

Innovative development

Innovative Development Program and its implementation ^[103-2]

The Innovative Development Program of RusHydro Group for 2016–2020 with a Prospect up to 2025¹ sets out the focus and framework of the Group's innovations and specifies the amounts and sources of funds to be spent on its innovative projects.

In the medium term, it aims to improve RusHydro Group's economic and operational efficiency by using innovative engineering, technical and management solutions focused on:

- extending lifespans and improving performance of equipment;
- enhancing reliability and economic efficiency of equipment;
- improving the quality of equipment diagnoses coupled with proactive identification and mitigation of operational risks;

- import substitution and reducing the dependence on imported equipment;
- reducing the environmental footprint;
- improving energy efficiency and cutting losses.

In the long term, the Innovative Development Program of RusHydro Group aims to:

- Assure the Company's position as one of the most technologically advanced energy companies, both domestic and international, via:

- development of efficient construction, modernization and repair processes for power generation facilities;
- development of real-time monitoring technologies for the core equipment;
- automation and robotization of maintenance and repair; and
- development of new innovative products based on RusHydro's know-how and expertise (e.g. energy efficiency and storage solutions, EV infrastructure, and advanced materials).

KPI for the Innovative Development Program of RusHydro Group

KPI	Target		Progress	
	2019	2020	2019	Delivered or not
R&D expenses, % of revenue	0.25	0.25	0.26	Achieved
Growth in the quantity of IP assets on the balance sheet, %	6.5	7	6.25	Delivered ²
Efficiency of hydropower capacity management, employees per 100 MW	20.36	20.13	21.14	Delivered ³
Innovative products purchased, % of total volume	1.33	1.46	0.69	Not achieved
HPP repair expenses, '000 RUB/MW (at 2000 prices)	19.8	19.6	17.58	Achieved

¹ Approved by RusHydro's Board of Directors (Minutes No. 244 dated November 23, 2016).

² Growth of 6.5% y-o-y means that in 2019 in absolute values 17.04 IP assets were to be created and booked on the balance sheet. The actual value of the IP assets created and put on the balance sheet amounted to 17 assets, so this indicator is deemed fulfilled.

³ Having regard to the fact that the approved calculation and evaluation methodology for this KPI was meant to cover the headcount involved in core operations (i.e. HPP operation). However, the Group's operations in the Far East were later reorganized, with RAO ES East transferring many of its regional management functions in charge of heat generation facilities and grids to RusHydro. As a result, RusHydro is now overstaffed with those employees who are not involved in HPP operation. Excluding such staff, this KPI may be deemed delivered. The 2019 report on progress against the Innovative Development Program deems this KPI as delivered.

- Ensure deeper engagement in green energy via:
 - development of hydropower potential in certain regions of Russia;
 - development of RES-based alternative energy infrastructure (geothermal power generation);
 - analysis and development of mini-hydro solutions.

In 2019, as resolved by the Government Commission for Economic Modernization and Innovative Development of Russia¹,

RusHydro Group updated its Innovative Development Program for 2020-2024 with a prospect up to 2029 (the Updated Innovative Development Program of RusHydro Group).

The Updated Innovative Development Program of RusHydro Group results from benchmarking of RusHydro's technological capabilities and innovation KPIs vs global peers² and factors in follow-up proposals prepared and

approved by the Company's Board of Directors³.

On December 11, 2019, RusHydro Group duly submitted its Updated Innovative Development Program for review to the relevant federal executive authorities⁴. It obtained affirmative opinions from the Russian Ministry for the Development of the Russian Far East and Arctic and Ministry of Education and Science. Its review is slated for Q2 2020 by the Interdepartmental Commission

