GAS-VEHICLE COMPLEX DEVELOPMENT PROGRAM
FOR EASTERN RUSSIA

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Introduction

Today socioeconomic development in Russia is accompanied by growing demand of industry and population in transportation services.

Special attention at solving priority tasks of the country development should be paid to the Far East and Transbaikalia regions covering 40% of Russian territory. State policy of transport infrastructure development in these regions is reflected in Federal target programmes “Economic and social development of Far East and Transbaikalia for the period up to 2013”, “Modernization of Russian transport system (2002-2010)”, etc.

The programs envisage continuation of motor roads and new railways construction. Sea and river transportation ensuring accessibility of Far East and Transbaikalia territories are major population mobility means. Civil aviation provides for long-distance transportation in the region.

To increase competitiveness of Russian transport system and to implement transit transport opportunities it is planned to solve the problems of transport corridors improvement, creation of alternative routes, integrated development of big road junctions and logistics complexes. Complex of investment measures aimed at development of international transportation corridors “East-West” and “North-South” will be realized. One of priorities in the transport system development will be lowering of transport harmful impact on the environment by increasing park of cost-effective and eco-friendly vehicles and air transport, switching vehicles to new fuels, including natural gas.

Natural gas as an alternative to liquid motor fuel is the most appropriate for transport application. Its energy and physical features (calorific value, toxicity level, impact on lubricants, etc.) provide for better cost-effectiveness and eco-friendliness of vehicles.
Possibility of widely applying natural gas in the Russian vehicle sector is ensured by availability of hydrocarbon resources (which in amount sufficiently exceed oil reserves) and of developed gas-transportation system.

Experience and knowledge accumulated in Russia are enough for further development of gas-filling network and increasing of vehicles fleet and equipment using compressed and liquefied natural gas.

**Development of gas-filling stations network for vehicles**

Natural gas as a motor fuel is used in six Siberian territories and in one Far Eastern territory. Location of existing gas-filling facilities is shown in the Fig.1. About 18 mln. m³ of gas are annually used in the transportation sector.

In the other territories of Eastern Siberia and Far East liquefied hydrocarbon gas (LHG) utilization is prevailing. Necessary infrastructure and maintenance services are organized here to ensure gas supply to the transportation sector.

In 2008 the Russian Federation Government adopted the Program for establishing a unified gas production, transportation, supply and distribution system in Eastern Siberia and the Russian Far East. JSC Gazprom was appointed the Program coordinator.

Within the framework of the JSC Gazprom strategy to implement the "Eastern Program", JSC Gazprom promgaz has developed Prospective schemes for developing a natural gas-filling station network.

Development of gas vehicle complex in Eastern Siberia and Far East presupposes creation of "blue" gas transportation corridors connecting regional centers and big cities, construction of gas-filling complex facilities and a corresponding operation and service infrastructure (Fig.2).

One of such corridors will connect Primorski and Khabarovski krai. Gas-filling stations network will be located along one of the main Federal road “Ussuri” (Khabarovsk - Vladivostok), including the Nakhodka port, and part of the regional road Khabarovsk – Lidoga – Vanino to the city of Komsomolsk-on Amur. This transport corridor will cross big cities like Vladivostok, Ussuriysk, Komsomolsk-on-Amur and Nakhodka, where the main part of the regional transport enterprises is concentrated.

The second “blue” corridor will connect the Sakha Republic (Yakutia) with the Amur region and go through the so-called Amuro-Yakutsk motor-road. This motor-road is crossing the following cities: Bolshoi Never – Tynda – Neryungri – Aldan – Tommot – Nizhniy Bestyakh – Yakutsk. Its length is 1134 km.

It is necessary to organize a third transport corridor on the Federal road “Amur” (Chita – Khabarovsky). Location of gas-filling complexes along this road will allow to implement looping route and to connect the two mentioned above corridors.

It will give the chance to car-owners to travel on the main motor-roads of five Far Eastern constituent entities (the Sakha Republic, the Amur region, the Jewish autonomous national area, Primorski and Khabarovski krai).

It is proposed to place a fourth transport corridor on the route Mirny – Nyurba – Vilyuisk – Yakutsk connecting the two main routes of the Sakha Republic and two biggest cities of the republic.

Organization of a fifth transport corridor on the route “Kolyma” will allow to provide communications between the Sakha Republic and the Magadan Region, where in future the “North transport corridor” Ust Kut – Mirny – Yakutsk – Magadan will be formed. Construction of gas-filling complexes along this route will allow to connect six Far Eastern constituent entities.

It is possible to organize a sixth transport corridor in the Sakhalin Region; it will go through the big industrial cities of Yuzhno-Sakhalinsk, Poronaysk, Uglegorsk, etc.
In the long view Far Eastern gas-transport corridors should be connected with the similar Siberian routes (Fig. 3). Organization of gas-filling stations network along the route Mirny - Lensk – Ust Kut – Bratsk – Taishet – Krasnoyarsk – Kemerovo appears the most feasible option. Several VGFCS already operate in Kemerovo and make part of gas-filling stations network connecting Kemerovo, Novosibirsk, Tomsk, Barnaul, and Omsk.

