Gazprom activities on methane emissions reduction

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Parameters of the Gazprom Unified Gas Supply System

Parameters	2008
Total number of compressor stations, (CS), units including	***281***
linear CS	***219***
booster station	**45**
CS UGS	**17**
Total install capacity of CS and booster stations, *thousand MW*	**47,238**
Gas pumping aggregates (GPA) at CSs and booster stations, units	**4242**
including	
gas turbine and gas motor compressors	**3559**
electric	**683**

Purposes and objectives

Purposes

– Increase the efficiency of Russia s natural gas complex,
– reduce atmospheric methane emission,
– obtain knowledge and objective estimates,
– give a scientific substantiation of final targets,
– gain background to define priority tasks and required steps within management of GHG emissions,
– meet the Russian legal requirement,
–estimate commercial benefits of methane emissions reduction projects.

Objectives

– Study economic and environmental benefits of methane emission reduction projects at Gazprom facilities,
– assess the amount of natural gas leakages resultant from the operation of the gas transport system technological equipment,
– set the main selection criteria for potential methane emissions reduction projects.

Relevance of the Problem

- Intensive promotion of the technological equipment modernization, operated at Gazprom facilities,

- participation of Russia in international agreements on stabilization and reduction of greenhouse gas emissions including the methane,

- corporate interests in implementation of market mechanisms under the Kyoto Protocol,

- corporate policy implementation of energy saving and enviromental protection

Methods and techniques applied

Methodology

- Collection, accumulation and analysis of statistical data on assessment of methane emissions resultant from regular operations
- Extensive studies on detection of natural gas leakages from the gas transport technological equipment
- Measuring of the identified leakage amount

