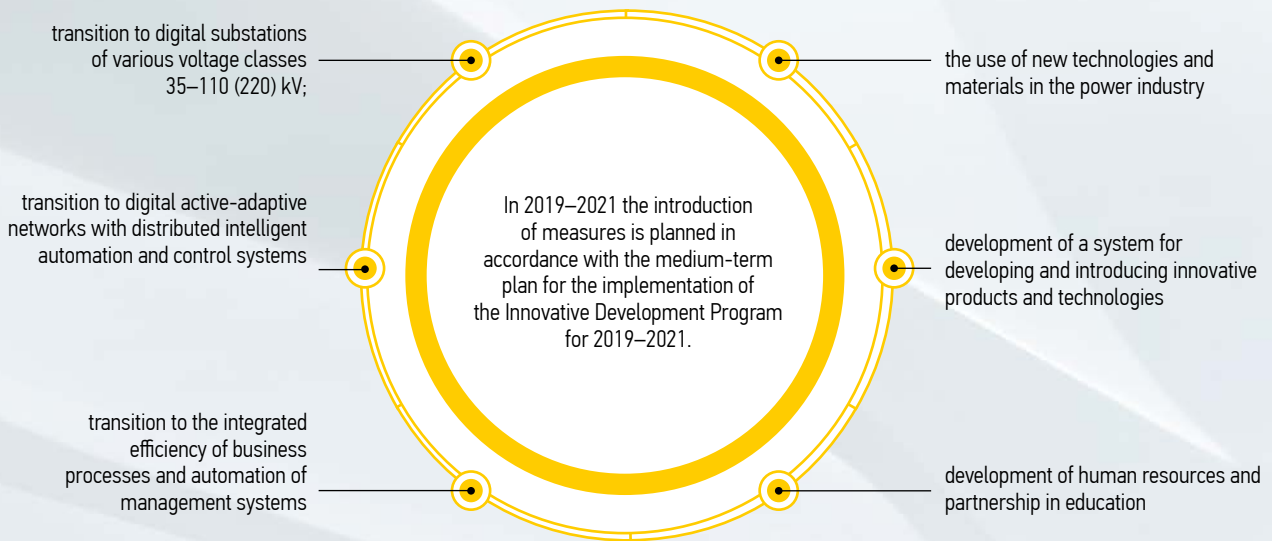


INNOVATIVE DEVELOPMENT OF THE COMPANY

THE MAIN DIRECTIONS OF THE CURRENT INNOVATION DEVELOPMENT PROGRAM



2018 results

4

SECURITY DOCUMENTS

ON R & D WERE RECEIVED

1

LICENSE CONTRACT WAS CONCLUDED

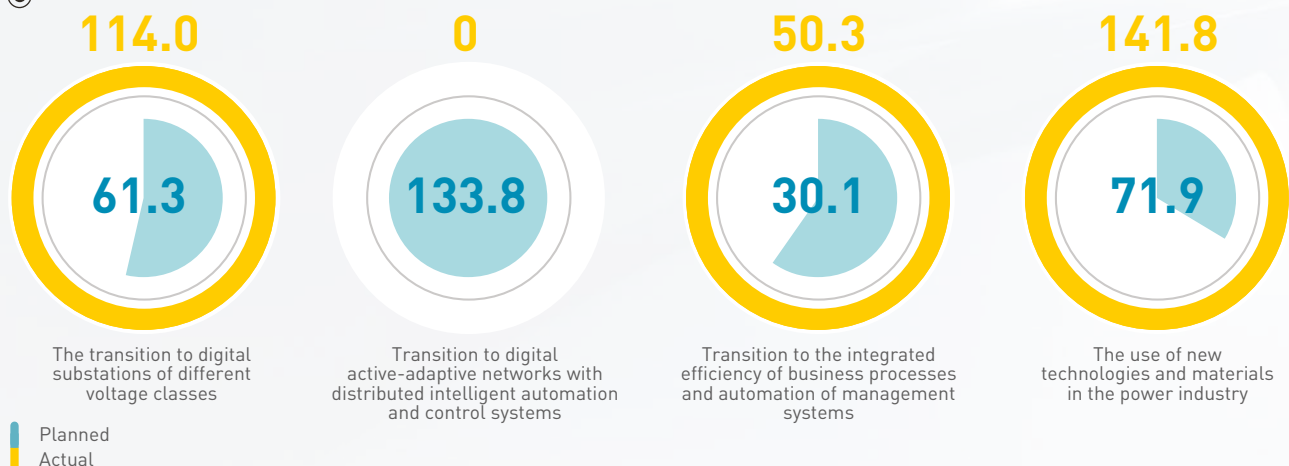
2

R & D RESULTS

WERE IMPLEMENTED ON POWER GRID FACILITIES

COMPANY'S EXPENSES FOR INNOVATIVE DEVELOPMENT

Costs in the main areas of innovation development in 2018, mln rub. without VAT



THE MAIN COMPLEX INNOVATIVE PROJECTS CARRIED OUT BY THE COMPANY IN THE REPORTING YEAR

Automation of sections of the 6–10 kV distribution network based on reclosers with the installation of a SCADA system of Dagomyskiy¹ RES

