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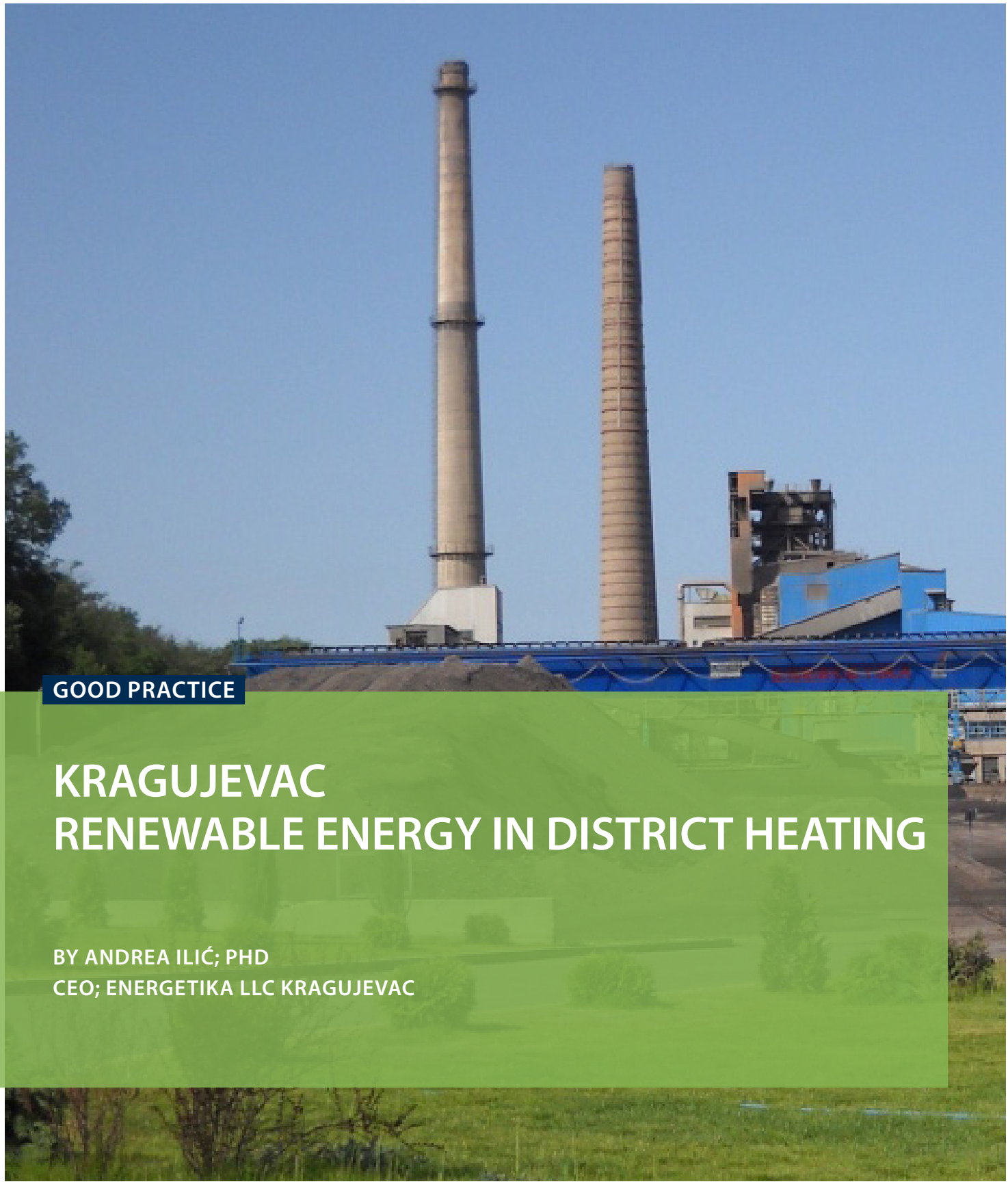

GOOD PRACTICE

KRAGUJEVAC
RENEWABLE ENERGY IN DISTRICT HEATING

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Partners of Connective Cities

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Overview

The City of Kragujevac used to be the first city in Serbia (and Yugoslavia) to build a district heating system in the year 1884, with a special system for heating the factory rooms of the Topolivnica and the Military Technical Institute. The current primary business of Energetika Ltd is the production and distribution of thermal energy for district heating of Kragujevac and Zastava. That caused significant pollution of the environment due to emissions of pollutants into the air and water, as well as large amounts of disposed ash and slag. DH Company and City of Kragujevac face challenges to become financially and environmentally sustainable.

