European Bank
for Reconstruction and Development

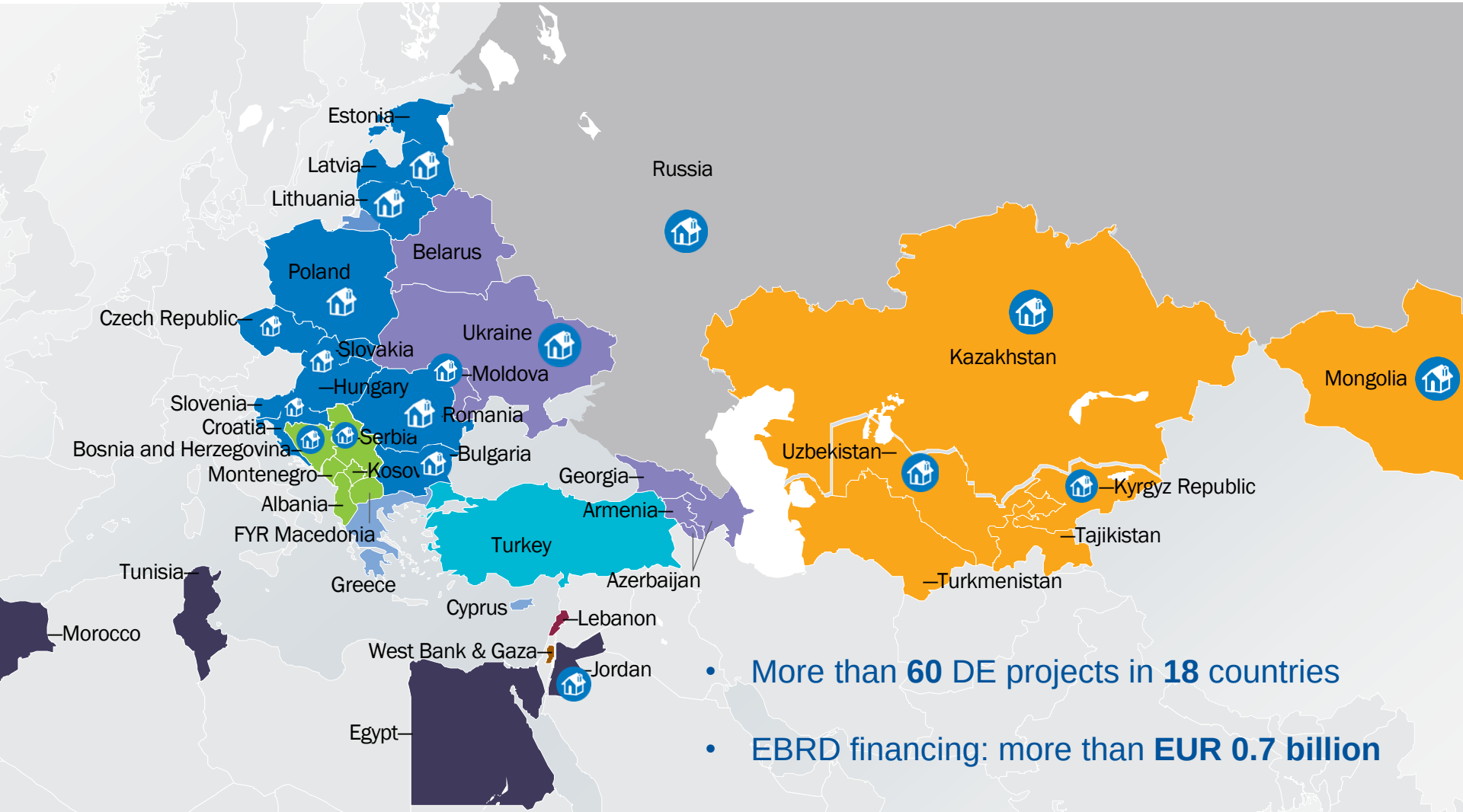
EBRD support for low carbon and renewable district energy

Energy Community workshop on efficient district heating

June 2020

EBRD District Energy Projects

European Bank
for Reconstruction and Development



- More than **60** DE projects in **18** countries
- EBRD financing: more than **EUR 0.7 billion**
- Total projects' capex: **EUR 1.6 billion**