Key innovative projects in 2019

Description	Objective
Development of a hardware and software system for monitoring and predicting the reliability of HPP hydraulic structures in geologically challenging environments.	Test and implement a hardware and software system for safety and reliability monitoring of hydraulic structures at Zagorskaya PSPP and Zagorskaya PSPP-2.
Research into new processes to repair and restore hydraulic structures, extend their lifespans and enhance their reliability, and draft implementation guidelines.	Develop robust techniques for repair and restoration of hydraulic structures.
Development of recommendations on how to assess human impact in the tailrace on the condition of machinery and hydraulic structures and HPP energy efficiency;	Develop and justify an action plan to raise and stabilize the water levels in separate outlets for better performance of HPP turbine equipment.
Modernization of reinforced-concrete penstock encasements, including application of protective coatings.	Insulate penstocks with waterproofing coatings based on advanced materials, extend time between repairs and cut repair expenses.
Development of a gravity-type energy storage driven by solid loads for a solid-state storage power plant (SSPP), including prototypes of mechanic arms required for its construction.	Develop engineering solutions to construct an industrial SSPP and automate installation works.
Development of an automated warning system to detect ruptures and measure turbine flows at RusHydro's diversion and impoundment HPPs.	Enhance safe operations across HPPs.
Reliability analysis of gas turbine units and development of a database and guidelines to assess their health.	Develop a hardware and software system for remote monitoring of gas turbine units.

¹ Meeting minutes No. 2 of October 22, 2018.

² Conducted in line with the Russian Government's Directive No. 3262p-P13 dated April 27, 2018.

³ Minutes No. 294 of August 29, 2019.

⁴ Russia's Ministry of Economic Development, Ministry of Energy, Ministry for the Development of the Russian Far East and Arctic, Ministry of Education and Science.

for Technological Development under the Government Commission for Economic Modernization and Innovative Development of Russia (the Interdepartmental Commission). Once approved by the Interdepartmental Commission, the Updated Innovative Development Program will be reviewed and approved by the Company's Board of Directors in May 2020.

Based on benchmarking of RusHydro's technological capabilities vs global peers, new solutions coming into play and potential economic efficiency benefits, the Company identified the focus of its efforts while implementing the Innovative Development Program in the reporting period and also seeking to improve its global ranking.



Integrated innovative development management for RusHydro and RAO ES East Subgroup

The innovative development programs of RusHydro Group and RAO ES East have been aligned to contribute in the same way to the following components of RusHydro's integrated KPI for innovations:

- R&D expenses, % of revenue;
- growth in the quantity of IP assets on the balance sheet in the reporting period, %;
- heat efficiency, %.

In addition, RusHydro's Board of Directors reviews and approves the innovative development programs of RAO ES East as part of the Innovative Development Program of RusHydro Group.

The Updated Innovative Development Program of RusHydro Group now covers both RusHydro and RAO ES East, which helps align innovative development priorities across the Group's footprint and save resources previously required to develop, approve and monitor two separate programs.

Amounts spent on the Innovative Development Program, RUB mn¹

	2017	2018	2019
Total, including:	2,189.4	2,372.9	2,751.1
RusHydro (including funding by design institutions)	586.7	655.4	483.3
RAO ES East Subgroup	1,602.7	1,717.5	2,267.8

Program for Intellectual Property Rights Management

The Program for Intellectual Property Rights Management within RusHydro Group is a policy paper that determines key initiatives aiming to create favorable conditions for sustainable development of the Company and its subsidiaries while implementing the Innovative Development Program of RusHydro Group as well as to achieve integrated KPI targets

in innovations while fostering a framework for intellectual property rights management.

This Program assumes that intellectual property rights management is part of innovative development with a focus on:

- promoting and identifying creations of the human mind;
- providing legal protection of intellectual property rights;

- protecting exclusive intellectual property rights;
- commercializing intellectual property rights.

To this end, the Company and its subsidiaries successfully implemented a number of initiatives in 2019, with improvements covering:

- organizational structures;
- regulatory framework;

¹ The Innovative Development Program of RusHydro Group is funded solely with its own capital.

- contracting process;
- employee incentives (motivation) and professional development.

