Overall in 2015, Russian Railways commissioned:

- 163.5 km of new and secondary tracks,
- 45.8 km of electrification,
- 157.7 km of station track;

and rebuilt:

- 129 electric interlocking switch units,
- 50.8 km of the automatic blocking system,
- 280.5 km of centralised traffic control,
- 640.4 km of long-distance cable communication lines,
- 288.1 km of the contact network,
- 2,814 km of railway tracks.

Modernisation and innovative development projects

The Company spent a total of RUB 1.3 bln on scientific and technological development in 2015, an 18% increase versus the amount spent in 2014.

New technologies

In accordance with Order of the Russian Government dated August 2014, the Company has established the Comprehensive Innovative Development Programme of the Russian Railways Group until 2020 under which a wide range of innovations is planned: technological, product, process, organisational and marketing innovations. The Programme consists of a new format of measures and projects that aim to introduce breakthrough innovative technologies and technical equipment based on the requirements of the Company's customer-focused business processes.

As part of the Programme's development, the Scientific and Technical Development Strategy until 2020 and Beyond until 2025 (the 'White Book'), which is an integral component of the Programme, was updated taking into account engineering, technological and economic challenges. The Strategy underwent a comprehensive discussion by the scientific community and was approved by Russian Academy of Sciences President Vladimir Fortov.

One breakthrough project that incorporates a number of innovative solutions by Russian and foreign developers was the Ust-Luga Transport Hub. The station was the first in Russia to introduce an automated control system for a driver-less hump locomotives. The promising set of automated control systems set up for the transport hub allows for using the building-block approach to configure the hardware of a marshalling yard, maximise automation and drastically reduce the use of manual labour, and cut costs on all components of the station's production process. Utilising such approaches should become the basis for the design and modernisation of marshalling yards throughout the entire railway network of the Russian Federation for the period until 2025.

Import substitution

The Company has approved and is implementing an Import Substitution Programme for the products it purchases.

The share of purchases of import-containing materials and equipment decreased 4% in 2015.

Challenging issues with respect to import substitution are being resolved in informatisation. The main problem is the lack of Russian-made products on the market of digital IT products and operating systems. Together with developers and manufacturers, the Company is implementing an import substitution plan for software. Traffic control and safety systems are transitioning to open source software using domestic components.

Components were tested using Milandr controllers and will be used in 2016 to manufacture prototypes for locomotive safety systems and automatic blocking systems.

Innovations in infrastructure

One of the key areas of the Company's scientific and technological policy is the introduction of innovations in infrastructure, where expenses on shipping activities make up approximately 35% of the total volume. A key priority is to reduce the cost of the life cycle of facilities while ensuring the safety of the transportation process and a high level of reliability of technical equipment.

New physical principles were employed in the reporting year when developing the interval traffic control system using a fibre-optic vibro-acoustic monitoring system and data transmission via a digital radio channel. The project is being introduced in the Moscow Railway operating domain. While a similar development is being implemented in Germany, the solutions developed by Russian Railways have fundamental differences: whereas in Germany the fibre-optic cable is used as a rolling stock location sensor, in the Russian design this function is integrated into the microprocessor interval control system through the use of digital radio communications. Compared with modern systems, the cost of equipping a section with this automatic blocking system is more than 75% cheaper.

The operating domains of the North Caucasus and West Siberian Railways conducted a set of tests to assess whether they could handle coupled trains weighing 12,600 and 14,200 tonnes.

As a result of pull and energy efficiency tests and an assessment of track impact parameters, such technology was introduced for trains weighing 12,600 tonnes starting from 1 July 2016 and was actively used during possessions on the Zabaykalsk and West Siberian Railways.

In September 2015, West Siberian Railway carried out pilot runs with coupled trains weighing 14,200 tonnes for the first time in the practice of Russian Railways. As part of the testing, mathematical modelling methods and an analysis of traffic safety criteria for freight trains with increased weight and length were carried out. The testing results and mathematical modelling results had a high degree of convergence.

