

The State and Perspective of Belgrade District Heating System Development

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About The Project



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- **Increasing Investments in District Energy Systems in Cities – a SE4All Energy Efficiency Accelerator: **City of Belgrade** (2018-2020)**
- **City-Wide Assessment Report**
 - An analysis of the current state of the district heating system in Belgrade - legal, technical, financial and environmental aspects
 - The base for the identification of the investment strategy and future implementation scenarios in line with the forecast of heat demand

Technical Analysis of DH system

- Installed power: 2'809.7 MW + 37,4 MW (- 17.45 MW until 2021)
- 37 heat sources: 14 heat plants, 10 (-2) boiler stations, 13 (-4) boilers
- Efficiency of production >90%
- Plans for additional 51 MW by economizers

Sector	Installed power [MW]	SHW [MW]	Building/Reconstruction
Novi Beograd	1,050.31 + 7.00	11.50	1965 - 2012
Konjarnik	447.88 + 9.50	0.37	1974 - 2015
Dunav	428.54 + 9.00	18.00	1980 – 2007
Voždovac	488.95 + 11.90	29.75	1969 - 2010
Cerak	396.90	16.77	1971 - 1990

Technical Analysis of DH system

- Length of the DH Network (14 independent networks)
≈1500 (750+750) km
- 402 (201) km was built in period 2006 – 2017
- **25 years** – estimation of average age of network
- Heat losses: **12.5% do 16%**
- Temperature regime: 120/65°C (80/60°C)
- Temperature regulation in heat plants and flow regulation in substations

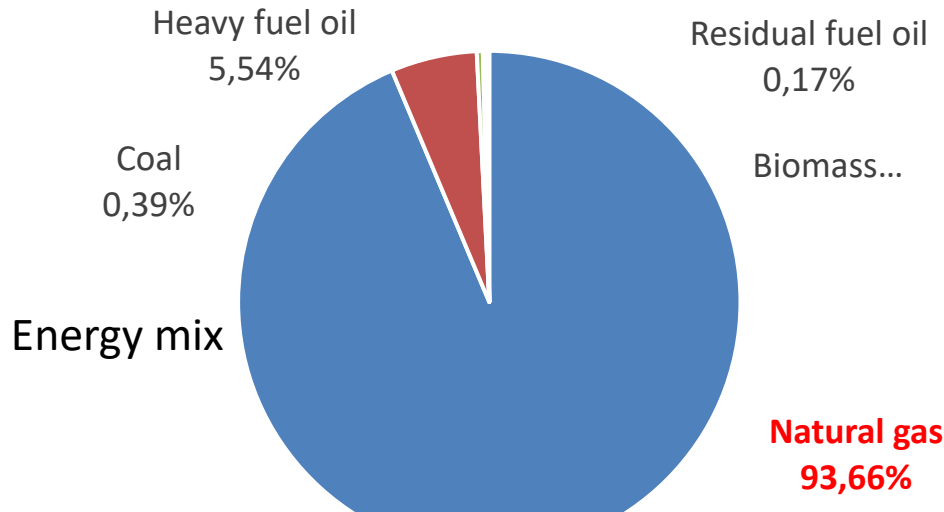
Technical Analysis of DH system

- The Number of Heat Substations 8'627 (from several tens of kW, to over 1 MW)
- Substations are digitalized and equipped with measuring and control equipment
- The total heated area of consumers > 22 millions m²
- 311,000 households (≥ 50%)