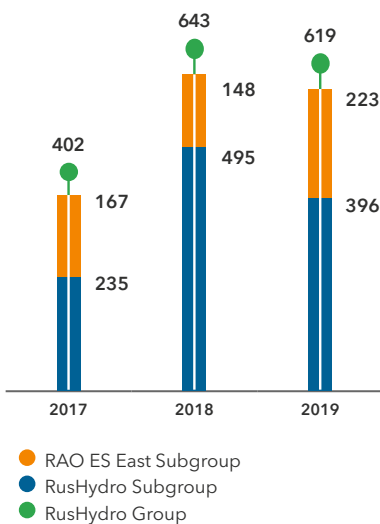
In accordance with the Russian Government’s directives and the resolution of the

R&D projects

RusHydro Group is committed to ramping up its R&D investments.

In 2019, R&D spending totaled RUB 618.8 mn¹.

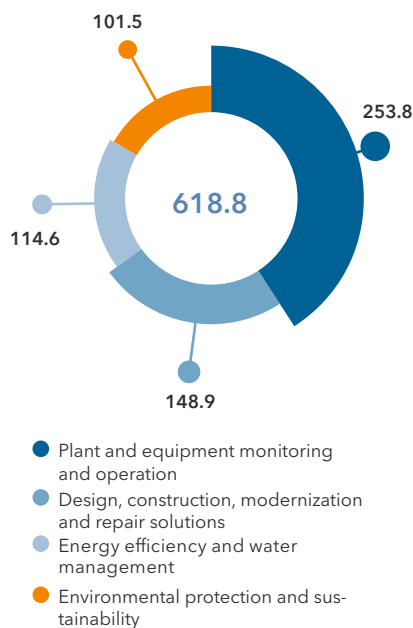
R&D spending, RUB mn (incl. VAT)



Company’s Board of Directors, detailed progress reports on the Program for Intellectual Property Rights Management within RusHydro Group are available on Rosimushchestvo’s interagency portal (<https://mvpt.rosim.ru/sitepages/enter.aspx>).

2019 R&Ds were aimed at addressing RusHydro Group’s most important (critical) technology issues related to preventing potential process upsets that may result in undersupply of electricity.

R&D spending by area in 2019, RUB mn (incl. VAT)



PJSC RusHydro's professional staff made the company a global energy market leader. At the heart of your activity lies a desire for continuous growth and improvement of the company, the Russian economy, and industry overall. This is a unique and well-deserved occasion for each of you because the success of your confident, driving movement forward depends solely on coordinated teamwork.

Andrey Murov,

First Deputy Director General – Executive Director of PJSC Rosseti

¹ Including VAT.

Key R&D projects implemented by RusHydro Group to ensure sustainable development

Description	Progress in 2019
<p>Development and implementation of a process to partially restore heat transfer surface elements of cogeneration heat exchange equipment (tubes) instead of replacing the entire tube bundle</p> <p>Objective: <ul style="list-style-type: none"> to develop and implement a process to partially restore heat transfer surface elements of cogeneration heat exchange equipment (tubes) instead of replacing the entire tube bundle and thereby improve its performance, which includes exploring the properties of a set of thermal conductive materials and developing a process and a commercial prototype for application of a protective coating to damaged elements (tubes) of a heat exchanger's tube bundle. </p> <p>Solution: <ul style="list-style-type: none"> to apply specialty epoxy coating (BLOKOR-MKK115). </p>	<p>Pilot testing (application of the protective coating and in situ tests) underway at Khabarovskaya CHPP-3. 2019 activities included: <ul style="list-style-type: none"> submitting patent applications; drafting proposals for its implementation and rollout at other power generation facilities. </p>
<p>Design of a composite power line conductor core based on thermoplastic resins</p> <p>Objectives: <ul style="list-style-type: none"> to achieve a 50% higher current-carrying capacity and reliability vs ACSR conductors without adding weight (resulting in savings on account of the increased quantities of transmitted power); to make overhead power lines and the entire grid more reliable by reducing the ice and wind load on pylons (resulting in extended conductor lifespans); 15% to 40% lower costs of building new crossings as fewer pylons will be required. </p> <p>Solution: <ul style="list-style-type: none"> to design a composite power line conductor core based on thermoplastic matrices along with manufacturing equipment. </p>	<p>In 2019, RusHydro developed and launched an experimental pultrusion machine and tested core prototypes.</p>

R&D effect on the Company's risks

Damage caused by natural and industrial disasters outside RusHydro Group's facilities is one of the key risks for the Company. This risk results from the underprotection of RusHydro Group's production assets against natural disasters.

