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AUTOMATIC INTELLIGENT CONTROL OF THE OPERATING CONDITIONS OF ISOLATED OPERATING POWER SYSTEM

Since 2011, the System Operators of Lithuania, Latvia and Estonia, together with ENTSO-E, have been carrying out researches and developing design solutions for the integrating of their energy systems with ENTSO-E. A complete exit of the Baltic states' energy systems from the synchronous operation with the UPS of Russia is planned by 2025. By this time, Lithuania will complete the implementation of the project for the construction of 400 kV AC power transmission Alytus - Elk (Poland), as well as the construction of a DC power transmission to Sweden.

The withdrawal of the energy systems of Lithuania, Latvia and Estonia from the agreement on the parallel operation of BRELL and their transition to parallel operation with the European energy system will lead to a break in the electrical connections of the energy system of the Kaliningrad region with the Lithuanian energy system and, accordingly, to the transition of the energy system to isolated operation.

The development of the energy system of the Kaliningrad region until 2012 was planned on the basis of the concept of parallel operation with the large capacity power system - the UPS of Russia. According to this concept, the energy security of the Kaliningrad region was ensured, in fact, by the conditions of parallel operation of its power system with the UPS of Russia. The development of generating capacities in the power system of the Kaliningrad region was planned to be carried out by means of large power plants, such as the Kaliningrad TPP-2 and the Baltic NPP. The design of the electric network, electric power facilities, the selection of equipment used at these facilities, the design of devices and systems of relay protection and emergency control was also carried out based on the parallel operation of the power system with UPS of Russia. At the same time, no special requirements were imposed for the regulation systems of power plants generation units, nor specialized regime control and emergency control systems was planned to develop in the power system.

The isolated operation of local, relatively small in terms of consumption, power systems, such as the power system of the Kaliningrad Region, has a number of features related, first of all, to processes of frequency and power flows regulation, as well as to ensuring the reliability and survivability of the power system in the occasion of various emergencies.

Changes of the operating conditions that occur in such a power system due to imbalances of active or reactive power proceed much more intensively. Accordingly, in such an energy system the special requirements are imposed for the generating equipment, as well as for the steady state and emergency control systems, related to the necessity to ensure that the parameters of the operation conditions are within the range of permissible values.

The system experiment of 2012 and the experience of operating of the power system of Kaliningrad region revealed the impossibility of using of traditional approaches to the organization of a steady state and emergency control in case the power system is allocated to work isolated from the UPS of Russia. Taking into account the current trend towards digitalization of the electric power industry, a number of scientific studies were carried out. These studies resulted in the development and implementation of the innovative technical solutions providing the organization of a digital control system in the power system of Kaliningrad region that integrates operation condition control and emergency control solutions.

In order to confirm the effectiveness of technical solutions developed and implemented in the energy system of the Kaliningrad Region, the bench tests, object tests and system tests were conducted under conditions of synchronous operation and isolated operation of the power system.

Первый автор: Dr GERASIMOV, Andrey (JSC «STC UPS»)

Докладчик: Dr GERASIMOV, Andrey (JSC «STC UPS»)

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