Russian NGV market development

Vasily Zinin
<table>
<thead>
<tr>
<th>Fuel Technology</th>
<th>Drivers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased efficiency of the engine and transition to Euro-6</td>
<td>High oil prices, Limited oil resources</td>
</tr>
<tr>
<td>CNG and LNG</td>
<td>Ecology, Accessibility, Technology replication</td>
</tr>
<tr>
<td>Hydrogen</td>
<td></td>
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<tr>
<td>E-vehicles</td>
<td></td>
</tr>
<tr>
<td>Biofuel</td>
<td></td>
</tr>
</tbody>
</table>
CARBON FOOTPRINT IN THE PRODUCTION OF MOTOR FUELS

**Clean Natural Gas (CNG)**

- **Upstream:**
  - Production: 0.01 t
  - Transportation: 0.202 t
  - Total: 0.24 t/toe

- **Downstream:**
  - CNG FS: 0.03 t

**Gasoline**

- **Production:**
  - 0.96 t/toe

- **Processing (gasoline):**
  - 0.0006 t

- **Transportation (gas pipes, rail transport):**
  - 0.0002 t

- **Total:**
  - 0.96 t/toe

**Greenhouse gas emissions by the production of gasoline 4 times more, than for the life-cycle of CNG**
AIR POLLUTANT EMISSIONS FROM VARIOUS FORMS OF TRANSPORT

CO2 emissions
(Volkswagen Golf with variable speed drives as an example)

- Gasoline engine: 167 g/km
- Hybrid engine: 146 g/km
- Gas engine (propane-butane): 136 g/km
- Gas engine (methane): 127 g/km
- Electric motor: 88 g/km
- Fuel cells (Hydrogen from water by Electrolyze): 276 g/km
- Fuel cells (Hydrogen from natural gas): 110 g/km

* The problem of accumulators utilization

Source: Volkswagen Group

TRUCKS

BUSES

Source: the Flemish Institute of Technological Research

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NATURAL GAS ROLE IN LOW CARBON DEVELOPMENT

NATURAL GAS – BASIC ELEMENT OF TRANSITION PERIOD TO LOW CARBON DEVELOPMENT

METHANE-HYDROGEN MIXTURE

MHM

«0» emissions

CO₂, NOₓ, CO

SO₂, PM

Further decrease

EXISTING GAS POWER GENERATION INFRASTRUCTURE AND EQUIPMENT UTILIZATION (with less constructive changes)

- Fuel gas for power generation units
- Gas for transport (fuel)

Hydrogen production from methane with zero CO₂ emissions

Cheaper and more efficient than electrolysis

CARBON (valuable material)

Natural gas increases efficiency of hydrogen technology

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There are pricing incentives for consumers and producers to enter Russian NGV market.
REQUIREMENTS FOR GAS FILLING INFRASTRUCTURE IN THE RUSSIAN FEDERATION

Infrastructure Development Models:

- Network – to solve the problem of covering areas (city, region) when access to refueling for any customer
- Trunk – to solve the problem of covering the main highways
- Point – to create infrastructure for client’s needs within a specific asset (depot, port, quarry, etc.)

Expected additional investments in creating minimum infrastructure: 3,4 BLN USD

<table>
<thead>
<tr>
<th>Market segment</th>
<th>Type of fuel</th>
<th>Model of infrastructure development</th>
<th>Number of fueling stations required</th>
<th>Expected additional investments in creating minimum infrastructure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passenger vehicle</td>
<td>LNG</td>
<td>LNG</td>
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<td>724,000,000,000 USD</td>
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<td>Agriculture vehicle</td>
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<tr>
<td>Municipal fleet</td>
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<td>23,000,000 USD</td>
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<tr>
<td>Special vehicle</td>
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<tr>
<td>Quarry vehicle</td>
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<tr>
<td>Regional freight operations</td>
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<td>41,000,000 USD</td>
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<tr>
<td>Taxi</td>
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<td></td>
<td>41,000,000 USD</td>
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<tr>
<td>Inland water transport</td>
<td>CNG</td>
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<td></td>
<td>41,000,000 USD</td>
</tr>
<tr>
<td>Outland water transport</td>
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<tr>
<td>Railway transport</td>
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<tr>
<td>Aviation</td>
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<td>CNG</td>
<td></td>
<td>41,000,000 USD</td>
</tr>
</tbody>
</table>
REGIONAL PRIORITIES FOR NGV MARKET DEVELOPMENT

MOST ACTIVE REGIONS
1. Krasnodar Region
2. Volgograd Region
3. Saint Petersburg
4. Saint Petersburg Region
5. Moscow
6. Moscow Region
7. Samara Region
8. Nizhny Novgorod Region
9. Bashkortostan
10. Omsk Region
11. Tomsk Region
12. Novosibirsk Region
13. Altay Region
14. Perm Region
15. Sverdlovsk Region

PILOT REGIONS
1. Rostow region
2. Belgorod region

HIGHWAY PROJECTS
1. M-10 «Russia»
2. M-11 «Moscow – Saint Petersburg»
3. M-4 «Don»
4. M-1 «Belarus»
5. M-7 «Volga»
6. MTM «Europe – Western China»

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CURRENT PRODUCTION AND DISTRIBUTION INFRASTRUCTURE OF GAZPROM GAS-ENGINE FUEL

Gas-filling stations in Russia

405 → 294 (73%)

Assets owned by Gazprom PJSC

CNG NETWORK

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ENGINE FUEL MARKET IN RUSSIA

2018 Consumption of motor fuels by vehicles in Russia*, %

- Gas 47.3%
- Diesel 2.1%
- LPG 0.7%
- CNG 49.9%

- Light motor vehicles – 29.9 million tons (46.7%)
- Trucks and specialized vehicles – 21.6 million tons (33.7%)
- Light commercial vehicles – 9.3 million tons of fuel (14.5%)
- Buses – 3.1 million tons (4.8%)
- Motorcycles – 0.1 million tons (0.3%)

Transport segments working on compressed natural gas:
- light motor vehicles;
- commercial transport;
- light-duty trucks;
- municipal vehicles.

Transport segments working on liquefied natural gas:
- long-distance haul motor transport;
- railway transport;
- water transport;
- quarry vehicles;
- agricultural vehicles

* According to Avtostat analytical agency
In order to achieve the self-sustainability effect at the gas-engine fuel market the annual gas-engine fuel vehicles fleet growth should be 50,000 units.
GOVERNMENTAL PROGRAM FOR NGV MARKET DEVELOPMENT

INCREASE IN SUBSIDIES

- 3.5 BILLION RUB. in 2019
- 10 BILLION RUB. in 2020
- 10 BILLION RUB. in 2021
- 10 BILLION RUB. in 2022
- 10 BILLION RUB. in 2023
- 10 BILLION RUB. in 2024

- 50 Mn USD in 2019
- 150 Mn USD in 2020
- 150 Mn USD in 2021
- 150 Mn USD in 2022
- 150 Mn USD in 2023
- 150 Mn USD in 2024

- 20-25 Regions are to be chosen

- 30% of CAPEX for filling stations
- 30% of Retrofit cost

- Rule-making
- Standardization
- Popularization
- Expertise
- Communication
- Monitoring

2019 - 2024

30% of CAPEX for filling stations
30% of Retrofit cost

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Thank you for your attention!

Natural Gas Vehicles Association

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