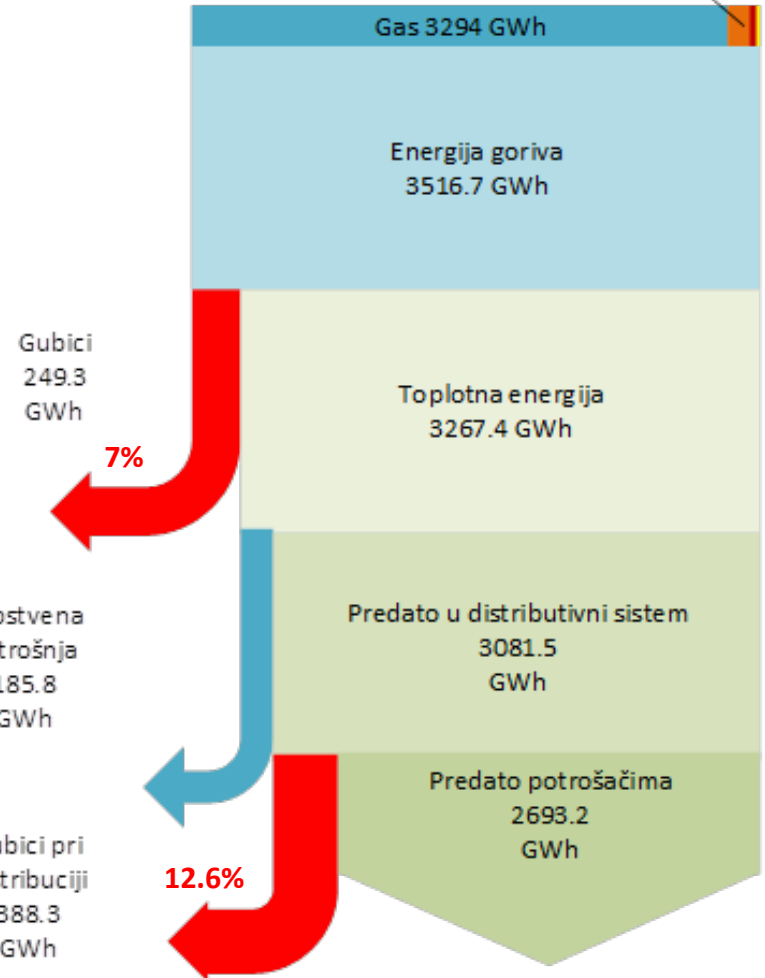
Sector	Heat source [MW]	Installed power at consumers [MW]	Number of substations
PUC BEOGRADSKE ELEKTRANE	2,812.58 + 37.4	2,587.65	8,627
Novi Beograd	1,050.31 + 7.00	1,007.62	2,329
Konjarnik	447.88 + 9.50	411.50	2,070
Dunav	428.54 + 9.00	498.93	2,081
Voždovac	488.95 + 11.90	340.24	1158
Cerak	396.90	309.85	989

- DH system of the 2nd generation

Energy Balance (2017/2018)



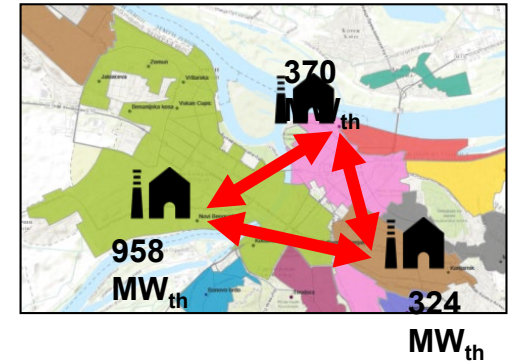
Gas 1371.4GWh
 Mazut i lož ulje 200.5GWh
 Briket 8.4
 Ugalj 1



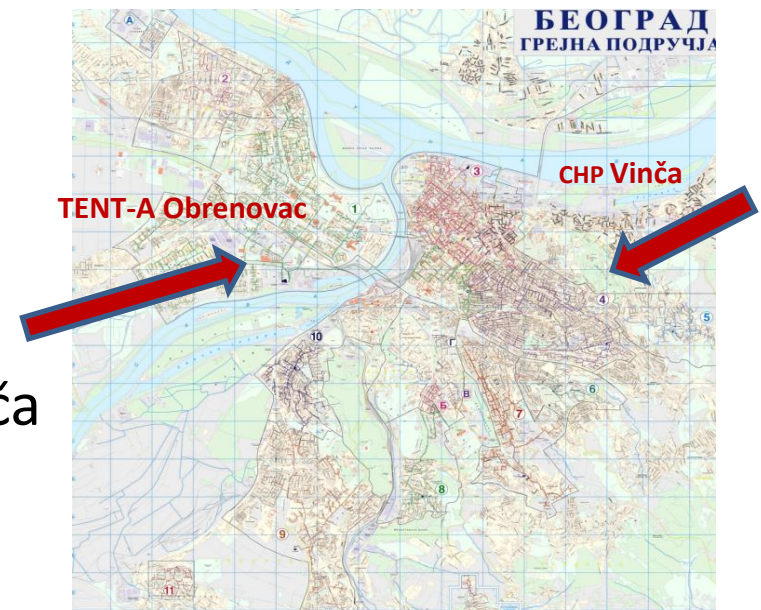
Grejna sezona	Indikatori		
	kg/m ²	kg/°Ch MW	kg/Ch/m ²
2009/10	14.90	2.21	0.00773
2010/11	15.33	2.12	0.00734
2011/12	15.86	2.16	0.00747
2012/13	12.91	2.04	0.00707
2013/14	11.51	2.22	0.00767
2014/ 15	13.73	2.69	0.00698
2015/16	13.62	2.76	0.00723
2016/17	16.27	2.55	0.00670
2017/18	14	2.53	0.00662 -1.6%