Focus

The idea revolves around leveraging disaster management and fire services to showcase successful outcomes resulting from implemented actions and strategies. Central to this concept is the emphasis on continuous improvement through ongoing learning and the exchange of expertise, knowledge, and experiences among all involved participants.

Background

Limited Liability Company for Production and Distribution of Energy and Fluids and Provision of Services "ENERGETIKA" Kragujevac is a state-owned company whose main area of business is steam supply and air conditioning. In addition to this main activity, the Company also performs:

- Transformation and distribution of electricity
- Production and distribution of demineralized (DM) water.

With the restructuring of the Zastava Group on December 31, 2000, Energetika became an independent business entity, based on the Establishment Agreement, as a Limited Liability Company.
In year 2021 coal fired boilers were replaced with gas fired boilers and new plant starts operating in heat season 2022/2023. That project reduced environmental pollution from the DH plant significantly.

Emissions: Before / After

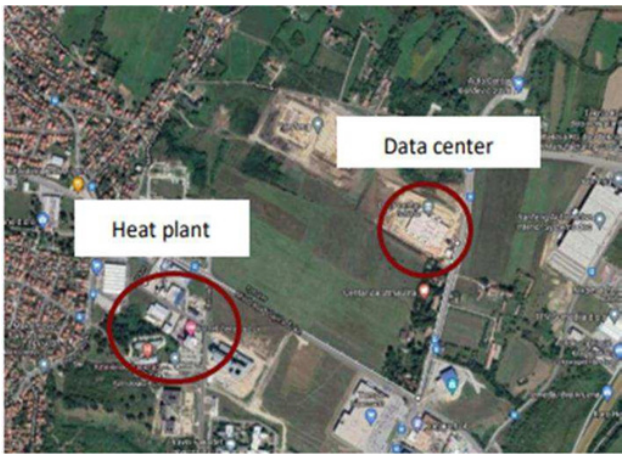
No.	Boiler plants	Unit	Pollutant			
			SO_2	NO_X	CO	PM
1.	Existing coal fired boiler plants	mg/Nm^3	2815	564	105	509
2.	New gas fired boiler plants	mg/Nm^3	0	≤100	≤100	0
3	Existing coal fired boiler plants	t/y	556.03	110.05	20.562	99.3
4	New gas fired boiler plants	t/y	0	≤12.05	≤12.05	0

Objectives

Aim of the project is the utilization of waste heat from a data center and feed in the district heating network by a heat pump. The data center is planned for 2 expansion stages and the first one is in operation for less than two years. Total useful area of the data center is 15.000m^2. Inside temperature for the IT systems is set by 21°C and cooled by electrical driven chillers. The data center is located near to the heat plant Boiler house "Aerodrom".

Activities

The currently installed cooling capacity of the 2 modules is 4,4MW. Due to the expansion of the data centre to 4 modules the cooling capacity will probably be doubled which is planned for the upcming years. The cooling system is designed for redundant operation.
Decentralized air-cooled water chillers with integrated heat exchangers are used. In total about 32 units will be installed from which 16 are already installed which means a cooling capacity of about 275kW per unit.
The cooling water supply/ return temperatures of the chillers is designed for 5/10°C. Utilization of heat from the chillers can in general be done in 2 ways - Heat extraction of condensing heat - Heat extraction of cooling water In general, both ways should be possible but utilization from the cooling water circuit would be the easiest way as there are no changes on the cooling machines. Two rooms are hydraulic connected to 2 cooling machines. In this case one additional heat exchanger can be used for 2 rooms which mean in total 16 heat exchangers are required (8 for each module).