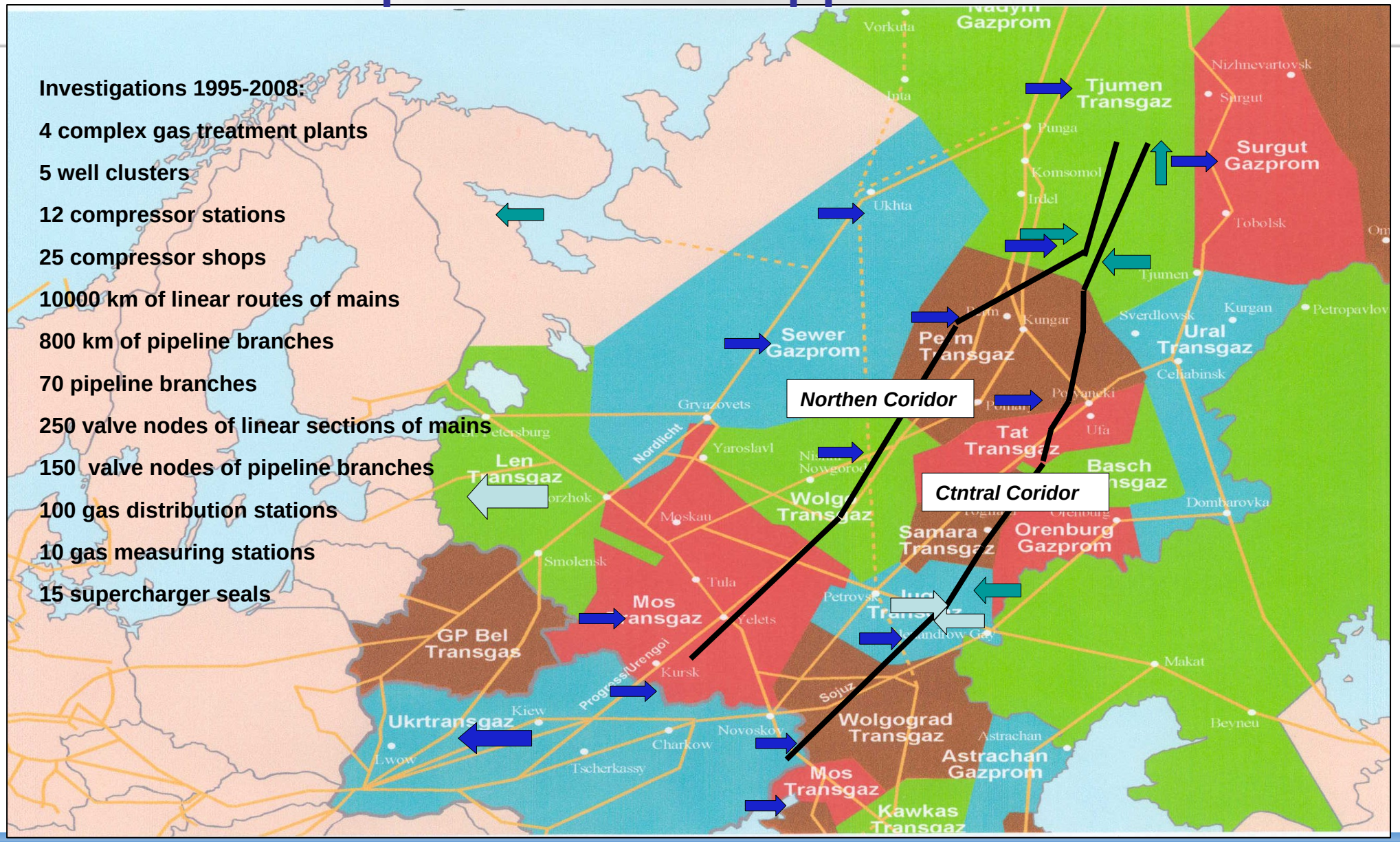
Techniques

The amount of the natural gas leakages was estimated by means of contact control media based on the practical recommendations and technical equipment certified under the normative documents of Gazprom.

Export and transmission pipeline routes

Investigations 1995-2008:

- 4 complex gas treatment plants
- 5 well clusters
- 12 compressor stations
- 25 compressor shops
- 10000 km of linear routes of mains
- 800 km of pipeline branches
- 70 pipeline branches
- 250 valve nodes of linear sections of mains
- 150 valve nodes of pipeline branches
- 100 gas distribution stations
- 10 gas measuring stations
- 15 supercharger seals



METHODS OF METHANE LEAKAGES REMOVAL VIA MODERN CONTROL MEDIA

TOOL DETECTION OF METHANE FUGITIVE EMISSIONS FROM DIFFERENT SOURCES IS CARRIED OUT VIA CONTACT SENSING AND DISTANT EXPLORATION OF THE EQUIPMENT SURFACE (ASSUMED SOURCE OF A LEAKAGE) INVOLVING INTERNATIONALLY CERTIFIED MEASURING MEDIA

METHODS OF LEAKAGE CONTACT DETECTION

Leakage detectors, methane concentration meters

Portable gas meter

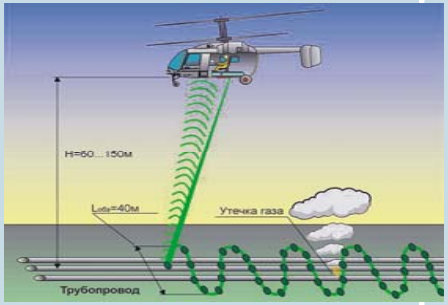
Multifunctional IrDA gas analyzer

Sampler unit

Volumetric emissions measuring and detection device

Gas detector

SYSTEMS OF METHANE EMISSIONS REMOTE DETECTION AND MEASUREMENT



Helicopter distant laser gas analyzer for pipelines

Laser system of the methane spatial concentration

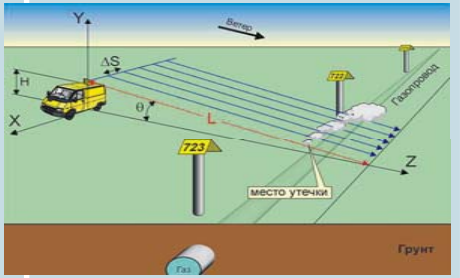
Laser measuring system of the methane local concentration

Board passive distant gas meter for methane concentration “Tomsk-1”