The risk management initiatives provided for by the 2019 calendar plan include the following R&D projects:

- development and testing of a technology to monitor structural stress in case of a tensiometer failure;
- development of a hardware and software system for monitoring and predicting the reliability of HPP/PSPP hydraulic structures in geologically challenging environments;
- development of an automated warning system to detect ruptures and measure turbine flows at RusHydro's diversion and impoundment HPPs;

- development of recommendations on assessing the human impact on tailraces with regard to the HPP equipment, hydraulic structures and energy efficiency;
- research into new processes to repair and restore hydraulic structures, extend their lifespans and enhance their reliability, and draft implementation guidelines;
- introduction of an expert system to support decision-making in response to incidents, accidents and emergencies at RusHydro Group's production facilities.

Research and Design Complex

The Research and Design Complex is RusHydro Group's asset which renders services to high-tech industries in Russia and consists of the Design Complex and the R&D Complex.

RusHydro Group's Design Complex includes

JSC Lenhydroproject, JSC Hydroproject Institute, JSC Mosoblhydroproject and JSC KhETC which engage in:

- design of new hydropower generation facilities as well as rehabilitation and modernization of existing ones (as general designer);

- design of RES-based generation facilities;
- integrated design of water infrastructure providing for the construction of dams, impoundments, pump stations, diversion channels and penstocks, embankments, fish passing and protection

facilities, port and navigation facilities, including water infrastructure for nuclear power plants;

- integrated on-site and table-top design and survey works when assessing various project stages, including power generation, hydraulic structures and water infrastructure;
- development of detailed design documentation and project support at all life cycle stages;
- field supervision over the ongoing energy, hydraulic and water infrastructure projects;
- construction oversight at energy, hydraulic and water management infrastructure facilities;
- use of local and regional water resources, development of local strategies for power generation and water infrastructure construction;

- advanced training programs (postgraduate studies);
- comprehensive engineering services including testing, modernization, reconstruction, design and rehabilitation of power plants and heat supply networks at JSC DGK;
- development of new activities related to converting equipment at power plants to gas – a promising fuel for the development of the energy sector in the Far East.

The R&D Complex includes JSC Vedeneyev VNIIG, JSC KhETC (the Far Eastern Analytical Center) which engage in:

- research and development covering hydropower generation and the wider energy industry, industrial and civil construction, engineering protection, surveys,

materials, technologies, technical regulations, etc.;

- competencies of the Analytical Center for the Safety and Reliability of Hydraulic Structures and Core Equipment of Hydropower and Heat Generation Facilities (under the Chief Engineer);
- research support to hydraulic projects in the energy sector and beyond, development of related project documentation (instrumentation and controls, specifications, etc.);
- research and engineering support to construction projects and other life cycle stages;
- development of technical regulations;
- advanced training programs (postgraduate and doctoral studies), including in core and unique competencies (with no similar curriculum offered elsewhere).

