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## OPTIMIZATION OF WATER SUPPLY SYSTEMS FOR INCREASED RESOURCE EFFICIENCY

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**The problem statement.** Modern challenges associated with a growing population, climate change, and limited natural resources pose the task of ensuring sustainable and efficient use of water resources for society. One of the key sectors that determines the viability of any settlement is the water supply system. Optimizing this system becomes a relevant task to ensure the efficient use of resources and support sustainable development.

**Research Findings.** The optimization of water supply systems involves finding optimal solutions to provide the necessary volume of water with minimal resource consumption. This includes improving infrastructure, utilizing advanced technologies, and implementing effective management methods.

**Infrastructure Improvements:** Modernizing and expanding infrastructure play a crucial role in ensuring the reliability and efficiency of water supply systems. This may involve the reconstruction of pipelines, expansion of reservoirs, and enhancement of water supply and distribution systems.

**Utilization of Advanced Technologies:** Implementing cutting-edge technologies in the processes of water purification, pumping, and distribution allows for an increase in the system's efficiency. For example, the use of modern water purification methods can significantly improve water quality.

**Effective Management:** The development and implementation of efficient management methods play a critical role in ensuring the optimal functioning of water supply systems. This may include automated monitoring systems providing real-time information about the system's status.

**Energy Efficiency:** Targeted reduction of energy consumption in water supply systems is crucial for reducing environmental impact and conserving resources. The use of energy-efficient technologies and alternative energy sources can be a significant step in this direction.

**Monitoring and Data Analysis:** The use of modern monitoring and data analysis systems enables the timely detection and response to problems, as well as analysis for improving the efficiency of systems in the future.

Integration of these aspects into the process of optimizing water supply systems contributes to achieving a balance between meeting consumer water needs and the rational use of resources, promoting sustainable development, and economic efficiency.

One key aspect of optimization is reducing the energy consumption of water supply systems. This can be achieved by implementing energy-efficient technologies for water purification and pumping. The use of renewable energy sources and the implementation of energy-saving systems can significantly reduce electricity consumption.

Effective optimization of water supply systems includes improving water supply management, identifying and eliminating technical losses, and implementing reserve systems to ensure system stability in emergency situations.

Innovative technologies in the optimization of water supply systems play a crucial role in increasing the efficiency and stability of these systems. Sensor systems and data collection and analysis systems become essential elements for improving management and ensuring the reliability of water supply. Let's consider some aspects of using innovations in this context.

Modern sensor technologies allow real-time measurement of water quality parameters, such as contamination levels, concentrations of chemical substances, or bacterial contamination. This enables the prompt detection of anomalies and quick responses to changes in water composition.

The use of intelligent systems for measuring and predicting water consumption allows real-time optimization of water supply systems. This contributes to reducing water losses through pipelines and improving resource efficiency.

Connecting various components of water supply systems through the Internet of Things (IoT) allows centralized control and management of the entire system. Monitoring and management can be done using mobile applications or web platforms, simplifying the management process and responding to potential problems.

Data collection systems allow the accumulation of large amounts of information about the functioning of water supply systems. The application of analytical methods and artificial intelligence enables forecasting, trend detection, and the development of optimal management strategies.

The integration of innovative technologies allows the development of automatic response systems to unforeseen situations. For example, automatic shutdown of sections of the water supply system in case of leaks or other emergencies.

**Conclusion.** Optimizing water supply systems is a key element of sustainable development and ensuring sustainable access to water resources. The implementation of advanced technologies, energy-saving systems, and efficient management can significantly improve the operation of water supply systems and ensure economic and ecological sustainability. Taking these measures is an important step in the development of modern urban and rural areas.

### References

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