

## District Heating - Improving Energy Efficiency in Niš

Supported by the United States Agency for International Development (USAID) through the Serbia Energy Efficiency Activity and implemented with E3 International's technical expertise, pilot projects at district heating companies in Pančevo, Niš, and Čačak are showcasing how modern technologies, data-driven management, and U.S. best practices can improve efficiency and reduce operating costs.

### Niš Substation and Boilerhouse Renovation

In Niš, Serbia's third-largest city, roughly one-third of the population relies on the municipal district heating network for warmth in the winter. The municipal district heating company, JKP Gradska Toplana Niš (DHC Niš), sought to increase efficiency of heat generation and distribution to reduce costs and improve customer satisfaction. To achieve this goal, DHC Niš needed to employ remote monitoring and control systems, techno-economic optimization of district heating systems, environmental protection mechanisms, and renewable energy sources, among other interventions.

USAID worked with DHC Niš to upgrade two key heating network facilities: the Majakovski boiler house and the Ratko Jović thermal substation.

USAID supported the design and installation of high- efficiency burners and a boiler control system at Ratko Jović, one of 14 boiler houses in the system, and the design and installation of a supervisory control and data acquisition (SCADA) system at Majakovski. The systems were implemented by local Serbian engineers and suppliers.

DURING THE 2019-2020 HEATING SEASON, NIŠ REPORTED



**GAS SAVINGS OF 195,000 m<sup>3</sup>**

WHICH TRANSLATES TO



**COST SAVINGS OF €66,000**

During the 2019-2020 heating season, the high- efficiency burners and boiler control system at Ratko Jović reduced natural gas consumption by 40 percent, and the new SCADA system at Majakovski reduced natural gas consumption by 8 percent, resulting in a combined savings of €66,000.

### JKP GRADSKA TOPLANA NIŠ DISTRICT HEATING TECHNICAL CHARACTERISTICS

Substations	<b>1,045</b>	Total Heating Area, Public Buildings	<b>375,830 m<sup>2</sup></b>
Number of Flats Connected to DH System	<b>29,784</b>	Total Heating Area, Residential	<b>1,647,299 m<sup>2</sup></b>
Percentage of Flats Connected to DH System	<b>34%</b>	Total Heating Object, Public Buildings	<b>76 MW</b>
Total Heating Area	<b>2,023,129 m<sup>2</sup></b>	Total Heating Object, Residential	<b>243 MW</b>
Number of Heat Sources	<b>14</b>	Total Installed Capacity	<b>250 MW</b>

## How It Works: Majakovski Efficiency Upgrades

The Majakovski Boiler House was built in 2010 with funding from the German Development Bank (KfW) and is supplied with a 14 megawatt (MW) gas-fired boiler. The equipment (hardware) is modern, of high quality, and well-designed. However, it is also operated manually, and thus subject to the operator's perception of needed control intervention.

The substation is equipped with some data readouts, which are used by operators to control the operation. For example, if the digital readout shows temperature above the desired level, the operator manually reduces heat input into the heat exchanger. In another case, the operator reads the values (temperature, pressure, flow, etc.) from the digital display and manually types the numbers into a spreadsheet on a laptop and also enters them in the paper-based logbook.

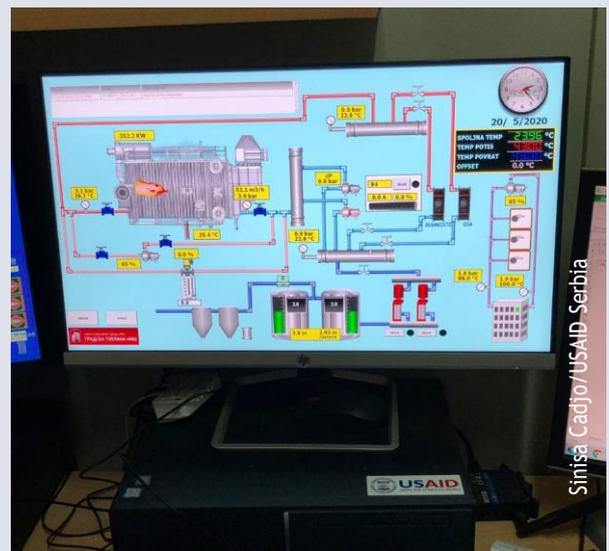
Human intervention in the control of the plant is subject to operator error, slow reaction time to correct problems, and inaccuracies in the existing sensors and data readouts, all of which decrease plant efficiency and increase natural gas consumption.

Interventions at the Majakovski Boiler House include:

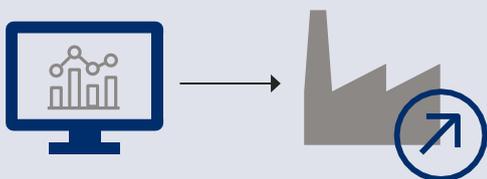
- A new central automation terminal in the command room;
- A new electro cabinet and required temperature sensors; and
- Cabling with appropriate cables and connection of all equipment.