Achievements of RusHydro Group's design institutions in 2019

Design institution	Project	Achievements
JSC Lenhydroproject	Nizhne-Bureyskaya HPP	Adjustments made to the Adjusted Nizhne-Bureyskaya HPP Project with Updated Cost Estimates for the Hydrotechnical Complex, Including the Water Reservoir, with Russia's State Expert Review Board issuing an affirmative opinion with regard to its design documentation and results of engineering surveys. Adjusted. Detailed design documentation developed to support completing construction and commissioning of Nizhne-Bureyskaya HPP.
	Chirkeyeskaya HPP	Affirmative opinion obtained from Russia's State Expert Review Board with regard to design documentation and results of engineering surveys, as well as validation of cost estimates for capital construction, modernization and renovation.
	Construction of two single-circuit 110 kV Pevek-Bilibino power lines	Adjustments made with Russia's State Expert Review Board issuing an affirmative opinion with regard to design documentation and results of engineering surveys, as well as validation of cost estimates for capital construction, modernization and renovation.
	Commissioning of the third hydropower unit at Ust-Srednekanskaya HPP	Detailed design documentation developed.
	Replacement of hydropower unit No. 5 at Votkinskaya HPP	
	Completion of Zaramagskaya HPP-1	

Design institution	Project	Achievements
Hydroproject Institute	Advanced water impounding project at the Volga-Akhtuba Floodplain	Design documentation is being developed to construct a waterway, an HPP and a water reservoir with two dams.
	Construction of engineering protection facilities in Nizhneudinsk and Tulun	Design documentation is being developed to construct flood control facilities on Iya and Uda rivers as part of Irkutsk Region's Environmental Protection Program for 2019-2024.
	Design of coastal hydraulic structures and a process water supply system for Kudankulam NPP, India	Design documentation is being developed to construct coastal hydraulic structures and a process water supply system for units 1 to 6 at Kudankulam NPP and field supervision is ongoing at units 3&4.
	Design of external hydraulic structures for El Dabaa NPP, Egypt	Mathematical model of water intakes and disposals is being developed to project sediment movements in the headrace and retention basin, avoid recirculation of cooling water between water disposals and intakes and assess environmental effects. Detailed design documentation is being developed for external hydraulic structures. Engineering support to the overseas project owner with a view to obtaining an affirmative opinion and building permit from local authorities. Pressure meter tests running on rock ground.
	Paks-2 NPP, Hungary	Design and survey works underway to expand and deepen the existing headrace and water intakes, the bridgework and conjugation structures and to construct pump stations, an open tailrace and a water discharge facility at Paks-2 NPP.
	Zagorskaya PSPP and Zagorskaya PSPP-2	Design and survey works underway on the headwater pond dam, intake channel and penstocks at Zagorskaya PSPP. Works underway to upgrade the automated diagnostic control system. Detailed design documentation is being developed, with geotechnical control in place and works underway to level the station node building at Zagorskaya PSPP-2.
	Arctic LNG-2	Design documentation is being developed to construct a plant to process liquefied natural gas (LNG) and stable gas condensate (SGS), including storage facilities, the Utrenny shipping terminal, supporting coastal infrastructure and port facilities.
	Detailed design documentation for Bokang-Baling HPP, India	Detailed design documentation is being developed in cooperation with India-based SAI.
Mosoblhydroproject	Comprehensive rehabilitation and modernization of the Cascade of Kubanskiye HPPs	Affirmative opinions obtained from Russia's State Expert Review Board with regard to design documentation and results of engineering surveys covering some of Mosoblhydroproject's facilities and structures. Detailed design documentation is being developed for PSPP and Sengileevskaya HPP.
	Krasnogorskaya SHPP-1 (Krasnogorskaya SHPP): new construction	Affirmative opinion obtained from Russia's State Expert Review Board with regard to design documentation. Detailed design documentation is being developed and field supervision is ongoing.
	Krasnogorskaya SHPP-2 (Pravokubanskaya SHPP): new construction	Affirmative opinion obtained from Russia's State Expert Review Board with regard to design documentation. Detailed design documentation is being developed and field supervision is ongoing.
	Adygeyskaya WPP	Affirmative opinion obtained from Russia's State Expert Review Board with regard to design documentation. Detailed design documentation is being developed and field supervision is ongoing.

