Plans for investment activity

Investment plans for 2018[1]

Volume of investments	RUB mn
Technical rehabilitation and modernization	34,302.63
New construction	71,242.71
Technological connection	12,302.61
Other	4,943.77
Total	**122,791.71**

Capacity to be comissionned	
Generation, MW	797.12
Heat, GcaL/h	782.89
Transformer capacity, MVA	992.37
Grid infrastructure, km	1,728.79

INNOVATIVE DEVELOPMENT

RusHydro Group Innovation development programme for 2016-2020, with a prospect up to 2025

The main objectives of the Innovation Development Programme of RusHydro Group for the medium term are to increase the economic and operational efficiency of the Company's operations through the introduction of innovative technical and management solutions aimed at:

- increasing the service life and productivity of equipment;
- developing technologies to increase reliability and economic efficiency of equipment operation;
- improving the quality of equipment diagnostics and proactive identification and elimination of production risks;
- reducing the dependence on imported equipment and focusing on import substitution;
- reducing the negative footprint on nature;
- increasing energy efficiency and reducing losses.

[1] Investment programme of PJSC RusHydro for 2018 was approved as part of the business plan of PJSC RusHydro for 2018-2022. (Minutes of the Board of Directors from 26.12.2017 No. 264).

The main objectives of the Innovation Development Programme of RusHydro for the long term are:

- ensuring the compliance of the Company's technological level with the level of advanced world and domestic energy companies, including:
  - development of efficient technologies for the construction, repair and reconstruction of generating capacities;
  - development of technologies in the field of monitoring the status of the main equipment in real time;
  - development of automated equipment maintenance and repair processes;
  - development of new innovative products based on the accumulated knowledge and experience of PJSC RusHydro (for example, services in the field of energy efficiency, storage of electrical power, infrastructure for electric transport, materials with new properties);
- development of clean energy sources, including:
  - development of hydropower potential in some regions of the Russian Federation;
  - development of alternative energy on renewable energy sources (geothermal energy);
  - analysis of the application and development of mini-HPP technologies.

Key performance indicators of the Innovation Development Programme of RusHydro Group

	Target KPI values			
KPI	2017	2018	2019	2020
Share of R & D expenses in revenues, %	0.25	0.25	0.25	0.25
Growth in the number of intellectual property assets put on the balance sheet, %	5	5,5	6.5	7
Efficiency of hydropower capacity management, person/100 MW	21.26	20.52	20.36	20.13
Share of innovative products in total volume of purchases,%	1.1	1.21	1.33	1.46
Specific costs for repairing the HPP, thousand rubles / MW (in 2000 prices)	20.1	19.9	19.8	19.6

Integration of the innovation management system of PJSC RusHydro and the RAO ES East Subgroup

The innovative development programmes of RusHydro Group and RAO ES East Subgroup are integrated as follows:

- the programmes are synchronized in terms of the performance of the indicators included in the integral KPI of the innovation activity of PJSC RusHydro:
  - share of R&D expenses in revenues, %;
  - an increase in the number of assets of intellectual property placed on the balance sheet for the reporting period, %;
  - coefficient of fuel utilization, % (only for JSC RAO ES East);
- consideration and approval by the Board of Directors of PJSC RusHydro of the Innovative Development Program of the RAO ES East Subgroup and annual reports on its implementation as part of the RusHydro Group Innovation Development Program.

Scope and sources of financing of the Innovation Development Programme (IDP)

The volume of financing of the Programme of innovative development of Group RusHydro Group (without considering the volume of financing of the Programme of innovative development of RAO ES East Subgroup) on the results of 2017 was RUB 586.7 mn, RAO ES East Subgroup – RUB 1,602.8 mn. All activities of RusHydro Group's IDP were funded by their own resources.

The indicator "The share of IDP in revenue" in the IDP reporting loop is not provided. Performance of the indicator "Share of R&D expenses in revenues, %" for RusHydro Group in 2017 was 0.18%.

The key innovative projects of PJSC RusHydro, implemented during 2017

- Development of an Automated system of signaling ruptures and the measurement of turbine debits on diversion and dam HPP of PJSC RusHydro;
- development of software complex of monitoring and forecasting the reliability of hydro-technical structures of HPP (PSP) in complex engineering-geological conditions;
- research of new technologies on the repair and restoration of HS elements with prolonging service life and reliability, development of a guide for implementation;
- a comprehensive assessment of the actual strength of hydroturbine elements operated by hydropower with the methods of numerical analysis of stress-strain state;
- development of recommendations on the accounting of the anthropogenic impact in the tailrace of HPP on the state of hydropower facilities, equipment and energy efficiency of hydropower plants;
- expansion of the digital platform of the branch of PJSC RusHydro-Nizhegorodskaya HPP.

