Analysis of the current state of the issue of automation of boiler plants in the Chechen Republic

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Abstract. This article discusses the practical state of the issue of automation of boiler plants in the Chechen Republic. The authors analyzed the foreign experience of implementation and transition to automatic regulation of industrial facilities. The advantages and uniqueness of the systems used are outlined. The basic requirements for boiler house automation include safe operation and rational regulation of gas flow. In the used automated systems, important indicators are the following: their self-control, the ability to signal during an emergency shutdown of a boiler room or one of the boilers and to fix automatically the factors that caused an emergency shutdown.

With each passing year, more and more enterprises come to understand the need to build their own automated boiler room or install an automatic control system (ASR) beyond the existing boiler house. The main reasons for this are the cheapening of thermal energy and its safe generation. As practice shows, such a boiler house pays for itself and allows you to flexibly adjust the temperature regime depending on the time of year and even days, which can significantly save on thermal energy and, ultimately, make the company more competitive in modern economic conditions. To achieve the required level of functionality today, automation systems are indispensable.

The basic requirements for boiler house automation include safe operation and rational regulation of gas flow. In the used automated systems, an important indicator is their self-control, the ability to signal during an emergency shutdown of a boiler room or one of the boilers and automatically record the causes that caused an emergency shutdown. One of the important features of automated gas boiler systems is the complete control of the safe operation of equipment [1]. Therefore, the designed modern automated systems consist of instruments and equipment that provide comprehensive regulation of the regime and the safety of their work. Integrated automation of boiler houses implies a reduction in the number of staff depending on the level of automation. In some systems used, when automating all technological processes in boiler rooms, including remote operation of boilers, it becomes possible to control the operation of boiler houses directly from the control room, while personnel are completely withdrawn from the boiler rooms.

Separately, it should be noted that over time, the requirements for a microclimate in residential premises increase, which are even more specific by the production technology. Modern production technology involves the creation of several zones with different temperature conditions within the same room, various air exchanges in adjacent rooms and zones, with strict observance of the norms.
These tasks can be solved only with a sufficiently high level of automation of control of heating and ventilation systems.

Unambiguously, a modern boiler house does not do without special automated systems that combine all the latest innovations in the field of heat flow control.

In the Chechen Republic, a multidisciplinary plant is operating, engaged in the production of high-tech equipment Teplostroyproekt-S.

The Teplostroyproekt-S plant is the largest producer of energy and thermal equipment in Russia. This is a modern diversified enterprise working in the field of heat power engineering. Today, the company is one of the largest enterprises producing modern energy equipment in the Southern Federal District and North-Caucasian Federal District. The Teplostroyproekt-S plant is also engaged in the modernization of existing boiler facilities with the design and installation of automated control systems (ACS) equipped with all the necessary metering and regulation devices.

![Figure 1. Block diagram of boiler plant automation](image)

As already noted, the reliability and safety of the functioning of boiler houses and other engineering facilities in modern conditions is ensured by a single complex of control and management of technological processes - a system of supervisory control and management, created on the basis of a SCADA system and an industrial computer. Automated workstation (APM) allows you to present a convenient control interface in the form of mnemonic diagrams, charts, tables, carry out alarms for emergency stops, generate a lot of reports on the operation of the boiler room per day, week, month, year.

Today, for tying boilers, it is often recommended to use a thermo-hydraulic distributor, which ensures a constant flow of water through the heating elements, which does not depend on the flow of the coolant in the heating circuit. In this case, the balanced operation of the boiler itself and all heating circuits is guaranteed [2]. As a rule, modern boilers, even in the basic configuration, come with protective modules and automatic burner. For existing boilers that require replacement of controller equipment, the Russian market offers various options for ready-made control cabinets, which include programmable logic controllers (PLCs), with which the heating system can be easily integrated into a remote dispatch system. Control cabinets are designed for each specific boiler room.

It is also possible to view all data via the Internet [3].
Each boiler room automation system is unique. The supervisor management system allows for real-time operational control by a minimum number of employees. At the same time, the risk of emergency situations is significantly reduced. Depending on the needs of the boiler house, both local and remote supervisory control are possible. Local supervisory control involves placing all the necessary elements of a control system, including a control room, within the engineering facility itself. Remote supervisory control implies the management of the facility and control of its activities with the help of a central control desk, geographically located at a distance from the facility itself. Technically remote supervisor control is carried out using GSM and GPRS wireless technologies.

The main advantage of boiler room supervisory control is continuous monitoring, independent of the “human factor”. Supervisory control allows you to control the basic processes occurring at the facilities, and their compliance with certain specified parameters, also involves separate control of the operation mode of each boiler installation, change of boiler temperature and determination of the burner operation mode. In addition, for monitoring, the set and actual temperature for individual circuits and for the boiler room as a whole, as well as the temperature in the boiler, are included in the number of parameters. Continuous readings of the pressure of water and gas in the system, all safety signals on the boiler and the state of the valves and throttle valves are monitored. The control circuit also includes the operating parameters of the loading pump and the recirculation pump of the gas-air system (DHW) [4]. When the parameters go beyond the set limits of safe operation, the boiler facility automatically stops. Information on detected violations through one of the control channels is transmitted to the local console and to the central console through one of the communication channels. Information about processes, parameters and their violations is stored in the database of the control room. Events are recorded in electronic journals using a special program automatically. If necessary, sensors for measuring analog quantities are connected to the supervisor control system, and this provides a comprehensive solution for managing and monitoring the facility. The maximum autonomy of work in the supervisor control system is provided by equipment with a built-in uninterruptible power supply (UPS), which supports the system for a certain time when the power supply is unavailable.
Cost recovery for supervisory control of a boiler facility is fast, due to a reduction in the number of operator jobs. A centralized notification of deviations from the set parameters allows you to organize the maintenance of several industrial facilities by the forces of one operational duty brigade. With supervisory management, there is no need for a permanent presence at the facility staff [5].

Based on the foregoing, we can say about the many advantages of automated systems.

References
[1] Malafeev V A 2003 Heating is part of the Russian energy sector Energy: economics, technology, ecology 7 9–15
[2] Draganov B Kh et al 2005 Heat engineering (Kiev: Astra Paul)
[3] Kotler V R 2006 Mini-CHP - foreign experience Heat power engineering 8 69–71
[4] Shevchenko G L, Pererva V Ya, Foris S N and Adamenko D S 2011 Automation of boiler plants (Dnepropetrovsk: NMetAU)
[5] 2017 Problems of general energy. Scientific collection (Kiev)