Renewable District Energy in the Western Balkans (ReDEWeB)

European Bank
for Reconstruction and Development

PROGRAMME DESCRIPTION

- ReDEWeB aims to enable renewable district energy investment in the Western Balkans
- **EUR 4 m funds available for 2019-2022, for both technical assistance and investment grants, funded by the Government of Austria**
- **Additional EUR 8.5m funded by SECO, to be utilised in Serbia for CAPEX grants, policy and TC work**

TYPE OF SUPPORT PROVIDED

- Policy support for renewable district energy
- Project preparation and feasibility studies
- Capacity building and networking
- Capex grants

GEOGRAPHY

- All WB countries

TARGET ACTIVITIES

TA component will support four areas of activity:

I. **National policy activities** developed in close cooperation with Energy Community Secretariat - ECS (supporting development of country Renewable District Energy action plans, supporting countries to meet their RE and EE targets from Energy Community Treaty)

II. **City policy activities** (integrating ReDE sources, generation and storage into municipalities' urban planning, introducing ReDE generation and EE measures for selected cities, advocating consumption based billing, etc.)

III. **Project preparation support to cities and developers** (mapping of DE consumption in selected municipalities, mapping of economically feasible RE sources, preparation of Feasibility studies, designs and PPP proposals for ReDE, etc.)

IV. **Capacity building** (education, networking and knowledge sharing; establishing a network of ReDE professionals; organising annual ReDEWeB conferences)

V. **Capex grants for selected projects**

The price of thermal energy from fossil fuels and renewable sources in district heating

European Bank
for Reconstruction and Development

Indicative prices for heat energy including all life-cycle costs:

Fossil fuel:

- Natural gas or heavy oil - boiler– (between 70 and 200 €/MWh) ?

Renewable sources of thermal energy:

- Solar thermal – between 35 and 45 €/MWh.
  - After the repayment of the investment - 2 €/MWh
- Heat pumps (without a high temperature geothermal) - between 30 and 45 €/MWh
- Solid waste to energy – up to 30 €/MWh
- Biomass – 40 - 45 €/MWh
- Geothermal energy – 30 – 40 €/MWh depends on temperature, yield and distance.
- Waste heat (data centers, industry, refineries …) – depends on conditions

Projects and technologies 1/2

European Bank
for Reconstruction and Development

No	City	Technology used	Partners
1	Pančevo (Serbia)	Solar thermal with seasonal storage and geothermal energy with heat pump	ReDEWeB & ReDE Serbia with MoME
2	Novi Sad (Serbia)	Solar thermal with seasonal storage and heat pumps that use heat from sewage and the River Danube	ReDEWeB with local self-government
3	Becej (Serbia)	High-temperature geothermal energy	ReDEWeB & ReDE Serbia with MoME
4	Vrsac (Serbia)	Heat pump that uses heat from the Wastewater Treatment Plant	ReDEWeB & ReDE Serbia with MoME
5	Krusevac (Serbia)	Heat pump that uses heat from the Wastewater Treatment Plant	ReDEWeB & ReDE Serbia swith MoME
6	Kraljevo (Serbia)	Heat pump that uses waste heat from flue gases	ReDEWeB & ReDE Serbia with MoME
7	Kragujevac (Serbia)	Heat pump that uses waste heat generated by the servers of the Data Center in Kragujevac	ReDEWeB & ReDE Serbia with MoME
8	Nis (Serbia)	Solar thermal and heat pumps that use low-temperature groundwater Construction of deep geothermal wells	ReDEWeB & ReDE Serbia with MoME
9	Bogatic (Serbia)	High-temperature geothermal energy	ReDEWeB & ReDE Serbia with MoME
10	Paraćin (Serbia)	Heat pump that uses geothermal water to start reusing district heating system that is out of operation	ReDEWeB & ReDE Serbia with MoME
11	Vrbas (Serbia)	Heat pump that uses geothermal water	ReDEWeB & ReDE Serbia with MoME
12	Priština (Kosovo*)	Solar thermal with seasonal storage	Cooperation with KfW and ReDEWeB