Temperature sensors and ancillary equipment at Majakovski



DHC Niš Central Automation Server



The new calorimeters and new SCADA enable more efficient plant operations and better management and control based on more accurate data.

DHC Niš installed two new calorimeters and one flow meter at the most critical positions (network inlet/outlet, boiler inlet/outlet). A new SCADA was installed according to the existing condition of the plant and will be upgraded in the next phase of renovations in accordance with the hardware upgrade of the complete boiler room (new measuring points, establishment of communication between the most important technological sub-units within the plant, etc.).

Additional savings are expected with the second phase of renovations: the boiler room hardware and software will be further upgraded, with the final goal of complete automation and automatic control of the entire plant based on the outside temperature.

## How It Works: Ratko Jović Substation Automation

The Ratko Jović thermal substation was constructed and commissioned in 2009 under a European Union assistance program. Its main equipment, including a gas-fired boiler, heat exchangers, valves, and basic control system components, are relatively new and in good working condition. However, the substation was operated manually, which causes significant variation and poor control of heat supply, resulting in substantial energy use inefficiency.

DHC Niš resolved issues stemming from manual operation by implementing a SCADA system to automatically control substation operation by reducing heat output based on customer demand and outdoor temperature, making the system significantly more energy efficient.



The company also installed a new gas burner that better fits actual demand. The original design assumed a much larger heat load (by buildings that were never built), and the existing burner was operating far below its design capacity, causing substantial burner cycling (up to 160 times per day), which is very inefficient and wastes large volumes of natural gas.

The original design included a 1.9 MW burner, but heat demand is less than 1 MW, meaning the burner is approximately twice the size needed. In addition, the substation's built-in elements are not compatible, so it is not possible to achieve optimum operating technology and operate the boiler room according to the appropriate regime.

Therefore, DHC Niš completed the following renovations:

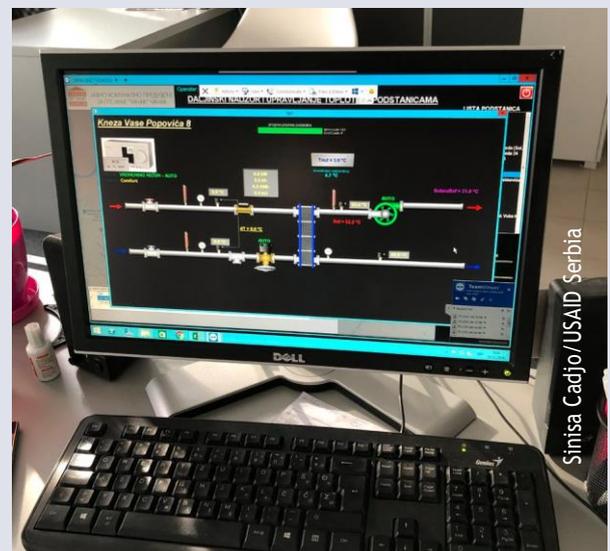
- Installation of a burner that is compliant with the current and projected natural gas consumption and existing boiler, which provides for combustion power in the range of 150-1,100 kW;
- Introduction of a hydraulic switch to improve the hydraulic balance in the system; and
- Upgrades to the central control and management system to increase energy efficiency and improve the reliability and availability of the plant in general.



Automation system at Ratko Jović



New burner (in red) at the DHC Niš Ratko Jović substation



Temperature sensors and ancillary equipment at Ratko Jović

## Costs and Savings

At an installed cost of approximately €122,000, investment in the boiler house upgrades and SCADA system has been extremely cost-effective for DHC Niš, allowing management to improve system performance, reduce operating costs through lower gas consumption, and increase customer satisfaction.

**€122,000**  
INVESTMENT



**2.1 YEARS**  
SIMPLE PAYBACK

## In Their Own Words

“ JKP Gradska Toplana Niš is strongly satisfied with the cooperation on these projects and the what has been done to upgrade and improve the existing condition in the best possible way, with installation of high-quality equipment and application of the most optimal actions in order to increase energy efficiency of Majakovski and Ratko Jović boiler rooms. All of the above has resulted in many benefits, and even greater savings are expected with the realization of the second phase of this project, which is useful to both JKP Gradska Toplana Niš and its users.”

PREDRAG MILAČIĆ, DIRECTOR, JKP GRADSKA TOPLANA NIŠ

## Disclaimer

*This activity was largely implemented by E3 International under its engagement on the USAID Serbia Energy Efficiency Activity (SEEA) in cooperation with TetraTech, Inc.*