Design institution	Project	Achievements
KhETC	Vladivostokskaya CHPP-2	The power supply system upgraded at the onshore pump station of Vladivostokskaya CHPP-2. Affirmative opinion obtained from Russia's State Expert Review Board with regard to design documentation and results of engineering surveys. Adjustments made to design and cost estimates with Russia's State Expert Review Board issuing an affirmative opinion with regard to the Rehabilitation Project for the Heat Supply Network between Vladivostokskaya CHPP-2 and the Heat Pipeline to Patroclus in Vladivostok.
	Anadyrskaya CHPP-2	Adjustments made to design and cost estimates for the Gasification Project at Anadyrskaya CHPP.
	Khabarovskaya CHPP-1	Affirmative opinion obtained from Russia's State Expert Review Board with regard to design documentation and results of engineering surveys for the Cooling Tower Upgrade Project at Khabarovskaya CHPP-1 (Innovative Development Program). Boiler No. 8 upgraded at Khabarovskaya CHPP-1.
	Khabarovskaya CHPP-3	Adjustments made to design and cost estimates for the Rehabilitation Project at Khabarovskaya CHPP-3 with Hot-Water Peaking Boiler Plant Converted to Natural Gas Combustion. Boiler feed water pumps upgraded at Khabarovskaya CHPP-3.
	Heat supply networks	Heat supply networks of CHPP-1 and CHPP-2 connected ranging from point No. 212 to point No. 1 in Petropavlovsk-Kamchatsky. Affirmative opinion obtained from Russia's State Expert Review Board with regard to design documentation and results of engineering surveys.

Achievements of RusHydro Group's R&D institutions in 2019

Research institute	Project	Achievements
Vedeneyev VNIIG	Assessing the human impact on tailraces with regard to the HPP equipment, hydraulic structures and energy efficiency	Key factors of the human impact on tailraces identified, including their effect on the reliability and safety of the HPP equipment and hydraulic structures. Current environmental and social effects assessed, including the effect of water levels and peak discharges on tailrace processes. Mathematical model developed to project tailrace processes and river bed evolution in a high-water season and as a result of daily runoff. Selected HPPs analyzed to assess the impact of current changes to river morphometry and tailrace processes on the operation of the HPP equipment and hydraulic structures, including the effect of tailrace levels on turbine operation. 3D model developed to project tailrace conjugation in case of flood discharge. Algorithm developed to plan tailrace protective works given the current state of river beds.
	Fostering smaller HPPs	The existing array of data and prior deliverables on hydropower potential of small and medium rivers, including suitable dam sites and watercourses, was analyzed and updated based on advanced information technologies, data modeling, processing and presentation tools and methodologies. Some 300 prospective dam sites scrutinized resulting in a selection of about 20 suitable sites meeting the required criteria, including their front-end engineering design.
	Arctic LNG-2: Wave model tests	Pilot tests run to assess the wave impact on gravity-based structures (GBS) for Arctic LNG-2. Tests were run in a wave tank to assess the wave impact (3D view of wave forces and wave force moment) and runup on GBSs, helping Arctic LNG-2 determine the maximum GBS exposure to wave impact and runup as a result of storms reoccurring once in 10, 100 and 1,000 years.
	Arctic LNG-2: Selection and validation of lightweight concrete and modified normal-density concrete mixtures, including laboratory and field studies	Lightweight and modified concrete mixtures developed and tested at the SAREN construction site in Belokamenka. Concrete pouring tests run to apply commercial batches to a dummy (prototype). Guidelines developed for concrete works on GBSs. Engineering support to concrete works at the GBS construction site. Research conducted to assess the impact of gas condensate on modified concrete used in GBSs and select the best possible protective coating.

