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Preferential Subject NPS1

Centralized power supply control system of active consumer with distributed generation sources

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The key to Smart Grid development is the establishment of new principles and control systems in power distribution and microgrids, because without it even a full upgrade of the power grid will not give the desired effect.

Despite the fact that current regulatory and legal framework for microgrid is not ready yet, the development and establishment of a centralized automatic electricity control systems (automation of power supply) will create the technical intellectual microgrid base and convert the power supply systems from passive to active.

For now, development of hardware and software on the domestic element base is actual for modern centralized power supply control systems with distributed generation sources that operate automatically in real time. Centralized power supply equipment will consist of a central processing unit, distributed intelligent electronic devices (IED) (for example, on the basis of NIPOM line terminals) located in the power and industrial units, information and communication systems according to IEC 61850 standard.

The centralized control system will be able to solve the wide range of tasks, even within existing normative and legislative framework, for example:

- optimization and adaptation of the control action for the load shedding,
- transfer of warning to staff of consumers,
- coordination and optimization of load cycle in normal regime, including its distributed generation,
- minimization of energy losses,
- maximization of reliability,
- diagnostics,
- analysis of electric power quality.

In future such automation will be an interfacing unit between customers and electric power producers.

Authors propose rules for microgrid active consumers determining based on the identification of the best options for short partial shutdown (restriction) of consumers with production reserves. Proposed optimal load shedding management will have a minimum impact on consumers.

An optimization approach is proposed to the outages, which is based on a thorough analysis of industrial reserves of various kinds of redundancy among consumers. The methodology basis of the production systems analysis is a universal simulation aggregative model. Aggregative simulation

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model is used to simulate virtually any operating system and receive virtually any of its parameters using numerical experiments on the model.

Authors present example of existing enterprise analysis: rational options are found for load capacity from 280/170 kW (winter / summer) to 40 / 20kW, load can be disabled for a period between 0.4 to 24 hours without significant impact on the consumer.

Authors propose method of optimal load shedding definition for a set of consumers. Implementation of this method is possible by means of centralized power supply control system of active consumer with distributed generation sources in a fully automatic mode.