Portable passive gas analyzer for methane “Proryv”

DGA of methane concentration based on an IrDA sound and optical spectrometer and projector

Distant measuring system of methane concentration



Vehicle distant laser gas analyzer for pipelines

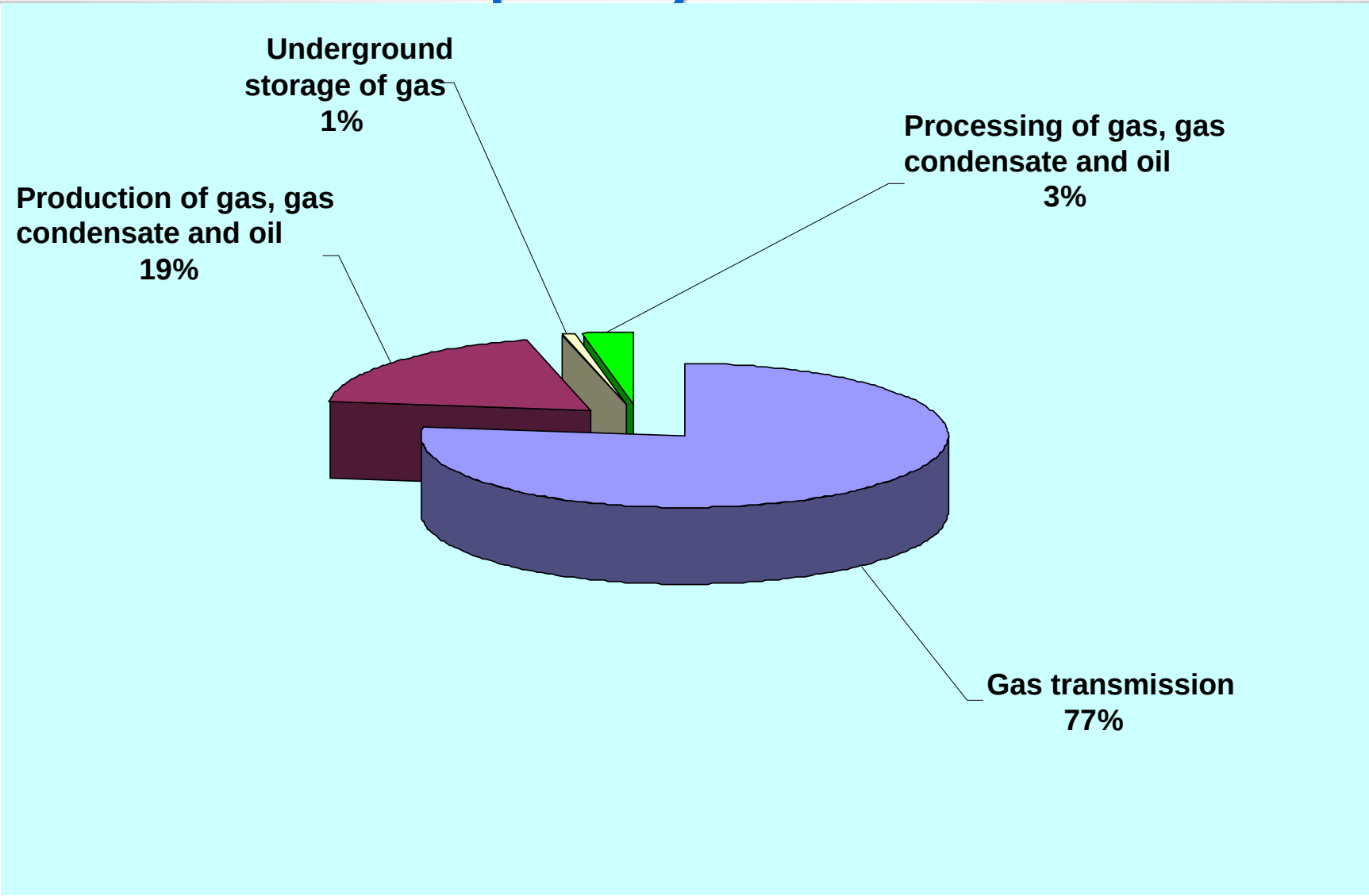
Indicators of methane emissions

Methane emissions source	OAO «Gazprom» data for 1999, 2005-2008		Data of the Wuppertal Institute, 2004
Gas extraction and preparation, % of the extraction			
Emissions Leakages Total	0,04 0,02 0,06	0,10 0,02 0,12	0,09 0,03 0,11
Compressor stations, м³/year / MW CS			
Emissions Leakages Total	- - 75000	4500-5500 40000-60000 45500-64500	5227 44191 49418
Linear gas main pipeline, м³/year / км of route			
Emissions Leakages Total	700 2700 3400	250-900 1600-3000 2500-3250	284 2425 2709
Gas distribution stations, м³/year			
Emissions Leakages Total	- - -	50-300 300-1000	-
Gas measuring stations, м³/year			
Emissions Leakages Total	- - -	30-50 90-150	-

Dynamics of greenhouse gases emitted by Gazprom facilities

Greenhouse gases emission		Years				
		2005	2006	2007	2008	2012
Methane	10^9 m^3	6,2	6,0	7,0	6,3	5,1
	$CO_{2\text{-equiv}}$, 10^6 t/y	90,7	88,2	102,6	92,5	75,0
CO_2 in natural gas combustion, 10^6 t/y		99,3	105,3	90,6	95,2	70,0
Methane in combustion	10^3 t/y	8,9	9,4	8,1	8,5	8,0
	$CO_{2\text{-equiv}}$, 10^3 t/y	186,9	197,4	170,1	178,5	168,0
