Comprehensive modernization, rehabilitation, and upgrade programs

Comprehensive Modernization Program

As many large HPPs were commissioned in the 1950s and 1960s, the need arose in the early 2000s to upgrade or replace the existing equipment. Tough economic conditions prevented RusHydro from replacing obsolete and worn-out equipment and forced it to focus on maintenance and partial replacements instead.

Since mid-2000s, a number of RusHydro's HPPs began replacing equipment on a case-by-case basis, but the overall trend of ageing prevailed.

This was true until December 2011, when the Board of Directors approved the Comprehensive Modernization Program to upgrade the Company's power generation facilities by 2025. Its key priority is to ensure that no core generation equipment with expired safe operation life remains in place by then.

Key results of RusHydro's Comprehensive Modernization Program

Results, pcs

Type of equipment	2018	2019 E
Turbines	7	10
Generators	8	10
Transformers	6	3
High-voltage circuit breakers	76	12
Hydraulic structures	25	22
Secondary switches	342	191
Secondary equipment	360	178

Additions to installed capacity, MW

HPP	2018	2019 E
Zhigulevskaya HPP	10.5	10.5
Saratovskaya HPP	12.0	12.0
Novosibirskaya HPP	5.0	5.0
Votkinskaya HPP	15.0	15.0
Cascade of Verkhnevolzhskiye HPPs	10.0	0.0
Nizhegorodskaya HPP	3.0	0.0
Total	**55.5**	**42.5**

Technical condition index of RusHudro's core equipment in 2018, %

Equipment	%
Turbines	78.41
Generators	76.15
Transformers	67.50

In 2018, Votkinskaya HPP's hydropower unit No. 7 was upgraded as part of RusHydro's Comprehensive Modernization Program, becoming the second fully modernized hydropower unit at the plant.

Over the five decades since its commissioning in 1962, this unit had worn down to a significant extent. It took about a year to replace its turbine, generator and secondary equipment and upgrade its automatic control system. The new hydropower unit was manufactured by Power Machines – a Russian company.

The second unit's runner, turbine chamber and automatic control and excitation system were replaced entirely. Designed to prevent lubes from being released to the environment, the new runner is expected to contribute more to ecological sustainability. The upgraded automatic control system will update the operators on the equipment status while also enhancing the operating efficiency and mitigating the risk of malfunctions.

In 2018, Volzhskaya HPP commissioned a new hydropower unit and replaced a turbine, generator and auxiliary equipment as part of the Comprehensive Modernization Program.

At Novosibirskaya HPP, the turbine replacement was followed by commissioning of the hydropower unit No. 7. The upgrade will boost Novosibirskaya HPP's installed capacity by 5 MW.

Cheboksarskaya HPP put into operation hydropower unit No. 14 following its upgrade, which included the recovery of the adjustable blade pitch and the replacement of the generator stator.

Rehabilitation and modernization program

The rehabilitation and modernization program draws upon the Comprehensive Modernization Program. While focused on ensuring adequate maintenance and commissioning new capacities, it differs from the Comprehensive Modernization Program in that it looks to replace equipment on a case-by-case basis, bringing more advanced alternatives to RusHydro's facilities. Its other priorities include extending lifespans of the core generation equipment, reducing production costs and enhancing the overall economic efficiency.

Driven by the need to ensure long-term reliability throughout its technological complex, JSC RAO ES East Subgroup runs its own rehabilitation and modernization program (as part of its investment program). The development and implementation of this initiative is regulated by RusHydro Group's Technical Policy.

The rehabilitation and modernization program saw Anadyr CHPP launch its first gas power boiler under a gasification agreement signed by RusHydro and the Government of the Chukotka Autonomous Area in May 2017 to carry out an extensive upgrade of the plant's equipment and build gas pipelines. It took less than a year to build the infrastructure for an on-site gas pipeline and gas distribution station, implement key utility systems and rehabilitate the boiler to feed on natural gas. All gas equipment has been pre-commissioned successfully. The plant feeds on the natural gas coming from the Zapadno-Ozernoye field, which is operated by Sibneft-Chukotka.

RusHydro's Dagestan branch commissioned Miatlisnkaya HPP's hydropower unit No. 2. Now all HPP's turbines were replaced (hydropower unit No. 1 was upgraded in 2015).

Program for the development of energy based on renewables[1]

Using renewables is a top priority for RusHydro Group, which keeps ramping up installed capacities by building new HPPs and commissioning new power generation facilities.

RusHydro was among the first in Russia to start developing projects relying on geothermal, solar and wind power generation. One of RusHydro Group's objectives for 2016–2020 with an outlook until 2025 is to improve energy efficiency by using alternative energy sources. Most of the projects are implemented in isolated energy hubs of the Far Eastern Federal District outside of the Unified Energy System.

Solar and wind power in isolated energy hubs

Since 2012, RusHydro Group has launched 19 solar power plants with a total capacity of 1.6 MW and four wind power plants with a total capacity of 3.6 MW[2].

Given the local specifics, none of the projects are standard by design, the 1 MW northernmost SPP in Batagay is not an exception. Our R&D specialists have designed a prototype wind diesel and solar diesel power stations and tested a range of equipment, including energy storage units, all to be used in isolated energy hubs of the Far Eastern Federal District.

Commissioned in November 2018, a unique 900 kW wind power plant in Tiksi, an isolated polar settlement

[1] Any renewable energy sources specified in Article 3 of Federal Law No. 35-FZ On Electric Power Industry dated March 26, 2003, excluding HPPs with an installed capacity of over 30 MW

[2] Including the WPP in Tiksi, which is under pre-commissioning.