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DECARBONIZATION OF SERBIAN DISTRICT HEATING SECTOR – THE ANALYSIS OF SCENARIOS

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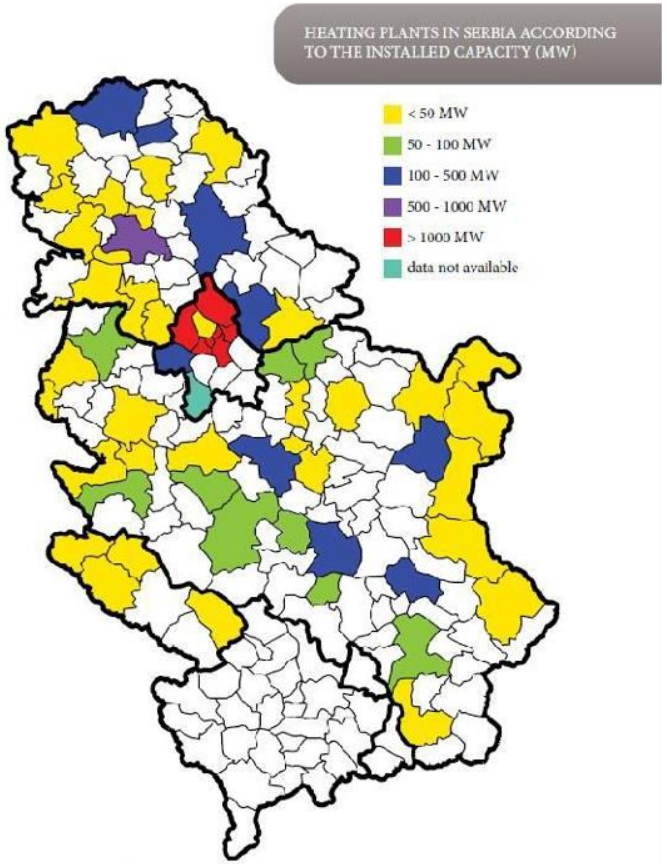
Introduction

- The Serbian DH sector comprises 60 district heating systems across the same number of cities.
- District cooling services are not currently available on the energy market.
- Serbia's DH sector faces significant challenges, including outdated infrastructure, a high dependency on fossil fuels (especially natural gas), and low integration of RESs.
- ReDE Serbia: Renewable District Energy in Serbia Projects, Project A: Policy Roadmap for Decarbonization of the District Heating and Cooling Sector in the Republic of Serbia, EBRD, SECO, 2025 (beneficiary MoME)

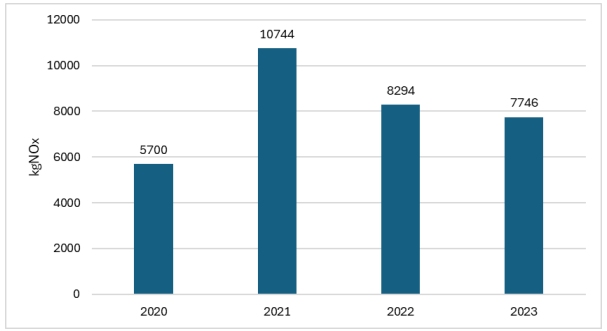


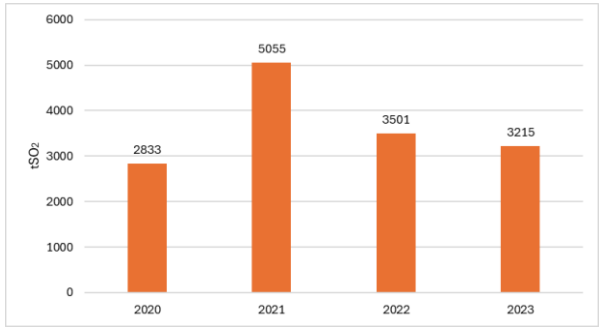
Current State of the DH Sector in the Republic of Serbia