TOTAL, $CO_{2\text{-equiv}}$, 10^6 t/y		190,1	193,7	193,4	188,0	145,1

Expected distribution of reduction of GHG emissions by Gazprom (in CO_2 - equivalent) in 2008-2012



Evaluating project potential of Gazprom Group and cross-related projects

Reduction of greenhouse gas emissions: priority projects of Gazprom					
№	Project	Capital investments, mln euro/year	Expected effect (2009-2012)		
			Thou tons of CO2-equiv.	From sale of ERU, mln euro *	From sale of saved gas, mln euro **
1	Use of mobile compressor stations (MCS) for pumping natural gas out of gas mains	51,0	21 500	322,5	102,0
2	Use of air or electric start up of GCU	4,0	834	12,5	4,0
3	Optimization of gas flow distribution in GTS (at the example LLC Gazprom Transgaz Ugorsk)	1,0	1 065	16,0	5,1
4	Replacement of gas compressor units by more efficient ones (with efficiency 35-40%)	20,3	3 867	58,0	-
5	Utilization of associated petroleum gas (at the example Urengoi oil and gaz condensate field)	14,4	1 666	25,0	-
6	Prevention of methane emissions at GTS of Gazprom	0,1	100	1,5	-
	TOTAL:	90,8	29032	435,5	111,1

* ERU selling price - 15 euro
** gas selling price - 70 euro per thou of cub. m.

Gazprom acknowledges the advantages of dry seals

GAZPROM

acquires new GPAs with dry seals

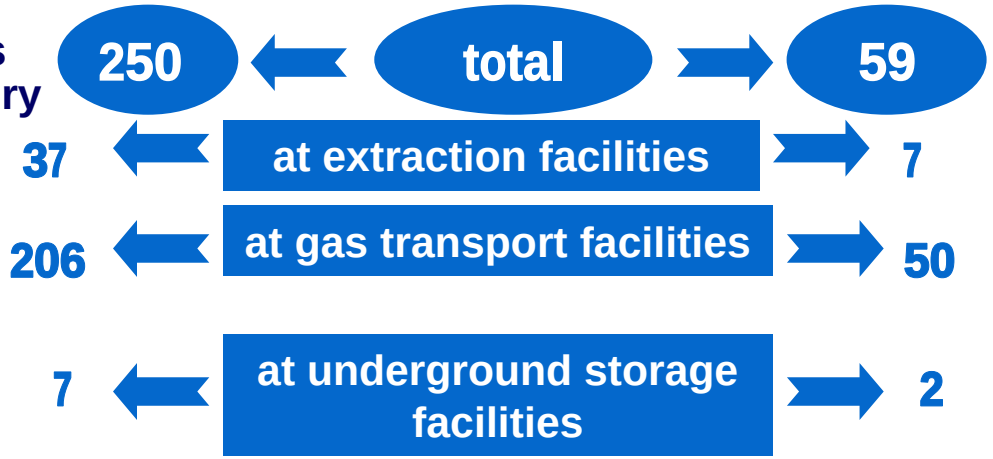
implements an ambitious corporate program of compressors modernization involving the dry seal technology