Development Strategy of the PUC

- The introduction of heat energy produced in Thermal power plant “Nikola Tesla A” (600 MW)
 - 28 km
 - The key project for the reduction of heat price
 - The interconnection of Novi Beograd with Dunav and Konjarnik



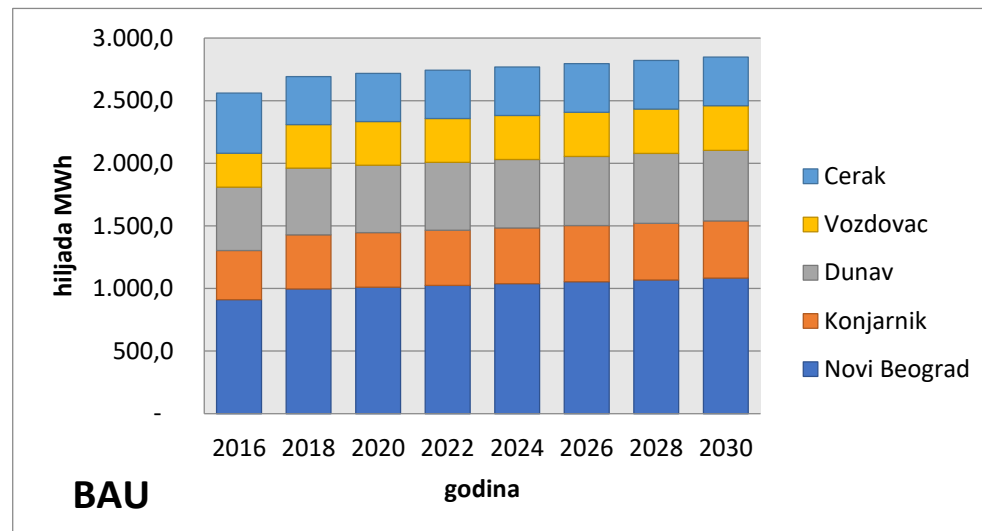
- CHP waste incineration plant in Vinča (56.5 MW_{th} + 20.6 MW_e)



Heat Demand in the Future

- Business as Usual

- Business as Usual (BAU) Scenario
 - continuing of the existing practice and tracking of historical trends
 - Tracking of historical trends of heat consumption for all sectors (Novi Beograd, Konjarnik, Dunav, Voždovac, Cerak) and all groups of consumers (households, commercial and business sectors, etc.)
 - Specific heat consumption is taken as average value from 2015-2018 period

