. - BRIEF INTRODUCTION

1.1 General information

Transmission System Operator GAZ-SYSTEM S.A.:
- Established in 2004 as a State Treasury Company of strategic importance;
- Designated as Transmission System Operator by the President of the Energy Regulatory Office;
- Transmits natural gas to the distribution networks and end users;
- Owner of Polskie LNG.
1. GAZ-SYSTEM S.A. - BRIEF INTRODUCTION

1.2 Facts & Figures (1)

- Over 2000 employees
- Head Office in Warsaw
- 6 branches: Gdańsk, Poznań, Rembelszczyzna, Świeklany, Tarnów, Wrocław
1. GAZ-SYSTEM S.A. - BRIEF INTRODUCTION
1.3 Facts & Figures (2)

- 9,777 km of pipelines
- Transmission of over 14 bcm of natural gas
- 15 compressor stations
- 970 exit points
2. INTERNATIONAL AND NATIONAL COOPERATION

2.1 Membership in European associations

- Gas Infrastructure Europe (GIE)
  - Gas Transmission Europe (GTE)
  - Gas LNG Europe (GLE)

- European Network of Transmission System Operators for Gas (ENTSOG)

- European Gas Research Group (GERG)

- Marcogaz
2. INTERNATIONAL AND NATIONAL COOPERATION

2.2 International partnerships

- Natural Gas Star International
- Battelle Memorial Institute - ICF Resources
- International Gas Union (via PZITS – The Polish Association of Civil Engineers & Technicians)
2. INTERNATIONAL AND NATIONAL COOPERATION

2.3 National level

- Institute for Oil and Gas
- Warsaw University of Technology
- Silesian University of Technology
- Warsaw University of Life Sciences
- And others.....
3. PROJECTS ON METHANE EMISSIONS
3.1 Reduction of natural gas emissions

- Environment protection
- Public safety
- Improvement of economic indicators
- Company image
To reduce emissions, it is necessary to:

- Identify emission sources
- Estimate emission quantity
- Calculate economic viability
- Eliminate sources of emissions
3. PROJECTS ON METHANE EMISSIONS

3.3 Emissions inventory

- Emissions from M&R stations, compressor stations, pipelines – coefficients were assigned
- Gas releases to the atmosphere due to maintenance works and breakdowns – amount of gas is calculated from available data
3. PROJECTS ON METHANE EMISSIONS

3.4 Percentage of natural gas emissions
3. PROJECTS ON METHANE EMISSIONS

3.5 Partnership of NGS

- improvement of emission coefficients;
- inventory of emission sources;
- assessment of the amount of emissions resulting from technological processes;
- assessment of the amount of fugitive emissions resulting from leakages
3. PROJECTS ON METHANE EMISSIONS

3.6 Cooperation with ICF

The aim was to analyze data using ICF’s proprietary software

- GAZ-SYSTEM S.A. provided necessary information on three of the six branches;
- ICF prepared the draft analysis on emissions inventory;
- The next step is to prepare a report on reducing methane emissions from the transmission system.
3. Projects on Methane Emissions

3.7 Cooperation within GERG

2010 - a project on best practices on natural gas emission measurement methods was completed.

- Participants – 7 European companies;
- Results:
  - the best available method - Air Flow Method;
  - Its disadvantage – no ATEX certificate
3. PROJECTS ON METHANE EMISSIONS

3.8 Methods of emissions measurements

<table>
<thead>
<tr>
<th>Method</th>
<th>Type of emission</th>
<th>Measuring range</th>
<th>Uncertainty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method using foil</td>
<td>Fugitive emissions</td>
<td>from 0.0018 m³/h</td>
<td>To 10%</td>
</tr>
<tr>
<td>Method with air flow (Hi Flow Sampler)</td>
<td>Fugitive and pneumatic emissions</td>
<td>0.09 – 14 m³/h</td>
<td>Up to 10%</td>
</tr>
<tr>
<td>Method of bags of known capacity</td>
<td>Organized emissions</td>
<td>0.3 – 30 m³/h</td>
<td>Approx. 10%</td>
</tr>
<tr>
<td>Methods with flow meters</td>
<td>Organized emissions</td>
<td>Depends on the device</td>
<td>2 – 10%</td>
</tr>
</tbody>
</table>
### 3. PROJECTS ON METHANE EMISSIONS

