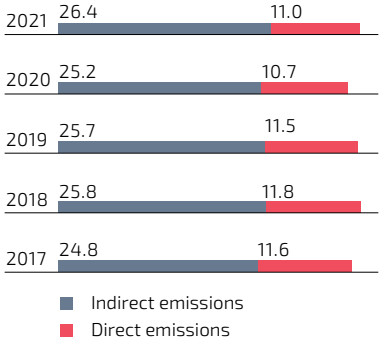
GHG emissions

GRI 305–1, 305–2, 305–5

The dynamics of GHG emissions depend first of all on transportation growth and corresponding increase in the consumption of fuel and energy resources for train traction. However, the growth in transportation has helped Russian Railways reduce its total GHG emissions by 45% to 37.4 mt of CO2 emissions vs 1990 with comparable traffic volumes. This means that the Company achieved its target to reduce the national GHG emissions to 25% compared to 1990 in pursuance of Presidential Executive Order No. 752 On the Reduction of Greenhouse Gas Emissions Volumes dated 30 September 2013

Direct and indirect energy-related emissions | mt of CO_2

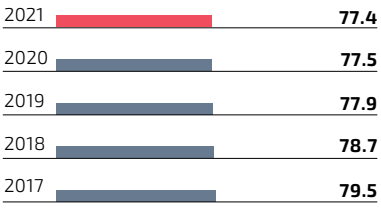


Indirect energy-related emissions make up more than half of the aggregate emissions in terms of mass. In 2021, their share reached 71% on the back of exponential growth in electric-driven transportation compared to that driven by diesel, and gradual increase in the percentage of electricity in the Company's energy mix.

GRI 305–4

GHG emissions per transportation volumes

| kg of CO_2 equivalent. / 10 thousand gross tkm



The parameter of Russian Railways' carbon intensity is a specific indicator of total direct and indirect energy emissions of greenhouse gases per unit of work performed (gross tonne-kilometre), and it was on a downward trend in 2015–2021. This indicator most accurately reflects the Company's efforts related to low-carbon development, as it does not depend on the volume of services provided.

In 2015–2021, Russian Railways decreased its carbon intensity by 8.8% to 774. kg of CO2 equivalent / 10 thousand gross virtual tkm. This is currently one of the lowest levels of GHG emissions per unit of work among the world's largest railway companies. This is mostly driven by a high degree of electrification of Russian Railways' infrastructure, with more than 51% of the total operating length of railways electrified. At the same time, the positive trend in carbon intensity reflects the effect of measures to save energy, increase energy efficiency, and change the energy mix.

The achieved reduction in carbon intensity of Russian Railways' services primarily rests on activities implemented under the Company's Energy Savings and Energy Efficiency Programme. The following two areas made the most significant contribution:

- enhancing controls and traffic control technologies;
- optimisation of operation patterns and upgrade of heating systems in stationary power generation.

Target: achieve carbon neutrality by 2050

Other important contributors were efforts to improve energy efficiency and the performance of locomotives; higher energy efficiency of processes and infrastructure facilities; and higher level of energy recovery on electric traction.

Electrification of railway infrastructure reduced the volume of diesel-powered operations on a number of railways.

In addition, we implemented several renewable energy projects:
- hot water supply systems based on solar collectors were introduced with the elimination of electric water heaters within the boundaries of the Kuibyshevskaya and Krasnoyarsk railways;
- geothermal and air-to-air heat pumps were introduced for heating and air conditioning to replace liquidated low-power coal-fired boilers in a number of units of the Privolzhskaya, North Caucasus, Kuibyshevskaya, Kaliningrad and South Eastern railways;
- a pilot 30.7 kW solar power plant was built at the Svetlograd railway station (North Caucasus Railway).

While these projects do not yet have a significant impact on the overall energy consumption mix and carbon intensity indicators, they are very promising in terms of testing the use of renewable energy technologies and potential contribution to the Company's low-carbon development going forward.

Plans to promote the use of low-carbon energy sources include:
- expanding the operating domain of electrified lines
  - electrification of existing non-electrified road sections and construction of a new electrified railway line
- promoting the use of natural gas and other alternative fuels as a motor fuel
  - promoting the use of natural gas and liquefied natural gas, including expanding the use of gas powered locomotives (gas turbine locomotives, gas powered diesel locomotives used in shunting operations)
  - creating experimental trains and locomotives using hydrogen fuel cells
  - creating traction rolling stock with hybrid power plants using Russian-made lithium-ion batteries
- promoting the use of natural gas and other alternative fuels in stationary power generation
  - developing the Company's own power generation based on renewable energy sources (solar and wind power plants)
  - using renewable energy sources in heat supply and hot water supply systems (heat pumps, solar collectors), generation of thermal energy using waste from old wooden sleepers).

Cogeneration plant using old wooden sleepers as fuel

The Chernyakhovsk railway station of the Kaliningrad Railway operates a mobile cogeneration unit for heat supply to production facilities. The unit uses hard fuel from old wooden sleepers. This way the unit generates inexpensive and green heat energy.

The cogeneration unit utilises the technology of fuel gasification with subsequent firing of the resulting gases.

The technology makes the content of harmful substances in a sanitary protected zone with a radius of up to 50 metres 6–10 times lower than usual.

This solution also improves the environmental safety of railway facilities due to:
- liquidation of the inventory of old wooden sleepers unsuitable for re-laying,
- cutting the cost of heat generation for the Company's railway facilities.

Effect:
- liquidation of more than 35,000 old wooden sleepers per year,
- economic effect of more than RUB 16 m a year.