

## Emergency shutdowns

Indicator	2016	2017	2018	Change vs. 2017, %
Number of emergency shutdowns at generating facilities with a breakdown by main causes	473	422	361	-14.5
Boiler equipment	104	76	74	-2.6
Turbine equipment	62	82	62	-24.4
Auxiliary thermal and mechanical equipment	116	48	44	-8.3
Electrical equipment	174	204	171	-16.2
Other	17	12	10	-16.7

### Accident reduction programs at production facilities

Measures to reduce accidents and emergency and fire training conducted in 2018:

The accidents that occurred at the Group's power facilities in 2018 were investigated. Investigation reports were prepared and subsequently recorded in the Accident Database in the Electric Power Industry automated information system of the System Operator. Corrective and preventive measures were issued for each case involving emergency shutdowns in accordance with established and approved deadlines.

Accident reduction measures:

- the timely and proper implementation of plans and programs for repairs, reconstruction, and modernization of equipment and technical devices
- enhancing the quality control of work performed by repair organizations during major and routine repairs
- preventing violations of the rules for organizing the repair and maintenance of equipment and the acceptance of equipment for operation
- conducting a technical inspection and expert examination of the industrial safety of technical devices, buildings, and structures at hazardous production facilities in accordance with federal standards and rules concerning industrial safety as well as regulatory and technical documentation
- increasing the level of automation of technological processes in the main and auxiliary equipment of power plants
- improving the quality of personnel training and conducting emergency response training taking into account the circumstances of accidents that have occurred
- carrying out simulator training and professional skills competitions among operating personnel
- improving the quality of accident investigation and fulfilling the measures prescribed as a result of accident investigations
- utilizing the analysis results of the causes of accidents when compiling production programs

- including managers and specialists from the services and units of the executive office of companies of the Group and PJSC Inter RAO in commissions to investigate accidents that occurred due to the erroneous actions of staff
- using administrative corrective measures and conducting mandatory unscheduled testing of the knowledge of rules and regulations among staff whose erroneous actions led to process disruptions (including appearing in front of commissions of higher organizations)

In 2018, staff underwent emergency response and fire prevention training in accordance with the established schedules and programs. Changes and additions were made to the training programs to take into account the results of investigations into accidents at power facilities. Fire training was conducted using the manpower and resources of fire departments that handle the fire protection of power facilities. The results of emergency and fire training were analyzed and evaluated by the technical managers of power facilities at meetings with staff who participated in the training.

In 2018, an advanced simulator complex for training personnel in emergency situations was put into commercial operation at the Sochinskaya TPP of JSC Inter RAO – Electric Power Plants. A software and hardware platform fully reproduces the algorithms of the entire production process. In the new simulation class, employees of the Sochinskaya TPP receive advanced training and hone their emergency response skills. They use computer monitors to simulate any abnormal situation, whether it be a shutdown of a pump, electric motor, or turbine. Special training sessions for the staff of electrical, thermal engineering, and chemical workshops are held regularly. The complex will help to prevent emergency situations resulting from the fault of operational staff.

The simulators for training the operational staff at power plants are equipped based on innovative Russian-made information technologies as part of the R&D program (for more, see the 'R&D projects' section).