Avoiding climate-damaging methane emissions during pipeline repairs

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Reduction of natural gas emissions

Reduction of natural gas emissions during maintenance work on pipelines / at field stations
Climate protection

Methane
- 21 to 25 times higher impact on global warming, measured in terms of CO$_2$ (t/100a)

- 2$^{nd}$ most important anthropogenic greenhouse gas, Global Warming Potential (GWP)
  Value: 21 - 25

Voluntary commitment by E.ON AG on climate protection
- (Corporate responsibility in environmental management)

- No requirements imposed anywhere in Europe (but voluntary commitments by gas suppliers)
- Evaluation of methane emissions (no CH4 emission allowance trading)
Natural gas emissions

Open Grid Europe experience

- 5 scheduled venting operations on the transmission pipeline system p.a. correspond to approx. 3 million m³ of natural gas (2.2 kt of CH₄) which equates to the annual gas consumption of some 1,500 households

Comparison

- Global anthropogenic methane emissions by source (in %)

  - Production, transportation and distribution of natural gas: 30%
  - Wet rice cultivation: 12%
  - Farmyard manure: 11%
  - Ruminants (enteric fermentation): 10%
  - Others: 9%
  - Coal mining: 6%
  - Wastewater: 4%
  - Landfill sites: 18%
Approaches to technical solutions

Use of stoppling method to reduce length of isolated pipeline section

Use of mobile compressor to transfer the gas
## Technologies available at Open Grid Europe

<table>
<thead>
<tr>
<th>Stoppling</th>
<th>Mobile compressor / Status today</th>
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<tbody>
<tr>
<td><img src="image" alt="Stoppling Equipment" /></td>
<td><img src="image" alt="Mobile Compressor" /></td>
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<tr>
<td>- Equipment rated up to 100 bar (MOP) available at Open Grid Europe</td>
<td>- Equipment available at Open Grid Europe</td>
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<tr>
<td>- Vented gas volumes are reduced to a minimum</td>
<td>- Low venting losses</td>
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<tr>
<td>- Natural gas transmission is not interrupted</td>
<td>- Use of natural gas not vented allows cost savings</td>
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<td>- costly</td>
<td>- Technology available for use at short notice</td>
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mobile compressor - reduction of natural gas emissions and losses

- Repair work on natural gas pipelines requires the lines to be depressurised down to atmospheric pressure, particularly when they have to be isolated. Using a mobile compressor allows the gas to be transferred from the isolated section into other pipelines or pipeline sections.

  ➔ Pipeline evacuated down to minimum residual pressures (6 bar)
  ➔ Methane emissions reduced by up to 90%
  ➔ Use of natural gas not vented to atmosphere
  ➔ High environmental protection effect

Example:
- An 18 km DN 1000 (40“) pipeline section operated at 70 bar contains some 1 million Nm³ of natural gas.
Mobile compressor - Natural gas savings per project

![Graph showing natural gas savings per project for different pipeline configurations.

- DN1400 (56") / 25km / 5.0 bar
- DN1400 (56") / 25km / 7.5 bar
- DN1000 (40") / 25km / 5.0 bar
- DN1000 (40") / 25km / 7.5 bar
- DN800 (32") / 20km / 5.0 bar
- DN800 (32") / 20km / 7.5 bar

The x-axis represents pipeline pressure [bar], and the y-axis represents natural gas not vented [TNm³].]
OGE requirements for mobile compressor

Compressor
- Max. capacity, shortest possible transfer time

Energy source
- Natural gas (autonomous unit)

Safety
- Built according to applicable European and German codes and standards
- Discharge pressure protection (can be adjusted as required in line with MOP of pipeline)
- Discharge temperature protection
- Gas warning sensor
- Fire extinguishing system (Inergen)
Mobile compressors – Technical data

Mobile (road-approved) natural gas transfer system

- **Vehicle:** Mercedes MB-1848 LS, 350 kW
- **Dimensions:** Length: 13.5 m; Width 2.55 m; Height: 4.0 m
- **Weight:** less than 40 t
Mobile compressor built in cooperation with LMF

- LMF, the vendor retained by OGE, was willing to face up to the project’s ambitious targets (maximum capacity, minimum weight and minimum evacuation time).

- The unit had the usual teething problems typical of prototypes. Thanks to decades of experience in gas engineering, these problems were resolved and the compressor made available for field use.

- The project has provided the most efficient mobile compressor unit currently available in Europe.
Mobile compressor – Technical details

Compressor

- Reciprocating compressor (LMF BS 604), two-stage, double-acting, 4x130mm
  - 640 kW (max.)
  - 2,200 – 61,000 Nm³/h (dependent on pressure ratio)
- Suction pressure: 69 to 5 barg,
- Max. discharge pressure: 70 barg

Drive

- Gas engine (CAT G3512LE)
  - 750 kW (max.) at 1,400 rpm
  - Average fuel consumption: 150 Nm³/h (250 Nm³/h max.)
Mobile compressor

- Air filter (CAT)
- Exhaust silencer
- Gas inlet filter
- Gas outlet
- Gas engine
- Fuel gas control run
- Reciprocating compressor
- Gas inlet
Installation

- Can be used to connect two different pipelines
- Can be installed on one pipeline as shown in the schematic
- Connecting fittings are retrofitted e.g. by hot tapping
- Min. diameter of connecting piece is 100 mm
- Adapters are available for different connecting pieces
Mobile compressor
Typical evacuation process

Pipeline Pressure [barg]

Time [min]

evacuation starts at 50 barg
pipeline section 20km, diameter DN1000
7 barg reached after 45 h
Installation

Schematic

- suction line
- discharge line
- mobile line
- transmission line
- engine
- pd: 55 barg
- ps: 50-5 barg

Open Grid Europe
The Gas Wheel
Reference projects in 2010

- Three projects on OGE pipeline system
  - Natural gas volume transferred: approx. 1.5 million m³
  - Avoided CO2 equivalent: approx. 25,000 t
  - Value of natural gas not vented to atmosphere: € 330,000
Reference projects in 2011

- Four projects on OGE pipeline system
- One project each on Bayernets and GRTgaz systems
- Natural gas volume transferred: approx. 8.5 million m³
- Avoided CO2 equivalent: approx. 145,000 t
- Value of natural gas not vented to atmosphere: € 1,870,000
I am pleased to answer your questions or contact christian.hadick@open-grid-europe.com