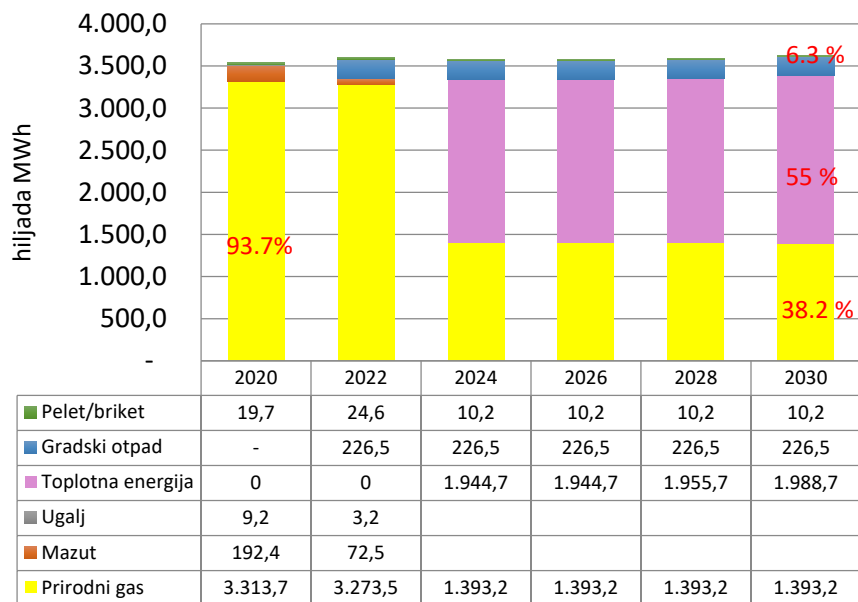


+5.8% in 2030

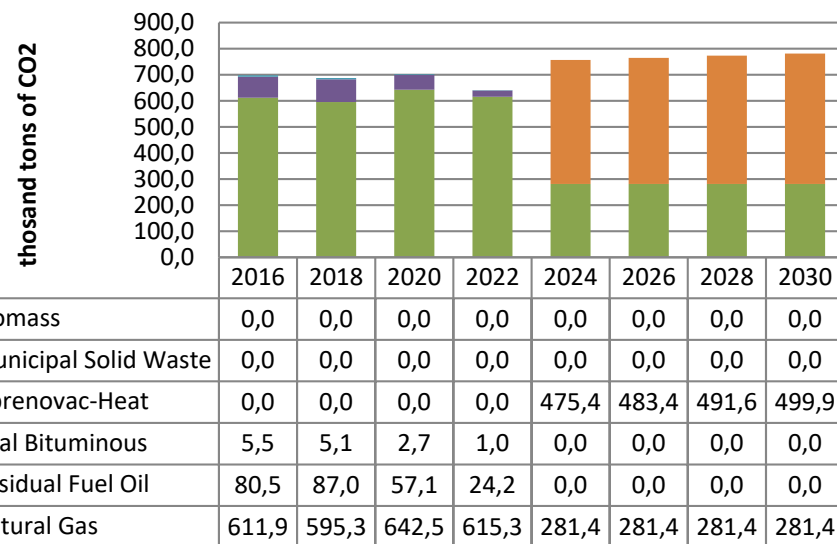
Heat Demand in the Future

- Business as Usual

BAU Scenario



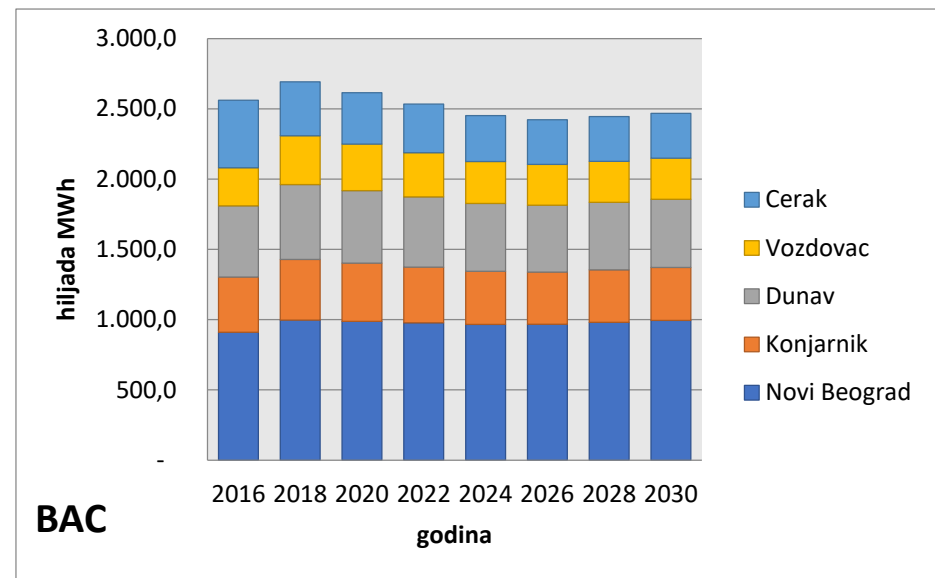
BAU



Heat Demand in the Future

- Billing on Actual Consumption

- Billing on Actual Consumption (BAC) Scenario - all consumers in the category "Residential" pay according to measured consumption
 - All households are in this payment system until 2025
 - Specific savings are taken based on experience from other Serbian cities (Pančevo, Šabac) – app. 20%