Projects and technologies 2/2

European Bank
for Reconstruction and Development

No	City	Technology used	Partners
13	Sarajevo (B&H)	Heat pumps that use geothermal water, sewage system and river water	ReDEWeB with local self-government
14	Banja Luka (B&H)	Heat pumps that use industrial waste heat	ReDEWeB with local self-government
15	Gradiska (B&H)	Biomass	ReDEWeB with local self-government
16	Zenica (B&H)	Solar thermal with seasonal storage and heat pumps using sewage systems	ReDEWeB with local self-government
17	Zabljak (Montenegro)	Biomass and the establishment of a new District Heating System	ReDEWeB with local self-government
18	Korca (Albania)	Solar thermal with seasonal storage and heat pump using sewage systems and the establishment of a new District Heating System	ReDEWeB with Ministry of Infrastructure and Energy and local self-government

DHS Sarajevo

European Bank
for Reconstruction and Development

Parameter	DHC-Toplane Sarajevo d.o.o. Sarajevo
Foundation date	**1977**
Owner	**Canton Sarajevo**
Number of boiler houses	**146**
Roof BH	**98**
Other BH	**48**
Installed capacity of all boilers [MW]	**523**
Engaged heat energy - consumed [MW]	**338**
Generated annual district heat [GWh]	**442**
Length of pipeline [km]	**182**
Number of heat substations	**195**
Number of connected residential consumers	**50,449**
Area of connected residential buildings	**2,935,140**
Number of connected commercial consumers	**2,395**
Area of connected commercial buildings	**552,713**
Fuel	**Natural gas/Light fuel oil**

NIRAS

WWTP Butile - DHS Sarajevo

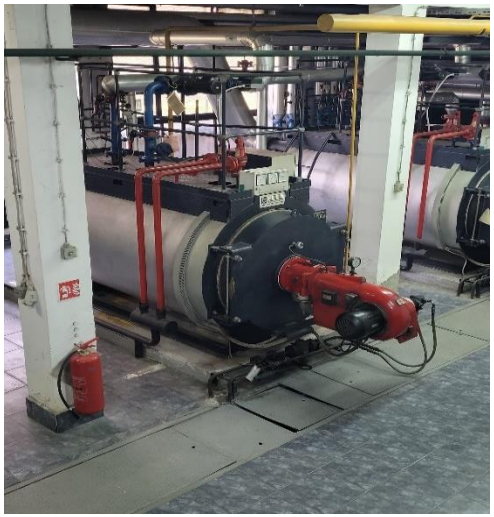
European Bank
for Reconstruction and Development

NIRAS

DHS Sarajevo

European Bank
for Reconstruction and Development

INDEPENDENT BH



ROOF BH

NIRAS

WWTP Butile

European Bank
for Reconstruction and Development

As the final output of the waste water treatment process is purified wastewater (effluent), considered as a valuable heat source that could be utilized in the heat pump system that can be integrated in the DH system of KJKP Toplane-Sarajevo. The amount of effluent varies seasonally, during the day, and also depends on rainfall.

- The flowrates of the effluent varies from 3,500m^3/h to over 5,000m^3/h. As the data taken to consider the possibility of this water serving as a source for obtaining heat, 4,000m^3/h was adopted
- The temperature of the water varies between 9.5 and 14^oC, as the value for the calculation is the adopted temperature of 10^oC.

NIRAS

WWTP Butile - DHS Sarajevo

European Bank
for Reconstruction and Development

- The idea is to raise the energy contained in the purified water to a higher temperature level via a heat pump and connect it to the boiler houses via a new pipeline.
- It is calculated that it is possible to obtain 36MW of thermal capacity.
- Due to its scale, this project would be implemented in two stages of 18MW+18MW

