

## Role of natural gas in low-carbon development

### Environmental impact of gas infrastructure development

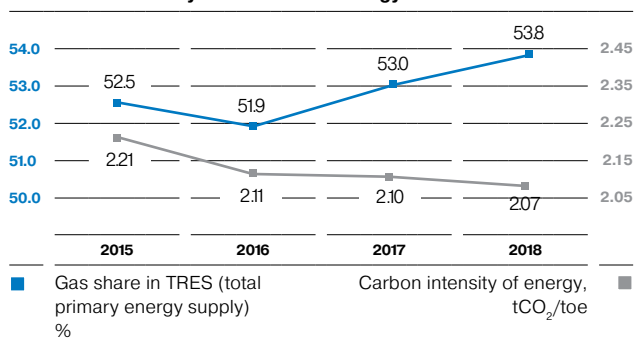
PJSC Gazprom makes meaningful contribution to the low-carbon development of the Russian economy and the countries that import Russian gas. According to the International Energy Agency (IEA), carbon intensity of power generation from natural gas is 1.5-2.5 times lower than that of oil and coal: 400 g CO<sub>2</sub>/kWh compared to 600 g CO<sub>2</sub>/kWh and 845-1020 g CO<sub>2</sub>/kWh respectively (depending on the type of coal). At a global level, the increase in natural gas consumption since 2000 has prevented almost 3 billion tons of carbon dioxide emissions.

The development of gas infrastructure in Russian regions is one of the Gazprom's most large-scale and socially significant focus area that helps to increase the share of natural gas in power and heat generation, and thus reduce greenhouse gas (GHG) emissions.

The carbon intensity of electricity in Russia is relatively low as compared to the global situation and other large CO<sub>2</sub>-emitting countries (USA, Germany, Japan, China, India, etc.) thanks to the high share of gas. According to the Analytical Centre for the Government of the Russian Federation, the carbon intensity of the Russian power sector decreased by 59.5 g CO<sub>2</sub>/kWh to 358 g CO<sub>2</sub>/kWh (-9%) in 2010-2016. This is equal to 42.7 mln tons (-10%) decrease of CO<sub>2</sub> emissions in the power industry for the given period while electricity generation increased by 51 bln kWh (+5%).

There is a direct correlation between the increase in the share of natural gas in total primary energy supply (TPES) and decrease in the carbon intensity of Russia's energy sector.

**Correlation between the share of natural gas in TPES in Russia and carbon intensity of the Russian energy sector**



Source: IEA

The additional substitution of coal by natural gas in the heat and power sector in Russia and abroad will ensure significant GHG emissions reduction and the achievement of ambitious climate targets in the fastest and cheapest way.

PJSC Gazprom supplies its consumers with low carbon energy and has the lowest carbon footprint of its supply routes along the whole production chain, i.e. the minimum GHG emissions. Pipeline natural gas supplies via new routes (Nord Stream, TurkStream) are characterized by lower emissions, as compared to existing natural gas supplies to Europe.

**Carbon intensity of various natural gas supply routes to Europe, g CO<sub>2</sub>e/MJ (LHV)**

LNG		
Qatar	<div></div>	13.6
Algeria	<div></div>	16.3
USA	<div></div>	22.3
Pipelines		
via Ukraine	<div></div>	10.6
TurkStream	<div></div>	7.3
Nord Stream	<div></div>	6.3

Source: Thinkstep

**Gas supplies via TurkStream instead of the Ukrainian corridor will result in greenhouse gas emissions reduction in the amount of 4 million tons of CO<sub>2</sub>e annually, and 20 million tons of CO<sub>2</sub>e per year as compared to LNG deliveries from the USA.**

### Switching transport sector to natural gas

The expansion of natural gas use as a motor fuel is Gazprom's contribution to the climate and environmental policy of the Russian Federation. Transport is one of the main sources of pollutant emissions; it takes 40% of the total volume of pollutant emissions into the atmosphere (80-90% in metropolises) and about 10% of GHG emissions.

Today, natural gas with methane as its major component (92–98%) is the most promising alternative fuel. Natural gas can be used as a motor fuel both in compressed, and in liquefied form. Switching transport to natural gas as a motor fuel will not only reduce negative impact on the environment, but extend the life of engines and vehicles, reduce prime-cost of transportation, and improve the energy performance of the transport system.