Research institute	Project	Achievements
KhETC (the Far Eastern Analytical Center)	DGK, Kamchatskenergo (including Geterm), Magadanenergo, Sakhalinenergo, Chukotenergo, Yakutskenergo	<p>The health of core equipment analyzed covering 923 units of equipment. 333 power transformers (the highest voltage category of 110 kV and above) and electric power grids evaluated across the above subsidiaries, as well as 29 power lines (ranging from 35 to 110 kV) examined for Chukotenergo (pilot project).</p> <p>In 2019, the Far Eastern Analytical Center issued 544 equipment-related recommendations seeking to significantly improve the health of core equipment, enhance its reliability and reduce breakdowns.</p> <p>Draft guidelines developed to calculate and project the health of TPP equipment (steam boilers, steam turbines, turbine-type generators) and its evolution over time with or without any impact factors, which provides for better repair planning in the medium term.</p>

International activities ^[OS]

Across its international operations, RusHydro Group focuses on attracting innovative technologies contributing to its accelerated development, as well as promoting services of its Research and Design Complex in international markets, including by enhancing competencies in target segments of the global energy sector.

RusHydro Group is committed to long-term and mutually beneficial cooperation with foreign partners in line with Russia's strategic interests.

The key areas of RusHydro Group's international activities include:

- cooperation with foreign energy companies and power equipment manufacturers in the field of construction and modernization of conventional energy projects, maintenance projects;
- implementation of advanced RES-based technologies providing for power supply to isolated areas in the Far Eastern Federal District;
- monitoring of global energy developments.

In December 2019, Hydroinvest and RazTES, part of Tashir

Group, signed an agreement (dated December 5, 2019) on the sale of 90% of its shares in MEK which owns Armenia-based Sevan-Hrazdan Cascade HPPs with a total installed capacity of 565 MW. The transaction was approved by both PJSC RusHydro's Board of Directors and Armenia's Public Services Regulatory Commission. On December 12, 2019, Hydroinvest received full payment for its shares. In Q1 2020, we made the required steps and efforts to close the transaction, including refinancing of the EBRD and ADB loans made to MEK, RusHydro's surety contracts with respect of MEK's loans.

On March 10, 2020, with the conditions precedent being satisfied, Hydroinvest transferred 90% of its shares in MEK to the buyer – RazTES. Therefore, RusHydro Group ceased to be a shareholder in MEK. Following the transaction, RusHydro Group covered its historical acquisition costs in full and reduced its consolidated debt by USD 4 mn (on the prevailing exchange rate). As a result, FX risks in RusHydro Group's loan portfolio were eliminated.

International cooperation

RusHydro Group joined efforts with Japan-based Mitsui&Co, Ltd, KOMAIHALTEC Inc and NEDO to construct wind power installations with a single capacity of 300 kW in Ust-Kamchatsk, Kamchatka Territory, in addition to its existing WPPs with a total capacity of 900 kW. RusHydro Group also continued working on its project to erect a 3.9 MW wind-diesel power plant in Tiksi, Republic of Sakha (Yakutia), using wind turbines designed by Komai (Japan) to operate in an Arctic climate and diesel generators made by Yanmar (Japan).

RusHydro Group continued cooperating with Voith Hydro on modernization projects for Saratovskaya HPP and with General Electric on equipment supply for the first stage of Yakutskaya GRES-2.

On a global scale, RusHydro Group is represented by its research and design institutions operating in 12 countries: Uzbekistan, Kyrgyzstan, Tajikistan, Laos, Vietnam, Angola, Turkey, India, Egypt, Hungary, Georgia, and Azerbaijan.

RusHydro Group's research and design institutions focus on:

- hydropower (construction of HPPs and hydraulic structures);
- nuclear power (construction of ancillary hydraulic structures).

Their services also span thermal power, construction of electric power grids, construction of oil and gas production and transportation facilities, including offshore facilities.

In the reporting year, RusHydro entered into an agreement with PowerChina (China) on cooperation for the construction of pumped storage power plants in Russia and collaboration on design and engineering projects.

Interaction with international organizations

RusHydro Group actively cooperates with international governmental and non-governmental organizations, and integration associations, including the Eurasian Economic Commission of the Eurasian Economic Union, CIS Electric Power Council, the Asia-Pacific Economic Cooperation, the Shanghai Cooperation Organization, the BRICS, etc.