NIRAS

WWTP Butile - DHS Sarajevo

European Bank
for Reconstruction and Development

HP UTILIZING TREATED WASTE WATER FROM WWTP IN BUTILE						
STAGE	BOILER HOUSE	Installed capacity	Engaged capacity	Heated area	Average heat consumed (2019 - 2021)	Natural gas consumption
		MW	MW	m^2	MWh/year	m^3
I	K-5 Alipašino Polje	56	48.8	504,354	70,049	8,501,120
I	K-1 Alipašino Polje	6	4.2	40,685	5,086	597,602
I	K-2 Alipašino Polje	6	4.7	41,574	5,197	610,663
I	K-3 Alipašino Polje	5	4.7	38,13	4,766	560,077
I	K-4 Alipašino Polje	6	4,3	42,042	5,255	617,536
II	Otoka	14	12.0	84,357	11,716	1,421,879
II	Čengić Vila II	32.5	20.4	213,248	29,618	3,594,383
II	Hrasno	42	36.3	298,631	41,477	5,033,567
II	Grbavica II	7	6.4	52,505	6,563	771,228
TOTAL		**174.5**	**141.8**	**1,315,526**	**179,727**	**21,708,055**

NIRAS

WWTP Butile - DHS Sarajevo

European Bank
for Reconstruction and Development

STAGE I:

Installation of one heat pump 18MW and connection to boiler houses K5 and then to K1, K2, K3 and K4 in Alipasino polje

The Phase I includes the following activities:

- Installation of an 18MW heat pump in Butile and preparation for the project phase
- Electricity supply to the heat pump and preparation for the second phase of the project
- Construction of a pipeline with a length of about 6.5 km from Butile to boiler house K5 on Alipašino polje and a pipeline with a length of 2 km from boiler house K5 to boiler rooms K1, K2, K3 and K4 on Alipašino polje.
- Hydraulic connection of pipelines in boiler room K5 and preparation for the second phase of the project
- Improvement of thermal substations for the possibility of reducing the return temperature
- Installation of economizers on the boilers of boiler room K5

STAGE II:

Installation of the second heat pump 18MW and connection to boiler house Otoka, Čengić vila 2, Hrasno and Grbavica

The Phase II includes the following activities:

- Installation of a second heat pump of 18MW in Butile,
- Electricity supply to the heat pump (substation),
- Construction of a pipeline with a length of about 6.5 km from boiler house K5 in Alipašino polje to boiler houses Otoka, Čengić vila 2, Hrasno and Grbavica
- Improvement of thermal substations for the possibility of reducing the return temperature and additional hydraulic balancing of objects in the 90/70C system
- Installation of economizers on boilers of boiler houses that would remain in operation in terms of meeting peaks

NIRAS

WWTP Butile - DHS Sarajevo

European Bank
for Reconstruction and Development

Parameters	Stage I	Stage I and II
Baseline scenario		
Heat production [MWh/year] stage I	90.353	179.727
Specific heat production costs from NG [EUR/MWh]	78,3	78,3
Annual energy cost [EUR] NATURAL GAS	7.071.333	14.066.046
CONSUMPTION OF NATURAL GAS m3	10.886.998	21.708.055
Project scenario		
Heat pump installed capacity [MW]	18	36
Heat production from heat pump [MWh/year]	75.600	151.200
Electricity consumption for HP and pumping [MWh/year]	23.184	47.376
Price of electricity [EUR/MWh]	80	80
The percentage of energy that will be provided by the heat pump	83,67%	84,13%
Total annual cost savings [EUR/year]	4.021.993	8.207.667
Estimated value of investment [EUR]	24.150.000	41.160.000
Simple payback period [years]	**6,0**	**5,0**