cooperates with leading suppliers of dry seal equipment and services:

«JSC Sumy Frunze NPO» «BURGMANN»
«John Crane» and «John Crane - Iskra».
«Grace Engineering»; PTP «SGER»

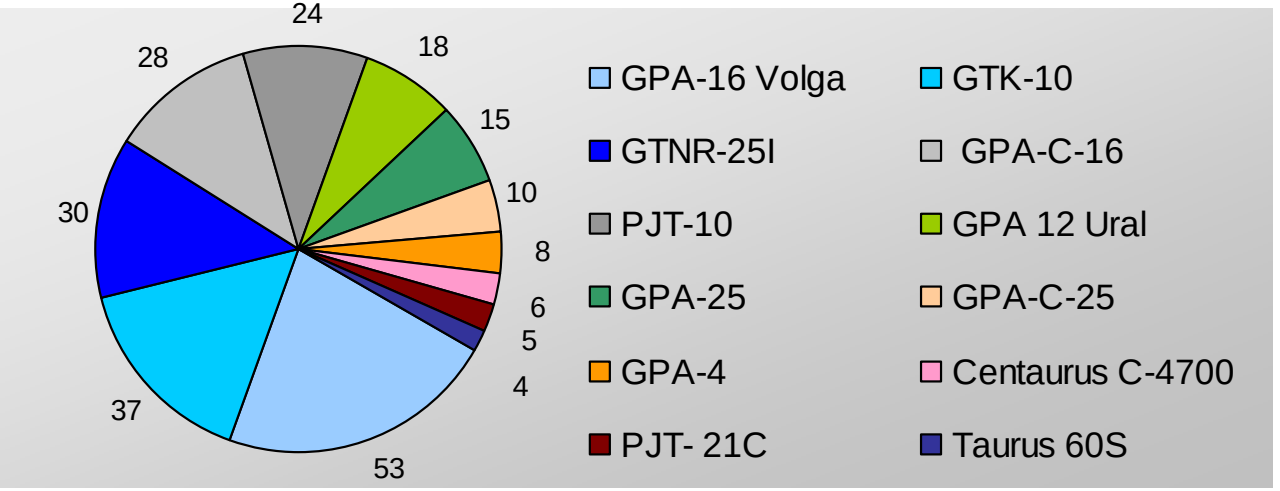
Implementation of seal system technology at Gazprom compressor stations

GPA superchargers equipped with dry seals



Number of compressor stations (GPAs with dry seals)

Implementation of dry seal technology by GPA types, units



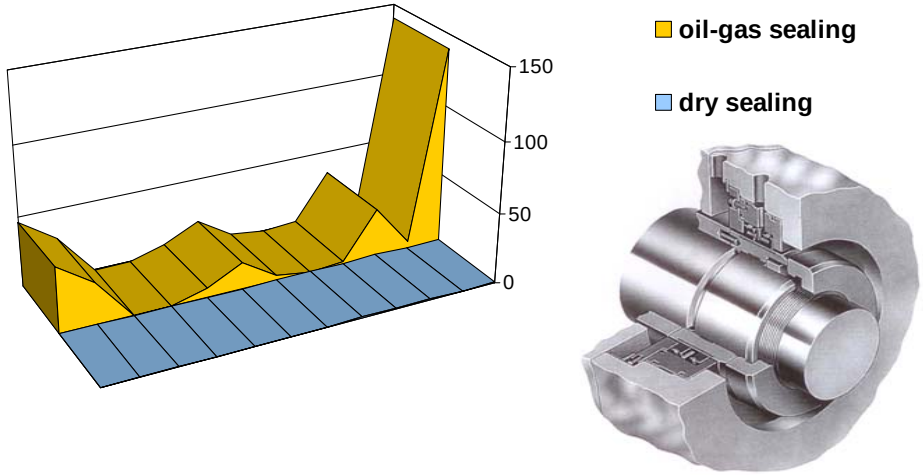
Implementation of seal system technology at Gazprom compressor stations