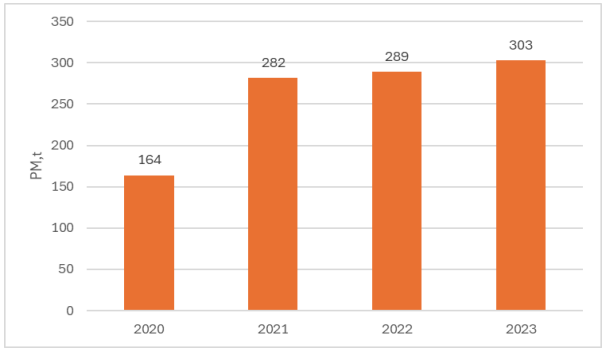
- Policy and legal framework
  - NECP, Energy Strategy
  - Energy Law, Law on the Use of RESs, Law on EE and RUE
  - Law on Communal Activities
- Institutional capacities
  - MoME, AERS
  - **Local Self-Government**
    - issue energy permits for construction of the facilities and licenses for performing energy activities in the district heating and cooling sector, maintain a register of issued licenses, determine the conditions for delivery and supply of heat to customers in its area, adopt a regulation that governs the method of distribution of costs, approves heat energy prices and prescribe other conditions for ensuring a reliable and safe supply of heat to customers.
    - responsible for the promotion and support of the usage of RES in the heating and cooling sector
  - District Heating Business Association “Toplane Srbije”

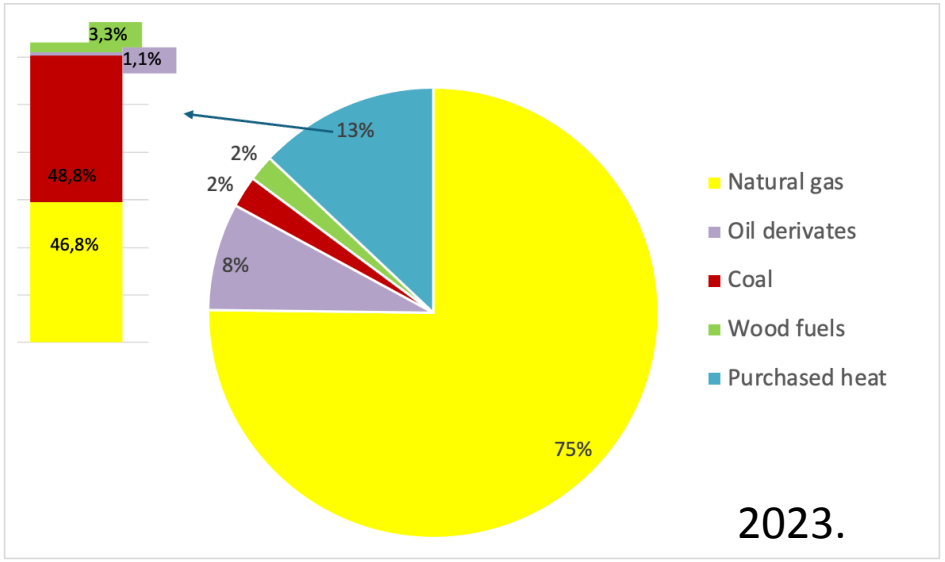
Current State of the DH Sector in the Republic of Serbia

- Belgrade, 2,856 MW; 7 DHS >100 MW (Novi Sad, 705 MW)
- 21 DHS (20-100 MW), 23 DHS < 20 MW