NIRAS

DHS Kragujevac

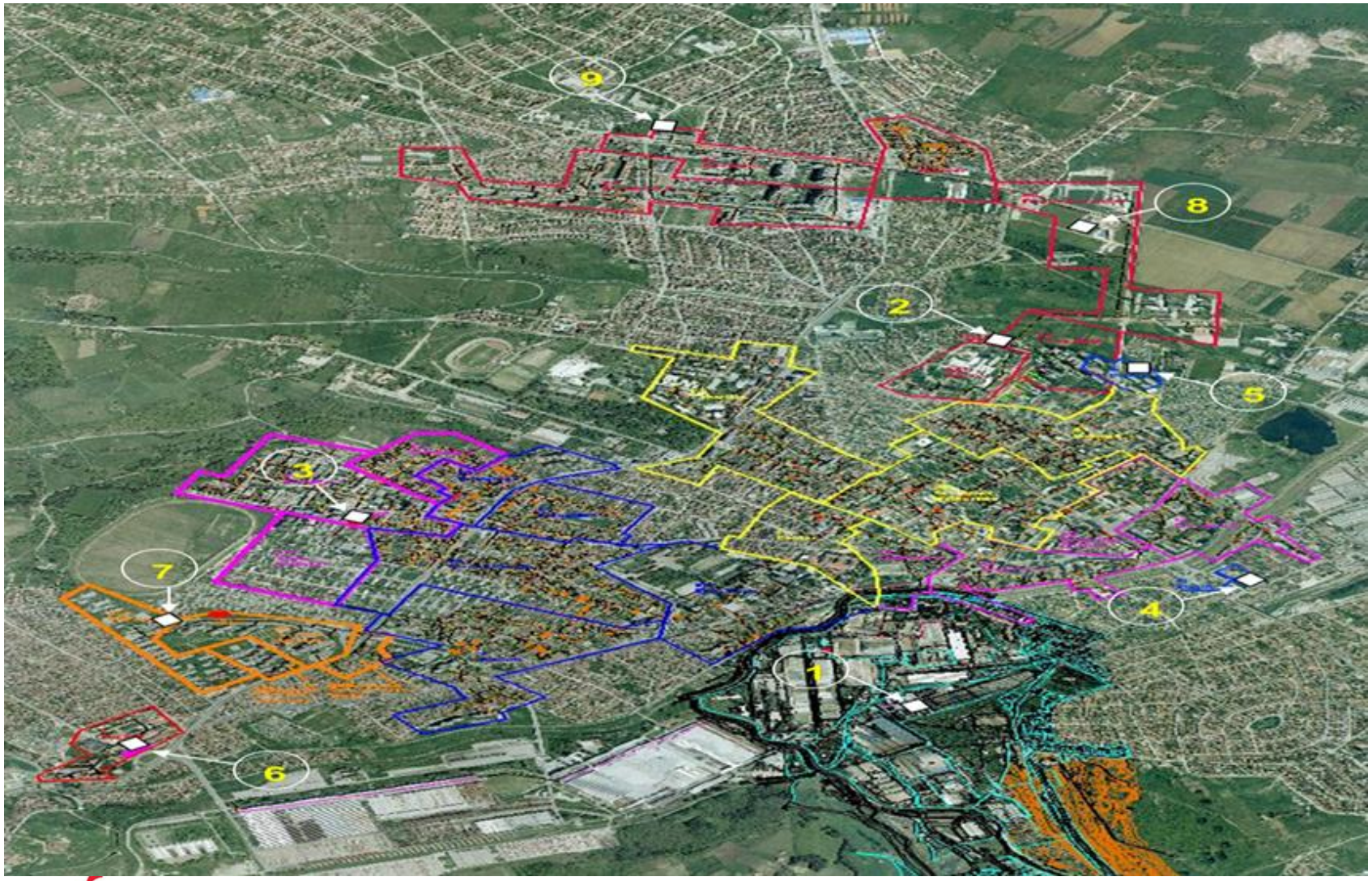
European Bank
for Reconstruction and Development

Parameter	DHC – Energetika doo Kragujevac
Foundation date	**1961**
Owner	**City of Kragujevac**
No. of boiler houses (BH)	**6**
No. of boilers	**21**
Installed capacity of all boilers [MW]	**432.59**
Engaged heat energy – delivered to the heating stations [MWh]	**253,121**
Generated annual district heat [MWh]	**282,892**
Length of pipeline [km]	**71**
Number of heat substations	**2,128**
Number of connected residential consumers	**20,865**
Area of connected residential buildings	**1,085,417.16**
Number of connected commercial consumers	**1,331**
Area of connected commercial buildings	**447,234**
Fuel	**Natural gas/Light fuel oil**