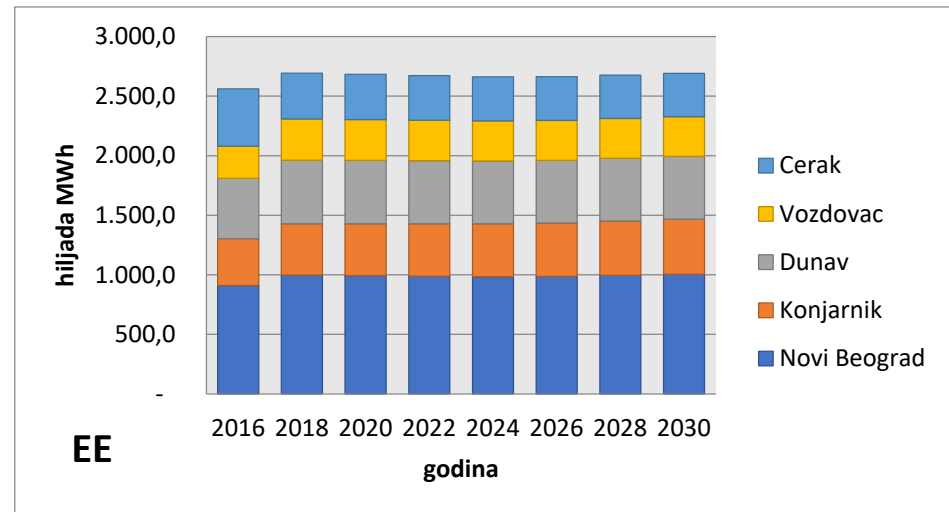


-7.2% in 2030

Heat Demand in the Future

- Energy Efficiency Scenario

- Energy Efficiency (EE) Scenario
 - Energy reconstruction of 15% of buildings until 2025
 - Specific heat consumption in reconstructed buildings less for 35% (average value)
 - 1st level of reconstruction (Tabula)