Position of the Data Center and the Heat Plant

The average heat dissipation of the server rooms is currently about 1.920kW and will probably be doubled for the second stage. Based on the current situation the nominal capacity of the heat pump is up to 2MW. In full operation up to 4 MW of heat capacity from the heat pump can be expected. In this case a split of 2 machines is possible which has many advantages (backup, stable operation, partial load, etc.). In this assessment the full expansion was considered. It is supposed to integrate the heat pumps in the return line to raise efficiency. The electrical savings of the data center were calculated based on an average heat emission of 700kW per module (2.800kW in total). The waste heat potential of the data center can be up to 6,3MW in full operation which raises heat pump capacity, electricity savings and improves economic parameters of the project. Effects to the system and plants will be checked in the feasibility study.

Effects

District heating presents an effective way of making the most of the available heat resources, reducing the carbon intensity of heat and reducing fuel costs. Thinking long-term, the City of Kragujevac has a clear role to play in rising to the climate change challenges, starting already the decarbonization process of its DH system. Following the Energy Sector Development Strategy of the Republic of Serbia by 2035, reduction of greenhouse gas emissions, adapting to the effects of climate change and re- asserting the low carbon credentials will mark the next phase in City of Kragujevac transition to a low carbon future. The Strategy set the clear goals in the district heating sector which the local government will follow, such as:
• Providing heat for safe supply of households and industry by strictly following environmental protection norms,
• Increase of energy efficiency in generation, transport, distribution and heat use,
• Higher use of RES, and
• Sustainable business operation of heat producers.
To achieve these goals the key actions to be taken are:
• Continuous modernization of existing district heating systems
• Establishing and applying a unique tariff system for heat production, distribution and supply,
• Institutional connection of systems, and
• Extension of the existing district heating system.

Looking at the experience of the EU countries, particularly those in Scandinavia, in the long-term planning of the DH systems, the DH Companies have been going through long transitional process developing systems from one to next generations. Although many of the DH companies in Scandinavia are moving to 5th generation already, the Consultant sees that the 4th generation of DH systems is good reference to set up the strategic development of the DH system in Kragujevac.

The long-term strategy for the DH system in the City of Kragujevac will be focused on the future development of district heating within the city as a whole, taking into account the existing system, and modification of the existing DH system to meet the characteristics of DHSs of the 4th generation.

Energy sources currently used in the systems of Enegetika llc are 100% fossil fuels. Transition to the energy mix composed of fossil fuels and renewable energy sources in a period of 15 years begin with the first projects identified increasing the share of renewable energy source

To achieve this, a transformational change in the energy use in the DH system is needed by reducing demand and investment in infrastructure. This will deliver a long-term affordable, low carbon heat supply in the City of Kragujevac.
The planned priority projects "Energetika d.o.o" will implement in the short-term for the next period of 3 years are:
a) Utilization of the waste heat from the Data Centre in Kragujevac.
b) Energy efficiency measures in the DH system.
Based on their expected and achieved results, strategic goals and target for the long-term arise.

More information: www.energetika-kragujevac.com

Conclusion

The City of Kragujevac has a clear role to play in rising to the challenges of climate change, starting already the decarbonization process of its DH system. As a transitional step the City has implemented the project of modernization of the DH system – the construction of 5 new boilers with total capacity of 110 MW, switching from coal to natural gas in the boiler house "Main location". Looking longterm, further efforts are needed through the use of renewable energy sources (RES), and promotion of energy efficiency measures has to be significantly enhanced as well. However, efforts have to be measured and quantified in order to understand if promised targets can be reached.

Having cheaper district energy as much as possible, achieving a high energy standard for maximized population and economy, with sustainable development are the main tasks in planning and implementing district energy projects.

Connective Cities – International Community of Practice for Sustainable Urban Development

Since 2013, Connective Cities promotes the worldwide exchange of municipal expertise, disseminates proven-practice solutions for sustainable urban development, and supports peer learning between German and international experts from municipalities, as well as the jointly development of project ideas within the framework of structured learning processes. Connective Cities is a joint project of the Association of German Cities (Deutscher Städtetag), the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH and Engagement Global with its Service Agency Communities in One World (SKEW). The project is funded by the German Federal Ministry for Economic Cooperation and Development (BMZ).

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