The project implementation period is 2018–2020.

It is planned to implement a set of technical measures, including:

- application in Sochinskiye electric networks of SCADA with the addition of OMS functions (shutdown control system, including emergency situations) and DMS (distribution network control systems) with the display of telemechanical data on 110 kV substation and 6–10 kV distribution center of Dagomyskiy RES;
- setup of automatic sectioning points (reclosers, motor-driven disconnectors, etc.) with integration into SCADA;
- the remote control of one 110 kV substation, nine distribution points with a voltage of 10 kV with integration into SCADA;
- the introduction of digital systems for determining the location of damage by equipping sensors for the flow of short-circuit currents with the integration of SCADA;

- creation of a communication system that meets the demand for digital RES (modems, communication channels, routers);
- creation of a smart metering system (with the automatic collection and the function of analyzing consumption and balances) based on Automatic system for commercial accounting of power consumption "Piramida";
- creation of an automated workplace of the operational (operational-repair) personnel of Dagomyskiy power distribution zone.

The coordination of the digitalizing passport of Dagomyskiy Distribution Zone by the Commission for the Management of Innovative Development of PJSC Rosseti began in 2018.

In 2019–2020 It is planned to coordinate the passport of the pilot project with PJSC Rosseti and its implementation

Development of the computer integrated manufacturing system (CAMS) of Kubanenergo PJSC

In the reporting year:

- changes were made to information systems based on the results of the revision of the methodology for assessing the consequences of a failure and taking into account the risks of failure in monetary terms;
- automated forecasting model of the probability of the manufacturing system failure;
- standard forms of test/measurement protocols were automated by test objects, groups, and types of equipment;
- automated functionality of mobile solutions;
- ACS MRO integration was carried out with reference books of raw materials and materials for accounting and logistics;
- automated methodology for assessing the readiness of electric power engineering entities to work during the heating season.

The introduced APSA controls contribute to the reduction of labor costs for performing individual operations, increase the transparency of the Company's activities at all levels of the hierarchy, make information available at all levels of management of power grid facilities. They also let to evaluate the effectiveness of

operational and investment costs in terms of various types of impact, to compare the efficacy of production asset management processes in the Company.

Controls for calculating the likelihood and estimating the consequences allow us to determine the optimal type, composition, and cost of technical impact when planning for maintenance and repair, technical re-equipment and reconstruction, as well as to determine the predicted level of reliability of power grid facilities.

Further development of the Company's asset management system is planned for 2019, including:

- creation of automated control systems by means of technical re-equipment and reconstruction;
- automation of methods for predicting changes in the reliability of power supply to consumers and the technical condition of assets, depending on available resources;
- the exchange of regulatory information between the asset management system and the automated metering system of transport of electricity

Implementation of automated process control systems based on digital devices using the IEC 61850² standard for the construction of the Substation 220 kV "Port"

The following digital technologies were used in the construction of the "Port" 220 kV substation:

- automated process control system (APCS) built on equipment, equipment produced by a Russian Company LLC "DEP Company" based on the protocol IEC 61850;
- integration of 10–35 kV bay controllers and relay protection and automation terminals into the process control system through digital data exchange using the IEC 61850 protocol;

- digital communication and transmission channels are organized via the optical fiber transmission systems (OFTS) to the dispatch centers of Kubanenergo PJSC and branch of JSC SO UES Kuban Regional Dispatch Administration (RDA);
- implementation of software online blocking switching devices of substations. In 2019 it is planned to put the following facilities into operation.

¹ SCADA – (Supervisory Control and Data Acquisition) is a software package designed to develop or provide real-time systems for collecting, processing, displaying and archiving information about a monitoring or management facility.

² The standard of the International Electrotechnical Commission "Communication Networks and Systems at Substations", describing data flow formats, types of information, rules for describing elements of a power facility and a set of rules for organizing an event-based data transfer protocol.