On the Baikal-Amur Mainline, positive results were seen in the operation of a multi-functional mobile laboratory that was set up on the core of the 2TE116 diesel locomotive. The number of third- and fourth-degree faults detected increased 50%, while operation costs decreased 50% compared with a track recording car.

Operating domain technology to organise freight train traffic on fixed optimal energy schedules was further developed in 2015.

The Elbrus hardware system was introduced to the operating domains of eleven railways from Vladivostok to St Petersburg.

On the Kuzbass-Northwest route alone, the use of this technology made it possible to save more than 380 mln kWh in 2015, while freight delivery speed was 13% higher in December 2015 than it was in December 2014.

An operational train handling reconfiguration system was put into permanent operation on the operating domain of South Urals Railway. Updated train traffic schedules are transferred in real time to locomotives equipped with systems to inform drivers.

An analysis of the development prospects for diagnostic tools revealed the need for the full automation of the control and monitoring process of infrastructure facilities by equipping rolling stock with comprehensive diagnostics systems and shifting away from a fleet of infrastructure diagnostic railcars. Together with Siemens, the Company established the world's first innovative on-board diagnostic system that was installed on the high-speed Sapsan train and since June 2015 has been evaluating the infrastructure of the St Petersburg-Moscow line according to 76 parameters at speeds of up to 250 km/h.

On the path to change

Valentin Gapanovich
Senior Vice President of Russian Railways

One of the breakthrough projects of recent years that has incorporated a number of innovative solutions from domestic and foreign designers was the marshalling system at the Luzhskaya station, marking the first time that Russia has introduced an automated control system for shunting locomotives and integrated minimally manned technology in all sectors, which made it possible to increase labour productivity 21% compared with the traditional gravity hump technologies.

The technological solutions that were applied when designing and building the Luzhskaya marshalling yard will serve as the foundation for the modernisation of other marshalling yards in Russia in the future.

Operating domain technology was further developed to organise freight train traffic on fixed optimal energy schedules in 2015. On the Kuzbass-Northwest route alone, the use of this technology made it possible to save more than 380 mln kWh in 2015, while freight delivery speed was 13% higher in December 2015 than it was in December 2014.

Based on materials from the final meeting of the Russian Railways Management Board

Work with small- and medium-sized enterprises

The Company utilises a range of measures to encourage new suppliers to participate in procurements, including small- and medium-sized enterprises (MSE), and also to assess the level and potential effectiveness of the high-tech products that are offered.

In order to further expand interaction with MSE in matters of innovative development, the Company established the 'MSE One-Stop Shop' system to increase purchases of innovative and high-tech products from MSE in the overall annual volume of procurements.

A pilot system in its early stages allows for the initial classification of offers received, the compilation of a register and the subsequent processing of the offers. A data entry form is available for external users to help them negotiate the registration procedure in addition to a form to collect information about the offer.

The next stages of the system's development will provide the ability to classify the relevant innovative and high-tech features in the proposed product when the user submits an application.

Energy efficiency

Russian Railways remains a leader among global railway companies in terms of the energy efficiency and eco-friendliness of freight and passenger transportation.

Given the challenging economic conditions of 2015, effective cost-cutting tools included improvements to the management system for the Company's energy conservation activities, including measures under the Energy Conservation Programme and the increased energy efficiency of Russian Railways, as well as planning and monitoring the fulfilment of target indicators in energy conservation within the Energy Efficiency Automated Information System.

As a result of the Russian Railways Energy Conservation Programme in 2015, 41 of the Company's branches achieved savings of 9.36 PJ valued at RUB 4.932 bln and reduced greenhouse gas emissions in the amount of 904,400 tonnes of CO_2 equivalent, which is the best result seen in the Company's energy conservation activities over the last six years.

With freight transportation decreasing 1.0% versus the 2014 level, Russian Railways reduced its absolute energy consumption level by almost 3.4%.

Specific electricity consumption for train traction declined 1.2% in 2015, while diesel fuel consumption fell 2.0%.

With the targets for the reduction in the energy intensity of industrial activities set at no less than 1.1% by the Russian Federal Tariffs Service for Russian Railways in 2015, the Company actually decreased the energy intensity of its industrial activities by 1.3%.