- **Elimination of gas contamination with oil as well as methane and vapor emission reduction.**
  - The oil contamination used to cut the pipeline throughput capacity by 1- 2%.
- **Decrease of aggregate capacity loss as a result of dragging removal in seals.**
  - Seal dragging leads to more than a ten-fold loss of the compressor throughput capacity.
  - One-per cent dragging decrease will result in a fuel consumption cut by several per cent.
- **Service life prolongation.**
  - Dry seals are specifically designed to operate as long as the compressor itself.
  - Dry seal systems require neither specific means for the oil circulation nor any treating units.
  - Additional technical components become useless the maintenance gets also decreased (once in 1 – 3 years) and less complicated.
  - Operational costs get reduced, while the system reliability is improved.
- **Energy saving effect resultant from the exclusion of "parasitic" energy consumption.**
  - Oil systems demand for 50 – 100 kW/hour, whereas dry seal systems take only 5 kW/hour, which 10 – 20 times as efficient.

Measuring results of methane emissions into the atmosphere resultant from seal systems of gas pumping aggregates

Type of GPA/supercharger	Methane emission source from oil-gas seal system	Methane emissions, m^3/hour
GTNR-25I/PCL-804/36	oil degasser vent stack	4,3-140,0
	bearing crankcase venting	3,0-5,0
GPA-C-16/NC-16-76	oil degasser vent stack	5,8-34,5
GTK-10-4/ N-235-21-1	oil degasser vent stack	0,07-1,7
	bearing crankcase venting	0,01-0,06
N-370-18-1	oil chamber stack	0,5-46,5
N-520-12-1	oil degasser vent stack	1,7-3,6
GTN-16/ 2N-16-76	oil degasser vent stack	15,4-19,1
	oil chamber stack	10,4
	bearing crankcase stack	5,4 -7,0
	oil chamber stack	1,8-2,3
GT-750-6/N-370-17-1	oil degasser vent stack	0,15-0,22
GPU-10 / N-370-18-1	oil degasser vent stack	0,007
	oil chamber stack	0,003
GT-6-750 / N-300	bearing crankcase stack	4,4-29,5
	oil degasser vent stack	0,6-46,5

Type of GPA/supercharger	Methane emission source from dry seal system	Methane emissions, m^3/hour
GTNR-25I/PCL-804/36	stack of the 1 step	0,05-1,26
	stack of the 2 step	0,04-0,38
ГПА-Ц-16 / НЦ-16-76	stack of the 2 step	0,07-1,2
ГТК-10-4 /Н-370-18-1	stack of the 2 step	0,03-0,6
ГПА-25 Днепр / Н-650-22-2-1,35	stack of the 1 step	0,08-0,8
	stack of the 2 step	0,03-0,42



Conclusion

Gazprom practical experience proves

- Evident economic, operational and environmental benefits of technical solutions in methane emissions decrease;
- Gazprom has a huge potential in methane mitigation;
- For measures with higher investment Joint Implementation projects could be attracted to acquire additional funding;
- Today Gazprom receives lots of proposals from national and foreign companies to participate in projects on methane emissions reduction, such as activation of aggregates with a starting device, application of MCS, switch from wet seals to dry seals, etc;
- Necessity to boost the implementation of the dry seal technology on oil seal GPAs;
- Demand for further studies to give a quantitative assessment of particular methane emissions and achieved emission reduction resultant from the shift to the dry seals.

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