To meet the stated targets it is necessary to concurrently and holistically develop gas-vehicle integrated infrastructure, inclusive of vehicle gas-filling compressor stations (VGFCS) network, gas-filling stations using liquefied natural gas (LNG) for compressed natural gas production (VLNGFS), vehicle re-equipment and technical support centers, bottles re-inspection points, service structures, driver and personnel training organization, etc.

In the regions where they plan to develop pipeline gas supply network it is possible to build VGFCS. In the regions where gas pipelines construction is not planned and consumers are very far from gas-supply source it is possible to place VLNGFS.

Now available technology solutions and advanced equipment provide for location of vehicle gas-supply station as much close to consumer as possible. To reach this goal it is proposed together with transport “blue” corridors along Federal and regional routes to establish gas-filling “chains” of local importance to ensure supply of the network “house – settlement – enterprise - route”, to which chains in particular may belong mobile gas-filling trucks for compressed and liquefied gas refueling, cluster and individual mini-VGFCS located directly near consumer will be applied.

Prospects mentioned above seem like utopia, but they are real and feasible. For realization of the presented plans JSC Gazprom promgaz is working out General schemes of gas supply and distribution of RF constituent entities, forming concrete decisions on location of gas-filling network facilities, realizing projects of switching regional vehicle fleets to gas-motor fuel. At this stage accounting for the operated regional vehicle fleets, traffic and its’ intensity, available resource base, etc., they define prospects of constructing new gas-filling complexes (multi-fuel ones among them), of renovating operated gas-filling complexes, determine such facilities break-even operation conditions and quantity of vehicles convertible to gas.

For such activities JSC Gazprom promgaz created database reflecting vehicles and agricultural equipment availability in every Siberian and Far Eastern constituent entity and developed proposals on their switching to natural gas.

Total amount of vehicles in Eastern Siberia and Far East exceeds 2 mln. units. It is proposed to switch to natural gas 100-150 ths. vehicles, which involves construction of 55 VGFCS and VLNGFS. Annual gas sales are expected in the range of 400-450 mln. m³.
At planning natural gas-motor fuel market development it should be considered that in Siberian and Far Eastern regions infrastructure of liquefied natural gas supply to population and vehicles is already formed. There are 195 VGFS in these regions, about 62 ths. tons of gas is annually sold (Fig. 4).

Development of VGFCs network in these regions should be balanced with VGFS development taking into consideration resource base and capabilities of every specific region.

Gas-motor complex development in the railway, water and air transport sector

Development of gas-powered locomotives in our country started in the end of 1980-ties. Hereafter these activities were stopped. In 2004 JSC Russian railways, JSC Gazprom and the Sverdlovsk Region government signed joint programme of developing and testing trunk and pusher gas-powered locomotives at the Sverdlovsk railway division.

The programme presupposes development of test samples of gas-powered trunk and pusher locomotives and infrastructure of natural gas supply.

Implemented preliminary feasibility study shows that JSC Russian railways’ expenditure on re-equipment of locomotives and engine-house facilities will pay back in 7 years (for trunk gas-powered locomotives) and in 6 years (for pusher gas-powered locomotives). At certain railway routes pay-back time could be substantially shorter.

Cost-effectiveness of gas-powered locomotives application is ensured by decrease in fuel and engine oil outlays and environment pollution penalties.

In Eastern Siberia and Far East operate five divisions of JSC Russian railways: Krasnoyarsk, East-Siberia, Far-East and Sakhalin railways totaling 17 ths. km in length.

Considering the railways length and traffic flow, use of gas as motor fuel here seems very promising.

In future it is essential to return to activities performed in the Soviet Union on switching of sea, river and air transport to gas-motor fuel. For Eastern Siberia and Far East these transports are no less important than railway and motor transport. It is necessary using available experience of such switching to re-apply and develop existing designs.

As far back as in 1980-ies in the Tupolev design engineering bureau the first in the world aircraft - flying laboratory TU-155 fuelled by liquefied natural gas was created. TU-155 aircraft passed multiple complex tests, established 14 world records, made trans-border flight Moscow – Bratislava – Nice, Moscow – Hanover.
Conclusions

Gas-motor complex development in the eastern regions of Russia is one of the priority tasks of gas supply and distribution development in these regions.

Switching from liquid motor fuels to natural gas provides for decreased budget outlays on motor fuels, for creation of economic, organizational and legal basis ensuring maximal efficiency of financial resources use when switching transport to gas-motor fuel, for economic incentives to produce, sale and utilize natural gas motor fuel, for substantial improvement of regional ecological situation.

Wide-scale development of transport gas-filling stations network requires for a range of measures to be developed, including issuance of norms and ecological requirements to motor vehicles (and, in particular, revision of penalties for GMF vehicle pollutant emissions), state support and stimulation of GMF vehicles use, keeping potential consumers, producers and regulators aware of opportunities to convert vehicles to GMF, organization of vehicles gas-filling stations network of both VGFCs and filling stations using liquefied natural gas (LNG) for compressed natural gas production (VLNGFS).

In the perspective it is planned to extend gas-motor complex by including facilities fuelled by hydrogen, bio-diesel, dimethyl ether, etc. as are now well underway.