

Activities for power grid repair and maintenance, improvement of energy facility reliability, target programmes for equipment upgrading and replacement allowed a stable failure rate decline by all indicators and at all IDGC of the South's branches.

In 2018, the number of failures in the grids of 6 kV and above reduced by 4.6% year-on-year from 7,568 to 7,222 incidents.

The specific failure rate went down by 5.1% year-on-year, from 6.72 to 6.38 faults per 1 thous. nominal units.

The average duration of power outages in the grids of 6 kV and above decreased by 14% year-on-year from 2.25 to 1.93 hour.

The number of failures in the grids of 110 kV and above declined from 887 to 834 accidents, down 6% year-on-year.

Change in the failure rate in the grid of 110 kV and above at the Company's facilities in 2016-2018



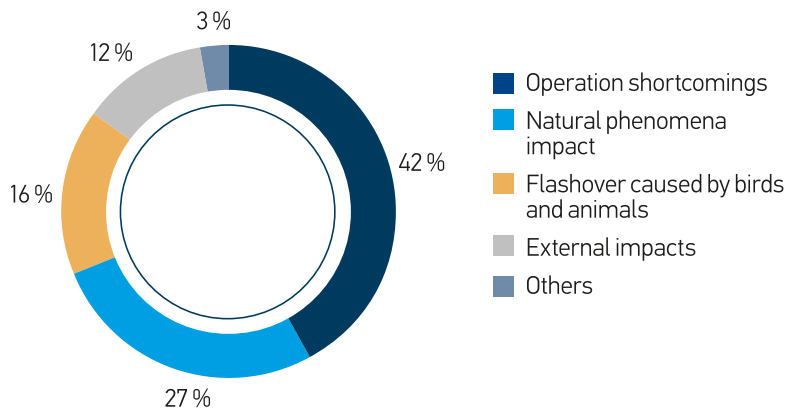
Change in the failure rate at 110 kV and above grid facilities

The main causes of failures, both in 2017 and 2018, were as follows:

operation shortcomings – mainly, heavy wear-out of the equipment

and its elements (average service life). This factor accounted for 42% of all the faults occurred in 2018;
natural phenomena impact – wind loads, atmospheric surges, etc. (27%);
flashover caused by birds and animals (16%);
external impact on energy facilities (12%).

Breakdown of causes, %



In 2018, three Company's branches entered a new long-term tariff regulation period with a transition to indicative reliability indices (SAIDI, SAIFI): Astrakhanenergo, Kalmenergo, and Rostovenergo. The target index values are approved by orders of relevant regional tariff-setting services for 2018–2022. By the end of 2018, these indices were achieved in all three branches.

A new tariff regulation period at the Volgogradenergo branch will start in 2019. The branch accomplished its annual reliability target by the year-end, the target value of System Average Interruption Duration Index (SAIDI) established by the regional tariff-setting service was achieved.

Activities performed to prepare the power grid complex for operation in special periods

During preparation for operation in thunderstorm, flood, fire, autumn and winter periods in 2018, IDGC of the South undertook a set of activities aimed at provision of reliable operation of the Company's power grid facilities.

Considering preparation for operation in the thunderstorm period:

all substations, fuel and lubricants warehouses, mineral oil facilities and antenna mast structures underwent engineering inspections (the specialists focused on compliance with lightning protection requirements of the regulatory documents, condition of free standing and portal lightning arrestors and their design grounding, condition of SS electrical equipment grounding devices, cleanliness of oil-level gauges, insulation condition, availability of dry vegetation);

valve-type lightning arresters and surge arrestors disconnected for the autumn and winter period (if any) were connected; before the connection, the arrestors underwent testing and visual inspection (examination of support insulation flanges, porcelain lining, stubs, trip recorders);

surge arrestor conduction currents were measured without disconnection from the grid (if technically feasible) or a thermal-imaging inspection of the equipment was carried out; in addition, the results of conduction current measurements were analysed and compared with the previous measurement data;

readings from trip recorders of valve-type lightning arresters and surge arrestors were compared with the last records of the operating log book or trip log book, the records were updated, if required;

availability of emergency event recorders, recording devices, oscillographs and other units for PTL fault localisation installed on substations was provided;

grounding circuits of lightning protection cables disconnected for

the autumn and winter period were restored on overhead lines with an ice melting circuit, the condition of spark gaps on lightning protection cable insulator strings was checked (and adjusted if required);

engineering inspections were conducted at random overhead line sections with a focus on the grounding of lightning protection cables in design points, condition of lightning protection cable contacts with the pole body, condition of grounding devices of poles and guy wires, condition of insulation;

sufficiency of the emergency reserve of lightning and surge arresters, most frequently damaged overhead line elements was checked considering both quantity and range of items;

based on the inspection and check results, the branches developed and approved action lists to eliminate the detected violations before the thunderstorm period; the activities were fulfilled within the assigned time limits;

installation of surge protection devices to overhead lines operating under reduced voltage relative to the insulation class and overhead lines with insulation reinforced due to the atmospheric contamination condition was checked for compliance with the requirements of subpar 4.2.145 of the Electrical Installations Code; readiness of main and backup communication channels for operation in the thunderstorm period was checked.

The number of thunderstorm hours across IDGC of the South branches averaged 38 hours and the maximum thunderstorm activity in separate areas achieved 55 hours. In general, the thunderstorm period lasted from April 20 to October 5. The average number of thunderstorm hours reduced by 2% year-on-year.