Priority directions of innovative development of RusHydro Group in the field of "Hydropower":

- ecology and environmental protection,
- hydropotential recycling schemes,
- technologies of design, construction, reconstruction and repair,
- energy efficiency and water resources management,
- monitoring and operating equipment and facilities,
- constructive solutions of HPPs, PSPs, RES.

Key Innovation Project RAO ES East Subgroup, unveiled in 2017 - technological solutions to reduce erosion wear and improve reliability of working blades of the latest stages of modern steam turbines by forming multifunctional nanocomposite coatings.

Implementation of the Innovation Development Programme in 2017

RusHydro Group (excluding RAO ES East Subgroup)	RAO ES East Subgroup
The total amount of funding for projects and activities included in the medium-term plan for implementing the activities of the Innovative Development Programme amounted to RUB 586.7 mn with a plan of spending RUB 742.5 mn (79 % of the plan). The main reasons for the underperformance of the plan are: contractors failed to fulfil contractual obligations, the company reduced the cost of activities as a result of procurement procedures, the company transferred financing for a number of projects in 2018 due to the need to clarify the technical requirements for the work, as well as the long duration of procurement procedures, established in the framework of pilot-industrial tests.	In 2017 it was planned to finance the implementation of activities of the Programme of Innovative Development of RAO ES East Subgroup for the sum of RUB 1,654.70 mn. The actual financing amounted to RUB 1,602.7 mn (96.9 % of the plan). According to the results of 2017 the KPI of the programme of innovative development of JSC RAO ES East was fulfilled: The growth of the number of intellectual property assets put on balance,% and reduction of production cost, % change to 2015. Underperformance of other indicators of the programme of innovative development of JSC RAO ES East occurred for objective reasons. The main one is the position of the Department for the Development of the Electrical Power Industry of the Ministry of Energy of Russia on the need to reduce the costs of the companies of the RAO ES East Subgroup for R&D as an activity that is not of vital significance for the companies of the Subgroup. As a result, the R&D programme of the RAO ES East Subgroup for 2016-2018 was halved.

Research and development. The most significant projects on sustainable development

Projects of PJSC RusHydro

Project	Description	Results of 2017	Plans for 2018
Development of recommendations on the accounting of the anthropogenic impact in the downstream of the HPP on the state of hydraulic structures, equipment and energy efficiency of HPPs	The novelty of the work lies in the mathematical modelling of hydrodynamics and channel processes in the lower reaches of the hydroelectric power station with the passage of floods and daily regulation of the power of the hydroelectric power station. Work in this setting is performed for the first time	Information was collected on the dynamics of channel processes during the operation of hydraulic structures. A programme of surveys of channels in the lower reaches of the HPP was prepared	Carrying out field surveys. Mathematical modelling of hydrodynamics and channel processes in the downstream. Implementation of water and energy calculations
Development of a water and energy management system based on the Dispatch Center	Development of tools for forecasting runoffs and the optimization of operation modes of hydro-energetic facilities for the thorough optimization of energy production and water-economic activity of hydropower facilities	Models of annual effluents for Cheboksary and Nizhny Novgorod hydropower plants were developed	Verification of sewage models of Cheboksarskaya HPP and Nizhegorodskaya HPP according to the flood data of 2018 Duplication of the flow model for all HPPs of the Volga-Kama cascade

The most significant projects in the field of development and implementation of innovations aimed at the realization of sustainable development of the companies of RAO ES East Subgroup, in 2017 were the following R&D activities

Reconstruction of Khabarovsk CHPP-1 for use as a fuel of natural gas with the use of innovative technologies for the preparation and supply of fuel (power boilers).

Development, implementation and investigation of the effectiveness of the prototype of a multifunctional facility to provide 100% Upper Amga Aldan Ulus with renewable energy sources.

Development of an agent-free water treatment technology for the needs of the Primorskaya GRES hot water supply.

Volume of R&D funding for RusHydro Group

	Plan, RUB mn	Fact, RUB mn	%
Total RusHydro Group	477.5	402.4	84.2
including RAO ES East Subgroup	204.3	166.9	81.7