NIRAS

DHS Kragujevac

European Bank
for Reconstruction and Development



NIRAS

DHS Kragujevac

European Bank
for Reconstruction and Development

No.	Boiler house	Until May 2022		From October 2022	
		Stable power (MW)	Energy:	Stable power (MW)	Energy:
1.	BH Zastava	304.0	Coal, gas	110	Fuel oil, gas
2.	BH Klinički centar	34.0	Fuel oil, gas	34.0	Fuel oil, gas
3.	BH Erdoglija	40.1	Fuel oil, gas	40.1	Fuel oil, gas
4.	BH Stanovo	5.0	Fuel oil, gas	5.0	Fuel oil, gas
5.	BH Centralna radionica	15.0	Fuel oil, gas	15.0	Fuel oil, gas
6.	BH “Aerodrom”	34.5	Fuel oil, gas	34.5	Fuel oil, gas
	Total	**432.6**		**238.6**	

NIRAS

DHS Kragujevac – DATA center

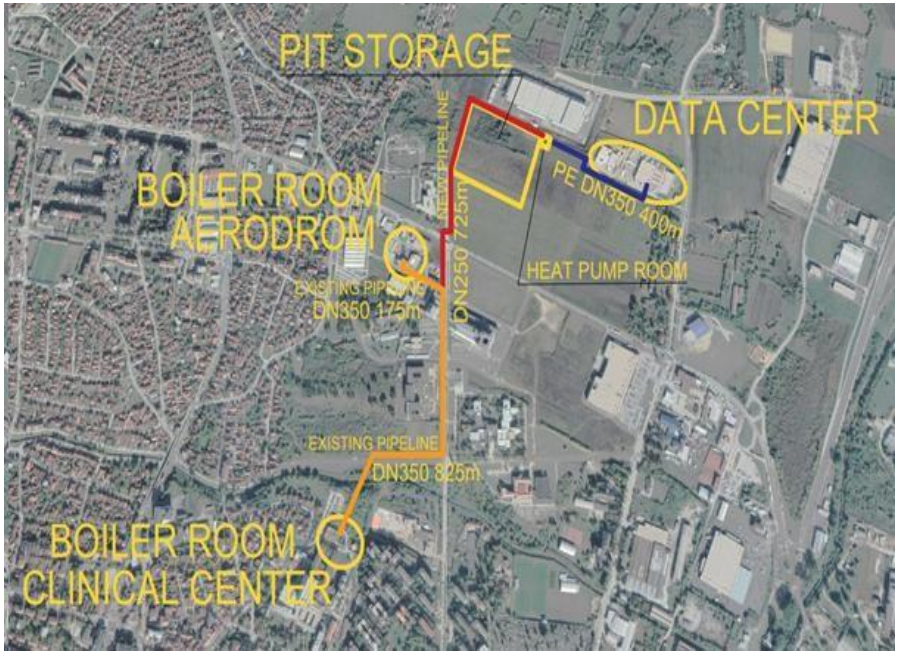
European Bank
for Reconstruction and Development

Currently, the pipe installation of the refrigerant chillers is installed on the roof. A temperature regimes of evaporator 10/5oC

It is foreseen to connect the existing installation of the refrigerant to a new installation that will transfer the refrigerant through a cold pipeline 400m long to the building where the heat pumps will be located.

Based on this, a temperature regimes of evaporator 10/5oC and condenser 50/60oC are suggested.

The temperature regime would also be the subject of detailed optimization, which will be clearly defined in the preliminary design.