### 3.9 METHODS OF EMISSIONS MEASUREMENTS

<table>
<thead>
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</tr>
</thead>
<tbody>
<tr>
<td>Remote plume sensing method</td>
<td>Emissions from structure sources</td>
<td>0.01 kg/h 1 km. 1 ppm</td>
<td>10 – 15%</td>
</tr>
<tr>
<td>Tracer method</td>
<td>Emissions from structure sources</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Flux chamber method</td>
<td>Emissions from surfaces</td>
<td>Several cm³/m²/h – several thousand cm³/m²/h</td>
<td>To 10%</td>
</tr>
<tr>
<td>Calculation method</td>
<td>All kinds of emissions, especially vented</td>
<td>---</td>
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</tr>
</tbody>
</table>
3. PROJECTS ON METHANE EMISSIONS

3.10 GERG projects

2011 - a new project proposal is discussed:
„Comparison of results obtained with different approaches to measurement of natural gas emissions – Air Flow Method and a method specified in EPA 21 (or EN 15446 standard)“
3. PROJECTS ON METHANE EMISSIONS

3.11 Method specified in EN 15446 standard

- Measurement of gas concentration on the surface of a leak source by portable device;

- Conversion of concentration to leak rate by using experimental corelations, which give coefficients for equation:

$$ER = A(SV)^B,$$

- $ER$ – emission rate, kg/h;
- $SV$ – screening value, ppm.
3. PROJECTS ON METHANE EMISSIONS

3.12 Air Flow Method

Air Flow Method

- Quantity of gas emitted is sucked together with air;
- Flowrate of gas and air mixture is measured;
- Methane concentration in the gas mixture for two different flowrates is measured;
- Results are consistent up to 10%.
3. PROJECTS ON METHANE EMISSIONS
3.13 Projects with INIG

- Verification of emission coefficients from M&R stations;
- Methods for emissions detection from transmission system;
- Emissions measurements from compressor stations – Part I and Part II.
3. PROJECTS ON METHANE EMISSIONS
3.14 Methods of emissions detection (1)

- Remote aerial detection system;
- Portable leaks detector;
- Infrared camera;
- Flame ionisation detector;
3. PROJECTS ON METHANE EMISSIONS

3.15 Methods of emissions detections (2)

- Portable semiconductor detector;
- Portable catalitic detector;
- Detection with the use of surfactants.
3. PROJECTS ON METHANE EMISSIONS
3.16 Aerial detection of methane leaks - ALMA system
3. PROJECTS ON METHANE EMISSIONS

3.17 Aerial detection of methane leaks - CHARM system
3. PROJECTS ON METHANE EMISSIONS
3.18 Portable remote methane emissions detector - RMLD
3. PROJECTS ON METHANE EMISSIONS

3.19 Portable remote methane emissions detector - LASERMETHANE™ SA3C05A
3. PROJECTS ON METHANE EMISSIONS

3.20 Measurements of emissions in gas compressor stations

Compressors:
- turbine compressors with combustion engines
- reciprocating compressors with combustion engines
- electrically driven reciprocating compressors
3. PROJECTS ON METHANE EMISSIONS

3.21 Measurements of emissions in gas compressor station at Rembelszczyzna
3. PROJECTS ON METHANE EMISSIONS

3.22 Measurements of emissions in gas compressor stations

The largest emission sources:

- Fugitive emissions
  - Valves of different types
- Vented emissions
  - Venting columns
3. PROJECTS ON METHANE EMISSIONS

3.23 Percentage of methane emissions

All branches – old coefficients

Branch I – new data
4. DAILY ACTIONS
4.1 Modernization & Investments 2009-2010 (1)

- Replacement of needle valves on ball valves;
- Elimination of liquid separators;
- Modernization of existing compressor stations;
- Modernization of stop and bleed assemblies.
4. DAILY ACTIONS
4.2 Modernization & Investments 2009-2010 (2)

- Two compressor stations - in Goleniów and Jarosław;
- 34 M&R stations;
- 84,6 Km of new pipelines.
5. SUMMARY
GAZ-SYSTEM S.A activities on methane emissions reduction

- Commitment to the reduction of GHG, including CH4;
- Development of own procedures for emission inventories;
- Cooperation with many companies and associations on projects related to methane emissions reduction;
- Use of modern technologies for emissions detection and measurement;
- Repairs and modernization of transmission system elements.
Thank you for your attention

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