

# INNOVATIONS

## 2018 milestones



Nornickel is the only Russian company on Forbes' Top 100 Most Innovative Companies list.

Nornickel won the 16th National IT Leader Award 2018 in the Non-Ferrous Metallurgy category for introducing personnel and machinery positioning and radiocommunications systems at Zapolyarny Mine.

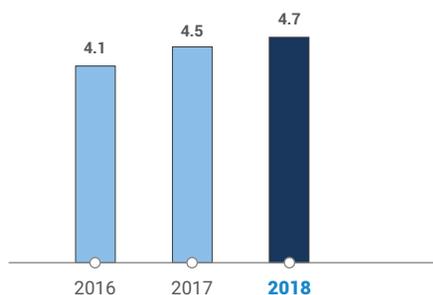


## RESEARCH AND DEVELOPMENT

R&D plays a key role in implementing Nornickel's strategic priorities such as reducing the environmental impact, improving production efficiency and setting stage for the Company's sustainable development in medium and long run. Nornickel's main R&D facility is Gipronickel Institute. Part of the Norilsk Nickel Group, it is also one of Russia's largest

research and engineering hubs for mining, concentration, metallurgy and processing of minerals that provides a wide range of research and technology services. In 2018, Nornickel's R&D activities mainly focused on research, technological development, and feasibility studies under the Company's updated strategic plan.

## R&D and feasibility studies financing<sup>1</sup> (USD mln)



<sup>1</sup> Excluding financing of key investing project.

## DIGITALISATION

Nornickel is actively embracing and applying information and digital technologies to streamline production processes. Since 2018, a digital laboratory within the Company's IT department is working on several dozen promising projects. Technologies introduced in 2018 include the digital vision to monitor short-circuiting of the cathode and anode in the tankhouse, digital twin to optimise the delivery of copper matte from smelting furnaces to converters, ore contaminant identifier to prevent foreign objects from getting into the concentrators' crushing machines, and the automated management system

at Bystrinky GOK to control and collect online all the information on the underground mining equipment – from fuel consumption to cargo carried.

In 2015, the Company launched the Technology Breakthrough initiative to automate and digitalise most of key processes at its mining and processing facilities by 2020.

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### Artificial intelligence and computer vision

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### Industrial exoskeleton trials

Despite a high level of automation, processes at mining and metals facilities are still very labour-intensive.

The exoskeleton can reduce load and improve safety. To experiment with the new technology, Polar Division ran a competition among its employees, inviting them to think of ways they could use the industrial exoskeleton at work. The proposed applications included scrap metal sorting and removal of cathode deposit build-up at the third recovery stage. The winners were the first in the history of Norilsk to test digital technology and take part in exoskeleton trials at the South-West State University in Kursk in March 2019.

### Mine automation system

Nornickel installed personnel and machinery positioning and radiocommunications systems at Zapolyarny Mine. The automation system scans individual tags assigned to the employees and self-propelled machinery and maintains wireless connection with each employee via their personal phones. It also features an anti-collision technology informing the driver of getting close to the deployed staff or equipment. The staff or equipment location data is continuously transmitted to the control room ensuring real-time coordination of actions in case of emergencies.