Representatives of RusHydro Group participate in committees and working groups of a number

of non-profit partnerships and international organizations, to which it is a member, including:

- Global Sustainable Electricity Partnership;
- International Hydropower Association;
- International Commission on Large Dams;
- World Energy Council.

RusHydro is an active contributor to major international forums, exhibitions and conferences related to hydro and heat power, renewable energy, heat supply, and sustainable energy.

In 2019, RusHydro Group acted as a partner of the Eastern Economic Forum which is a reputable platform for establishing and strengthening relations with foreign partners, especially from the Asia-Pacific countries, and attracting investors to energy infrastructure projects in the Far East. RusHydro's representatives took part in the Russian Energy Week international forum and the 2nd Russian-Chinese Energy Business Forum. The St Petersburg International Economic Forum is another traditional platform for RusHydro's presence.

RusHydro Group participates in intergovernmental commissions on trade, economic, scientific, and technical cooperation between Russia and other countries.



Voith Hydro and RusHydro have enjoyed a wonderful partnership for years. We are extremely proud to participate in RusHydro's comprehensive modernization program for hydroelectric power plants the company owns. We're equally pleased to take part in projects to build new hydropower plants by providing our know-how, supplying our top-notch equipment, and sharing our knowledge. By doing so, we can make a considerable contribution to developing Russian hydropower. In 2019, the VolgaHydro plant opened in Balakovo. This company was established by RusHydro and Voith Hydro as a joint venture, and it serves as a good example of our long-lasting successful cooperation.

Dr. Leopold Heninger,

CEO & President of Voith Hydro Europe



RusHydro Group in the International Electrotechnical Commission

The International Electrotechnical Commission (IEC) is an international standards organization made up of all national committees (NCs). It promotes international cooperation on all matters relating to electrical and electronic standards.

As an active contributor, RusHydro Group continued to send its experts to the IEC's working groups. In 2019, the Company's representatives took part in such working groups as WG 25, WG 30, MT 31, WG 14, MT 28, MT 34, and the vibration working group.

Business process digitalization

RusHydro Group approved its Digitalization Program¹ to cut costs on the development and operation of its facilities by revolutionizing, intellectualizing and streamlining governance models based on the analysis of the Company's underlying business processes.

The Program includes 18 digital projects covering virtually all business lines of the Group. Key achievements in 2019:

- digital controls, i.e. modernization of collective output controls across RusHydro's HPPs with a view to making dispatch schedules from the System Operator of the Unified Energy System autoexecutable;
- remote control over switchgears;
- information system up and running to support the Situation Analysis Center.
- closer monitoring of substations.

In 2019, the Company prepared a draft Digital Transformation Blueprint (the Blueprint). The Blueprint is aligned with the Digital Power Industry national project initiated by the Russian Ministry of Energy which aims to leverage

digital technologies and platform solutions to revolutionize the energy infrastructure.

RusHydro Group's digital transformation seeks to improve operational efficiency of its core and supporting processes through:

- digital end-to-end technologies;
- all-inclusive digital ecosystem;
- digital corporate culture.

RusHydro Group's objectives for digital transformation are to:

- arrange for generating, selecting and implementing digital initiatives;
- develop a talent pool with required skills;
- implement decision making tools driven by data analytics.

The Blueprint describes the target component model and architecture for RusHydro Group's digital transformation towards 2030. The target model relies on digital end-to-end technologies which help the Company achieve operational excellence.

Its focus areas include establishing the Center of Excellence for Digital Transformation which will be seeking opportunities to improve business processes, analyse data and implement technological initiatives, i.e. options to use and combine end-to-end technologies in business solutions aimed at enhancing transparency, flexibility and efficiency of the Company's underlying processes.



Cooperation for digitalization

RusHydro and Sberbank entered into a strategic cooperation agreement covering, *inter alia*, transactions and investment banking operations whereby the parties intend to learn from experiences of blockchain management, software robotization, cloud solutions, and AI technologies. The agreement also provides for the collaboration on learning software for innovative development.

¹ Order No. 952 of December 10, 2018.