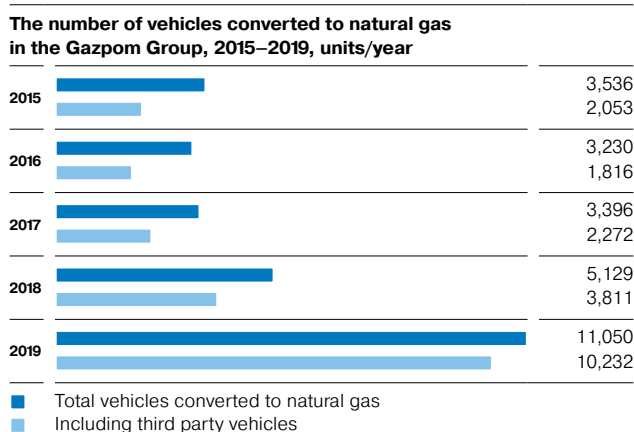
Gazprom carries out systematic work to expand the use of natural gas as an engine fuel. In 2016, the Gazprom Management Committee approved the Program on the Development of Gas Fueling Infrastructure at Industrial Sites of Subsidiaries for 2017–2019, as well as the Program on Development of Low Tonnage Production and Use of Liquefied Natural Gas (LNG), which provides for a number measures to convert Gazprom's vehicles to gas and install gas fueling modules at industrial sites of the Gazprom Group companies.

**In 2019, the Company built over 40 new gas refueling facilities (modern NGV-refuelling compressor stations, gas-filling modules at existing filling stations, and locations for the allocation of mobile NGV refuelers).**

The Company continues to convert its own fleet to natural gas. It is planned that the end of 2020 will see 70% increase in the number of NGVs at Gazprom's subsidiaries. Gazprom is also developing the network of NGV compressor stations, and coordinates the work of interested parties of the Russian gas engine market.

**In 2019, the Gazprom Group enlarged its NGV fleet by 11,050 units.**

PJSC Gazprom converted 10,340 vehicles and OOO Gazprom mezhregiongaz — 706 vehicles to natural gas.



Switching transport to natural gas fuel significantly reduces emissions both in the fuel use phase and along the entire fuel production chain. GHG emitted during production of compressed natural gas (from production to refueling) are 4 times lower, than from conventional petroleum engine fuels. The GHG emission reduction potential is estimated at 65 mln tons of CO<sub>2</sub> annually in case 50% of vehicles are converted to natural gas in the Russian Federation.

The IX St-Petersburg International Gas Forum saw signing of documents on the expansion of natural gas utilization as a motor fuel between PJSC Gazprom and the management of some territorial entities of the Russian Federation, as well as signing of roadmaps on accelerated development of the gas motor market until 2024 in Saint-Petersburg, the Leningrad and Kaliningrad regions. The roadmaps provide for the construction of new gas refueling network facilities, including cryogenic refueling stations, and the development of new service centers for the re-equipment and maintenance of NGVs. The Forum also witnessed signing of agreements on the expansion of the use of gas as a motor fuel in the Nizhny Novgorod and Lipetsk regions, as well as in the Republic of Tatarstan.

The roadmap on strategic cooperation in the use of gas-motor fuel was signed with OOO SIBUR. An Agreement on the areas of strategic cooperation was signed with OOO United Machine-Building Company. The synergy of the parties will be focused in particular on organizing the production of new gas-fueled heavy trucks and special-purpose vehicles, and improving their technical and operating parameters. Special attention will be paid to consideration of imports phase-out suggestions and the local content of the production of gas equipment and spare parts. Another important step was the signing of a roadmap on memorandum of cooperation on the use of natural gas as a motor fuel in water transport with AO Alexeev's Hydrofoil Design Bureau was another key step. The roadmap envisages the development of NG ship engine and gas-motor fuel storage system for high-speed vessels, standard solutions for inland navigation LNG bunkering and floating filling points for river ships.

Crucial focus area of the Company on expansion of the Russian gas fuel market is LNG production and trade, as LNG has a high application potential in road, water and rail transport, mining and agriculture industry. It is expected that new distribution infrastructure facilities — stationary cryogenic filling stations and mobile LNG filling stations will be developed. The implementation of the program will help Gazprom to build a large business segment, increase natural gas trading, and improve operational efficiency of existing GDS. Currently, the Company is working on a number of pilot projects for the use of LNG on transport. In 2019, methane vehicles were exhibited in Saransk (the Republic of Mordovia) and in Ukhta (the Komi Republic) to demonstrate the benefits of using natural gas as a motor fuel. Workflow charts, specifics of utilization, diagnostics and maintenance of NGVs and compressed gas vehicles were also presented on the exhibitions.