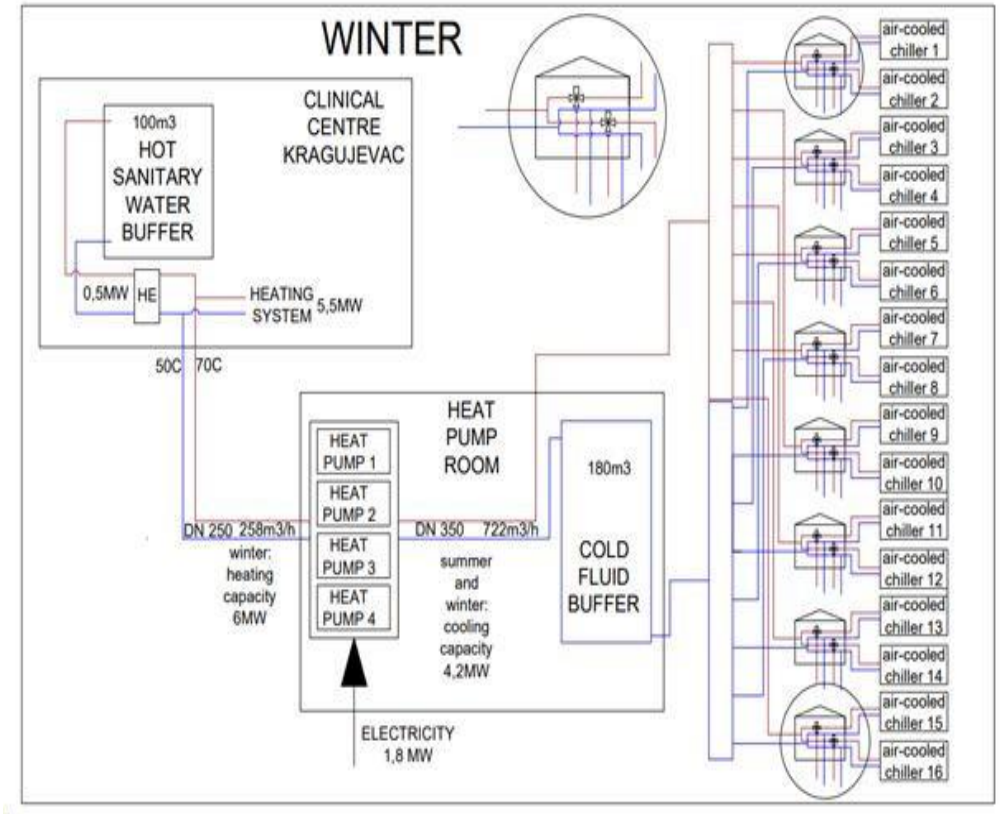


NIRAS

DHS Kragujevac – DATA center

European Bank
for Reconstruction and Development

- Heat pumps: total capacity 6 MW
- Hydraulic integration heat pump-cold pipeline
- Hydraulic integration heat pump-buffer (l=400m, DN350, PEHD)
- Water buffer tank V=180m^3
- Ethylene glycol (V=280m^3)
- Pump condenser side (q=722m^3/h H=20m)
- Construction of a pre-insulated pipeline DN250 up to l=800m
- Pump evaporator side (q=236m^3/h, H=40m)
- Hydraulic integration heat pump-heating pipeline
- Electricity supply 1.8MW
- Facility for storage the heat pump 120m^2
- Hydraulic integration of boiler houses



NIRAS

DHS Kragujevac – DATA center

European Bank
for Reconstruction and Development

Parameters	Units	Value
Baseline scenario		
Heat production	[MWh/year]	**53,778**
Specific heat production costs	[EUR/MWh]	**56.0**
Annual energy cost [EUR]	[EUR]	**3,011,440**
Project scenario		
Heat pump installed capacity	[MW]	**6.0**
Heat production from heat pump	[MWh/year]	**28,500**
Electricity consumption for HP and pumping*	[MWh/year]	**4,801**
The percentage of energy that will be provided by the heat pump	[%]	**53.0**
Total annual cost savings	[EUR]	**1,139,839**
Annual CO2 emissions reduction	[tCO2]	**3,077**
Cumulative cost savings for 20 years	[EUR]	**22,796,780**
Estimated value of investment	[EUR]	**4,499,350**
LCOH – Baseline scenario	[EUR/MWh]	**56.0**
LCOH – Project scenario	[EUR/MWh]	**23.8**
Simple payback period	[years]	**3.9**

NIRAS

Questions

European Bank
for Reconstruction and Development

For all further enquiries, please contact:

Bojan Bogdanovic
ReDEWeB Fund Manager
Tel: +381 63 863 9079
Email: BogdanoB@ebrd.com

Zoran Božanić
District Heating Expert
Tel: +381 64 850 70 01
Email: bozaniczoran@gmail.com

EBRD
One Exchange Square
London, EC2A 2JN, UK,
www.ebrd.com