Methane emissions utilization in Russian oil and gas industry: Innovative technologies

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MAIN APPROACHES TO THE PROBLEM RESOLUTION

- Assessment of methane emissions utilization technologies and development of BREF
- Control and assessment of methane emissions in natural gas production
- About the emissions inventory of greenhouse gases in natural gas production
TECHNOLOGIES, THAT MAY HAVE METHANE EMISSIONS IN OIL AND GAS INDUSTRY

Natural and associated gas

Production

- Well operation
- Gas compression in gas booster station
- Gas cooling in gas booster station

Transmission

- Gas transmission system operation
- Gas compression
- Repair works of trunk pipeline linear part
- Natural gas dehydration
- Gas heating before reduction
- Gas distribution system

Storage

- Gas injection
- Energy support
- Process equipment operation
- Well survey
- Gas compression

- Liquid removal technologies
- Optimization of self-killing wells
- Improvement of gas compressor unit operational characteristics
- Optimization of boosting compressor station
- Boosting compressor unit. Operational parameter recovery
- Air cooling unit. Reliability enhancement

- Optimization of operational characteristics and gas transmission facility schedules
- Improvement of piping accessories reliability
- Gas leakage. Detection and assessment
- Improvement of repair work effectiveness on gas mains.
- Diethylene glycol degassing and high pressure gas utilization

- High pressure gas utilization
- Utilization of extra reservoir energy
- Replacement of cushion gas in underground storage.
- Inert gas utilization
- Application of zero gas emission technology
- Gas compressor units. Recovery of performance parameters

TECHNIQUES FOR DECREASE OF METHANE EMISSIONS & UTILIZATION
Oil storage reservoirs.
Technology of condenser installation

Technology description:
Technology goals to prevent emissions of light hydrocarbons vapors in tanks by installation of condensers. Up to 95% of high calorific value vapors are condensed in condensers. They can be used as a fuel for own needs or can be sold to outside companies.

Technology requirements:
• Separator inlet pressure 2 ÷ 14 kPa;
• Pressure in separator 276 kPa;
• Unit capacity 0.7 ÷ 14.1 thousands CMPD.

Examples: USA companies – Natural Gas STAR participants.

Information source: http://www.epa.gov/gasstar/documents/russian/ll_final_vap(rus)2.pdf
OFF GAS UTILIZATION TECHNOLOGIES
Example of the best available RF techniques

Technology description:
The unit provides continuous off gas separation and compression. The process includes off gas treatment - removal of water-methanol mixture, and further condensate separation in separator. Then gas is fed into rotary compressor and compressed to 0.2 MPa. Part of this gas is used for own needs (boilers, gas heaters). Remained gas is compressed up to 7.5-8.0 MPa and fed into main condensate pipeline after pumps to be transported to the consumers.

Technology requirements:
• product gas volume - 1.5 mlnCM;
• process gas pressure (boilers, heaters) – 0.2 MPa;
• pipeline gas pressure - 7.5 ÷ 8.0 MPa.

Examples:
Gazprom dobycha Yamburg LLC
Gazprom transgaz Ugorsk LLC
Urengoy gas-chemical complex.
Development of the innovation technologies of methane utilization has specific restrictions

In oil and gas industry choice of technology depends on methane origin, its volume and concentration when extracted from oil and gas fields and anthropogenic biogas sources.

**Biogas**

- Biogas (methane) sources as a rule are located close to accommodation facilities and are in a free access.
- Agricultural sector and waste industry have to follow the specific procedure:
  - provide methane emission analysis: sources and qualitative composition
  - screen utilization technology
  - coordinate building activity

**Natural gas**

- Gas released from oil and gas companies has constant composition
- Oil and gas companies implement different utilization technologies. They have to follow procedures:
  - select facility for methane utilization
  - assess emission source
  - select methane utilization technology
**Methane utilization technology**

**Introduction procedure:**

- Identification of range of application;
- Inventory of pollutant emissions/wastewaters, used raw materials, materials and energy;
- Assessment of costs for technology implementation;
- Assessment of economic and ecological effect from technology implementation.

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**General selection diagram**

- Selection of technologies by categories
  - Technology - candidate
    - Environment - oriented effect
      - Positive
        - Impact on product quality and industrial safety
          - Yes
            - Acceptable level
              - Yes
                - Technology can be applied

- R&D design and exploration work (procurement)
- Experimental testimony
- Integration into statement of work
- Acceptance committee decision, positive or negative decision concerning industrial application
- Economic analysis, technical and economic requirements, statement of work, procurement permission
METHANE UTILIZATION TECHNOLOGIES: MAIN IMPLEMENTATION STAGES

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<td>Coordination of construction works</td>
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### Conditions of the Choice and Implementation of Methane Utilization Technologies in Gas Production and Transportation