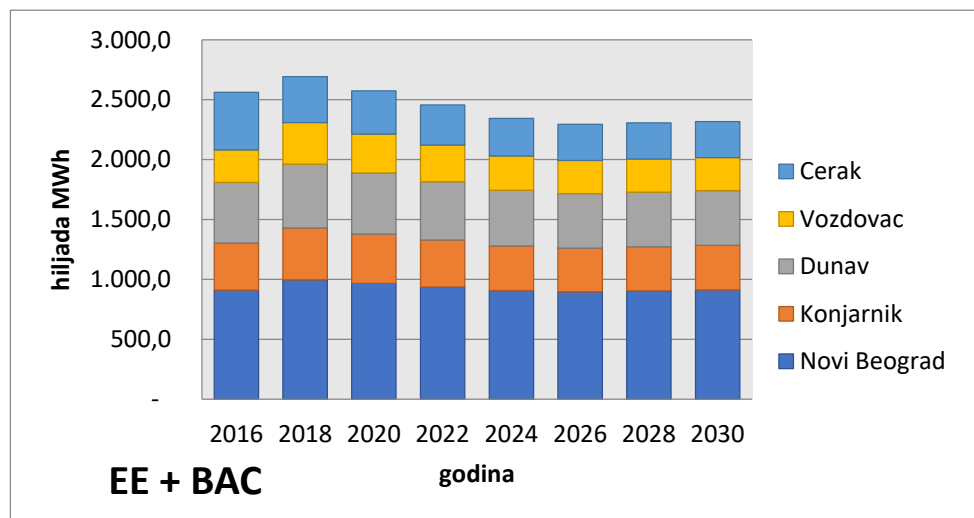
-0.1% in 2030

Heat Demand in the Future

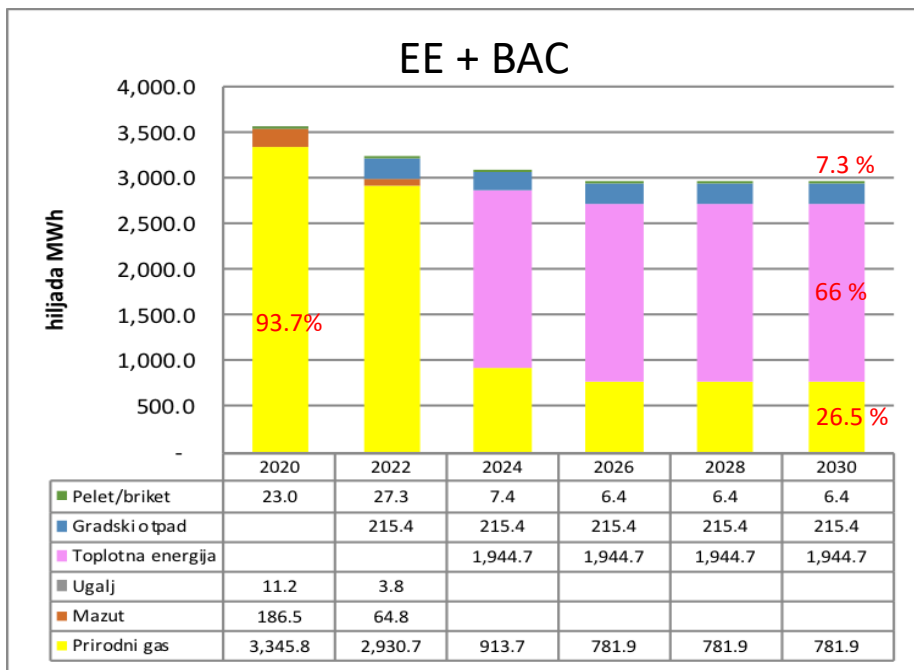
- BAC+EE Scenario

- Simultaneous application (BAC+EE) of energy efficiency measures and the introduction of billing based on actual consumption

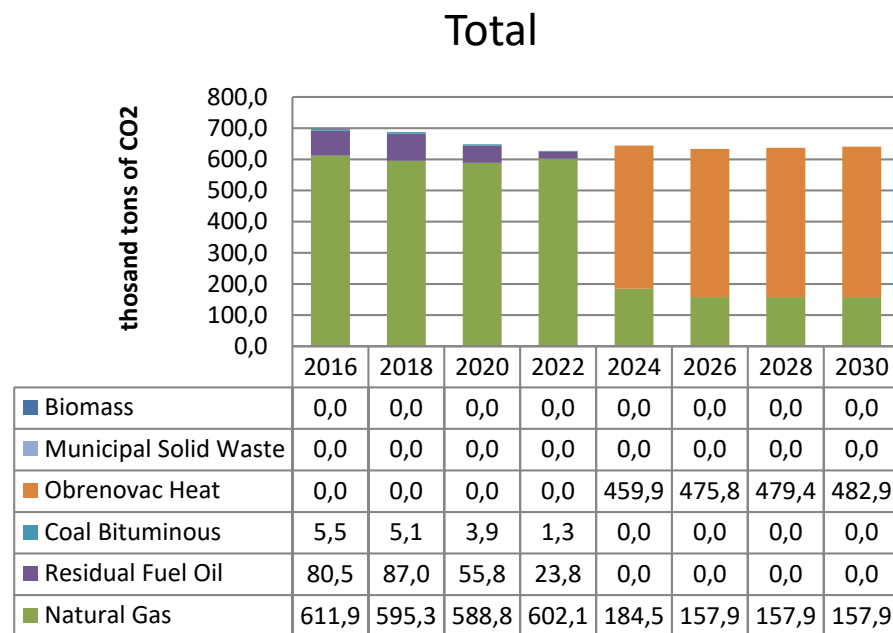
-18% in 2030



BAC + EE Scenario



-18,5% compared to BAU



-18% compared to BAU

Indicators

	Current state	BAU - 2030	EE + BAC - 2030
P/F ratio	1,28	0,96	0.90
Import dependency	80.99%	31.61%	22%
CO ₂ emission	702 t	781 t	640 t
Methane emission	17.27 t	3,8 t	2,4 t
N ₂ O emission	3.01 t	0.5 t	0.28 t

Conclusions

- Short-term development based on:
 - New heat sources: TPP and incineration plant “Vinča”
 - Energy efficiency measures on consumption side
 - New method of billing
- Reduction in energy consumption
- Increasing of security of supply
- The production of heat energy remains based on combustion processes
- Therefore, some other, non-combustible energy sources (heat pumps, solar energy) should be considered in order to make the Belgrade DH system more sustainable

Thank you for your attention!

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