Within the relevant period of 2018, there were 156 lightning outages of 110 kV overhead lines, 124 of them with successful automatic reclosure (79%).

For 110 kV overhead lines, the specific number of lightning outages per 100 km and per one year of operation was 1.42, which does not exceed the permissible range specified by RD 153-34.3-35.125-99 Guidelines for Protection of 6–1150 kV Power Grids from Lightning and Internal Overvoltage (0.33–2.3).

The activities performed in accordance with Order No.57 of ROSSETI dated February 16, 2018 proved to be efficient. Similar measures are scheduled for the preparation for the thunderstorm period in 2019.

Preparations for operation in the fire-hazardous period:

fire separation distances were made around 35–110 kV substations in areas with a higher risk of damage due to natural fires (a total of 883 SS);

the areas around the equipment were cleared from trees, shrubs and garbage of fire-safety purposes;

lists of overhead line fire-hazardous sections were updated and approved, activities for fire protection of wooden posts in areas of the overhead line fire-hazardous sections were taken;

gravel was replaced (cleaned) within the side curbs of substation oil receptacles, oil drains serviceability and condition of emergency tanks for oil reception from SS transformers and oil-filled equipment were checked;

function test of indoor and outdoor fire-fighting mains was executed with regards to pressure and water consumption rate, relevant reports were issued;

fire-fighting trainings were organised together with fire brigades of EMERCOM of Russia;

dry grass and combustible materials were removed from facility areas, buffer zones of 35–110 kV substations, transformer substations and 6–10/0.4 kV distributing points;

buildings, structures, premises, areas of energy facilities

and motor vehicles were fully provided with primary fire-fighting equipment;
condition of emergency exits and evacuation routes was checked;
unscheduled briefings were held for the personnel
(6,518 employees) on firework procedures, actions in case of fire,
evacuation from buildings, rules of primary fire-fighting equipment
use.

The said activities help prevent fires at the Company's energy facilities during the fire-hazardous period of 2018.

Preparations for operation in the flood period:

To ensure reliable operation of the Company's power grid facilities during the spring-flood period in 2018, IDGC of the South issued Order No.943 dated December 27, 2017, On Preparation for the Flood Period that:

approved the members of the Central Flood Commission of IDGC of the South;
provided for issuing of relevant orders in the Company's branches and establishment of Flood Commissions;
approved the Mandatory Action Plan to provide reliable operation of power grid facilities in the flood period;
ensured development of supplementary action plans;
specified the list of power grid facilities, buildings and structures located in high-risk areas during the flood period of 2018;
arranged the cooperation and data exchange with regional divisions of EMERCOM and the Russian Meteorological Service during the flood period.

The Mandatory Action Plan approved by the above-mentioned order includes:

23 activities to be executed during preparation for the flood period;

five activities to be conducted during the flood period;

one activity to be carried out after the flood period.
All the activities were fully executed as per the approved Plan.

The Company's branch commissions checked the implementation of the Action Plans to provide reliable operation of power grid facilities in the flood period and issued conclusions on their readiness for the flood period in 2018. Relevant readiness certificates were signed.

The Company's branches organised regular monitoring of the groundwater level for minimising the risk of accidents at power grid facilities of IDGC of the South during the flood period.

In the flood period in 2018, IDGC of the South branches did not record any exceedance of long-time annual average water levels in their operations area.

The Company's branches did not impose high alert or special working regimes in their operation areas due to the spring flood.

Flood-induced emergency outages of power grid equipment, including consumers' de-energising, were not recorded.

Flooding of equipment, SS buildings and facilities, overhead line sections was not detected in the reporting period.

Preparations for operation in the autumn and winter period:

reconstructed objects significant in the autumn and winter period were put into operation (retrofitting of 110/6 kV T-13 SS and 110/35/6 kV T-25 SS of Rostovenergo; reconstruction of 110/10 kV Kamyzyak SS, 110/35/10 kV Zenzeli SS, 110/10 kV Yenotaevka SS and 110/35/6 kV Lesnaya-Novaya SS of

Astrakhanenergo);
the Repair Programme was fully executed;
the demand for backup power supply sources was met (271 items with a total capacity of 4.4 MW are available, which allows providing consumers with power during emergency recovery works);
the emergency equipment and materials reserve required for emergency recovery works is fully completed;
scheduled technical inspections of equipment, buildings and structures were carried out. All facilities were allowed for further operation;
emergency response drills regarding employees' actions in complicated conditions of the autumn and winter period were held for the operational personnel (54 emergency response drills to introduce schedules for temporary outage in consumption; 12 joint drills with the EMERCOM – 100% of the annual plan);
technical availability of the overhead line ice melting circuits was provided. In accordance with the schedules approved and agreed with branches of SO UPS, JSC – Regional Dispatch Offices (RDO), 46 test ice-melting operations were carried out on 110 kV overhead lines.
The Company fulfilled both main and additional readiness conditions specified in the Regulations on Inspection of Power Industry Entities Readiness for Operation in the Autumn and Winter Period.

On November 14, 2018, IDGC of the South was granted a Certificate of readiness for operation in autumn and winter period of 2018/2019 based on the resolution of the Russian Ministry of Energy (Order No.1031 dated November 14, 2018).