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<td>Well uploading time optimization</td>
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<td>Installation of plunger jacking systems in gas wells</td>
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<td>Well automatization system “Smart”</td>
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<td>Installation of well separator pumps</td>
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<td>Prevention of gas loss during inner pipeline cleaning using special condensation system for gas recovery</td>
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<td>Pumping of blowdown gas in low pressure pipeline</td>
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<td>Combined highly effective gas transmission technology on gas mains. Application of large diameter pipes with flow intratubal coat</td>
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<td>Application of nitrogen units in compressor station. Application of nitrogen units for process equipment blowdown</td>
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# FEASIBILITY STUDY STAGES

## Main stages

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<th>Selection of facility and expected results from technology introduction</th>
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<td>Selection of alternative technologies list</td>
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<td>Business plan development</td>
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<td>Receipt of independent expert’s conclusion at the initial stage of implementation</td>
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<td>Identification of source, size and procedure of using own funds for technology implementation</td>
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<tr>
<td>Identification of financing form (direct or indirect)</td>
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<tr>
<td>For direct financing: tender documentation development</td>
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<td>For indirect financing: development of documentation to be presented to government authorities for project approval</td>
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<td>Development of scheduled plan</td>
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<td>Supervision over schedule</td>
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<tr>
<td>Assessment of received economic effectiveness from implementation</td>
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<td>Choosing the best financing investment-based form</td>
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<td>Arrangement of documentation required for approval in a chosen company</td>
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<td>In the case of lease financing: arrangement of required documentation</td>
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**Purpose** – reduction of gas loss in the period of repair works on linear section of gas main by pumping gas into the parallel gas pipeline or in the following site of the gas pipeline after the stop cock on the gas flow.

**Operating principle:** gas contained in out service section is pumped into parallel pipeline or in the same pipeline but after line valve by mobile compressor station.

**Effect:**
- Gas economy up to 80% of gas contained in the section;
- Reduction of methane emission 12.3 mlnCM (2013), 35 mlnCM (2015 and forecast for 2016) (only for PAO Gazprom);
- Resource saving.

**Performance parameters:**
- MCU are recognized by end pressure: from 5.5 MPa to 11.8 MPa;
- Non recurrent costs for MCU purchase and introduction – 120-160 mln. roubles.
Real methane emission and leakage assessment

The Company jointly with Gazprom BNIIGAZ LLC regularly estimates methane and carbon dioxide emissions from operated technological facilities.

Gazprom dobycha Yamburg LLC has conducted instrumental analysis for leakage measurement to detect methane emission sources and assess their amounts.

Analyzed unit – Comprehensive Gas Treatment and Condensate Recovery Unit CGTU – 1V and 3 well clusters in Yamburg oil-gas-condensate field.

Methane Emission Control Experience.
Scientific and Research Developments for Gazprom dobycha Yamburg LLC Facilities.
Almost all CGTU technological equipment with potential locations of methane leakage has been instrumentally tested.

The qualitative and percent share of leaky technological equipment determined in CGTU-1V:

- valves within the range of 0.5 - 30% 
- vent stacks within the range of 10 - 67%

Methane Emission Control Experience.
Scientific and Research Developments for Gazprom dobycha Yamburg LLC Facilities
As a result of the Program for Natural Gas Emission Assessment on Gazprom dobycha Yamburg LLC Facilities the followings have been developed:

- in accordance with Gazprom Organization Standard
- details assessment of methane emission from technological facilities of Gazprom dobycha Yamburg LLC
- establishes list and order of measures to prepare and implement methane emission record and control
- uniforms development and implementation procedure for surface technological equipment methane emission assessment

Methane Emission Control Experience. Scientific and Research Developments for Gazprom dobycha Yamburg LLC Facilities
The result of the work is the document “Greenhouse gas emissions inventory for Gazprom dobycha Yamburg LLC facilities” with Program Complex.
The components of Inventory Program Complex

Program Complex (PC) functionally consists of three sections:

- Greenhouse gas emissions inventory
- Emission rate calculation modulus
- Report formation modulus

PC program system implies:

- Databases
- Calculation modulus
- User interface, including:
  - Windows interface
  - Web interface

In the near future the program complex will prepare emission inventory report in two languages (Russian and English) in an automatic mode.

Methane Emission Control Experience.
Scientific and Research Developments for Gazprom dobycha Yamburg LLC Facilities.
Gazprom dobyscha Yamburg LLC

The developed and perspective gas fields

Gazprom Dobyscha Nadym LLC
Gazprom Dobyscha Noyabrsk LLC
Gazprom Dobyscha Urengoy LLC
Gazprom dobyscha Yamburg LLC
Indigenous population density is less than 1 person per square kilometer.
The innovative solution of some problems is described.

Springerlink: http://link.springer.com/book/10.1007/978-3-319-41805-6

MONOGRAPH ON ENVIRONMENTAL CONTROL OF FAR NORTH HAS BEEN PUBLISHED

Biogeochemical Technologies for Managing Pollution in Polar Ecosystems

Vladimir N. Bashkin

Editor


ISSN 156-0745
ISSN 2215-1702 (electronic)
ISBN: 978-3-319-41804-9
Yamal-Nenets Autonomous Okrug (District) – vulnerable diversity

Objective – to preserve and protect from man-made impact

THANKS FOR ATTENTION!