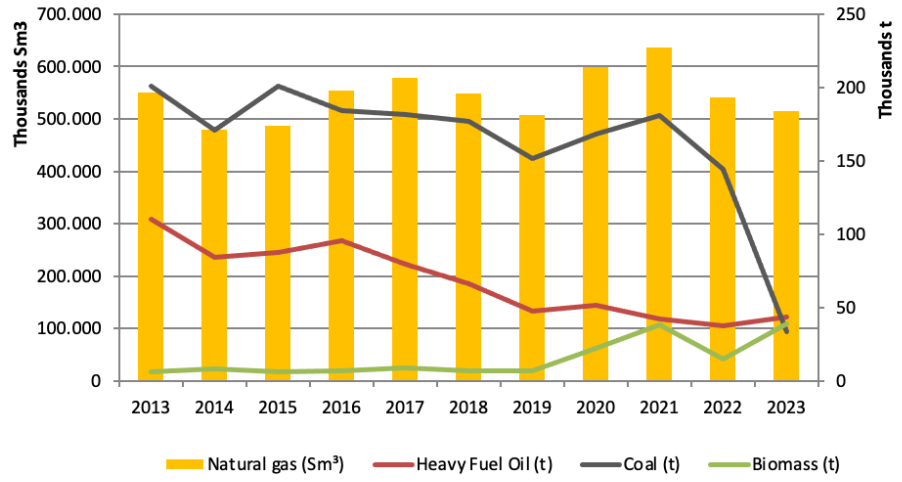






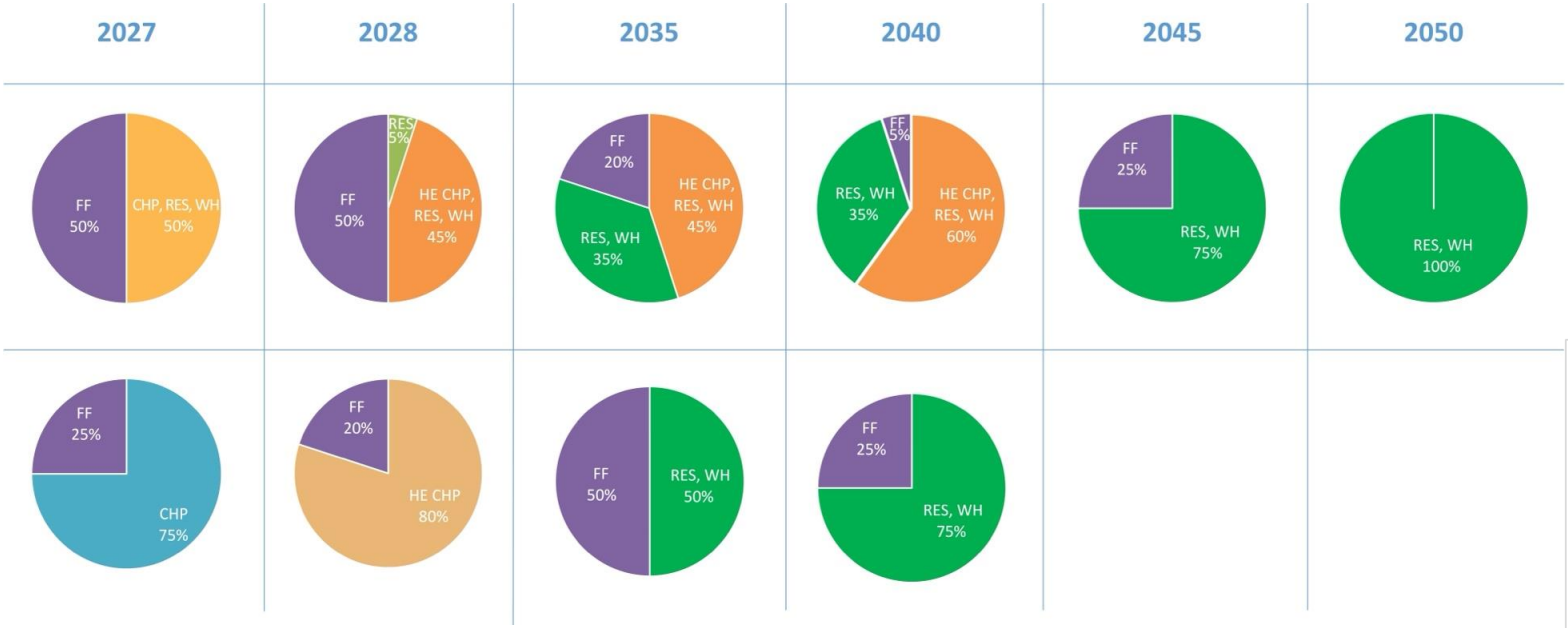
0.230 kg CO_2/kWh

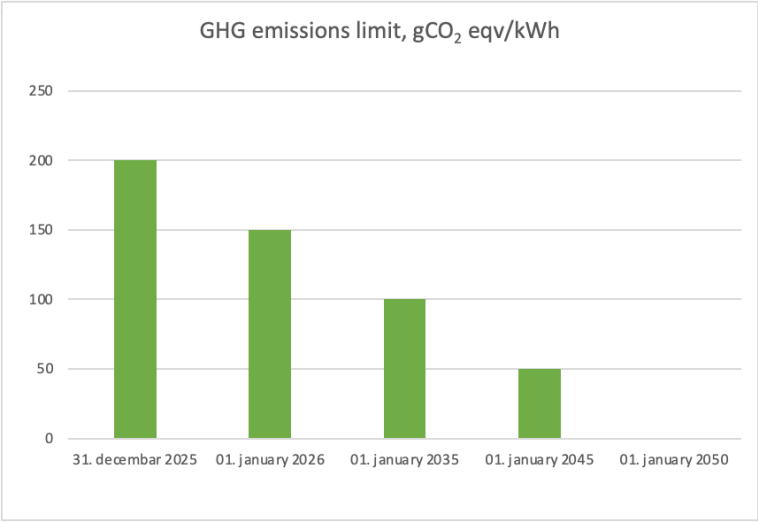
GHG	Fuel used								Total
	Natural gas	Heavy fuel oil	Heating oil	Coal	Firewood	Wood chips	Pellet	Briquets	
CO_2, t	963,249	148,384.3	821.4	50,879	0.0	0.0	0.0	0.0	1,163,333.9
CH_4, kg	17,170.2	5,751.3	2,464.2	529.4	1,471.2	11,374	278.0	31.5	39,070.3
N_2O, kg	1,717.0	1,150.3	6.7	794.2	196.2	1,516.6	37.1	4.2	5,422.1



EU plans

- *Criteria for efficient DH&C systems according to Directive (EU) 2023/1791 on energy efficiency (FF - fossil fuels, WH - waste heat, HE CHP – high efficiency cogeneration)*





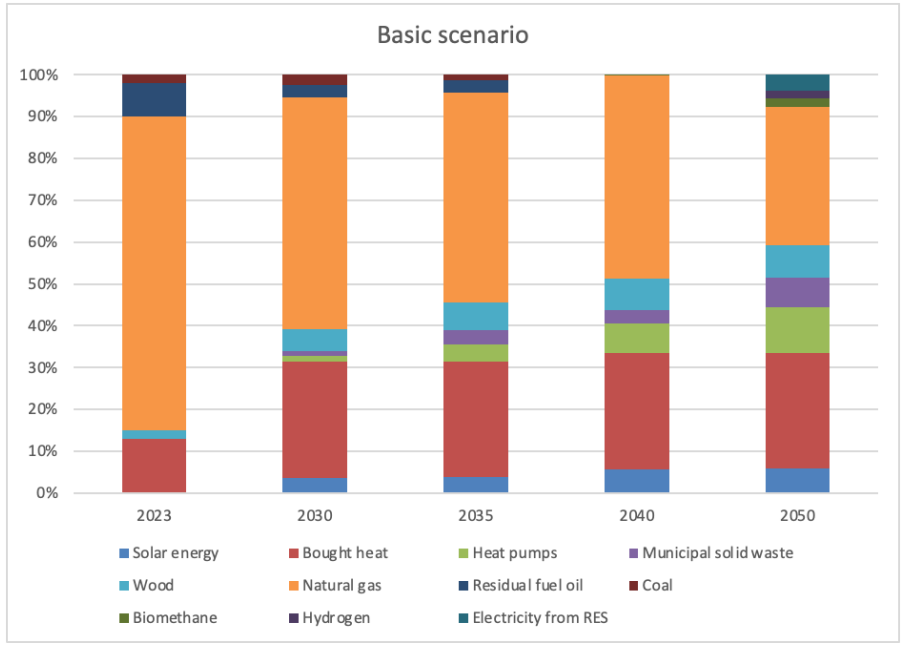
EU recommendations

- The main EU recommendations for the H&C decarbonization through DHC systems are generally applicable for the Serbian case:
  - Quantified sustainable DHC targets at national level
  - Stable and sufficiently strong price signals (e.g., CO2 taxes for fossil fuels, taxes on non-recovered waste heat, reduced VAT)
  - Support schemes to facilitate the initial development of sustainable DHC systems and help them to overcome long pay-back time
  - Mainstreaming strategic long-term local/urban heat planning, identifying district heating generation potential, sector synergies, etc.
  - Obligation to DHC companies to develop long-term decarbonisation plans
  - RES and waste heat quota obligations for DHC companies
  - Incentives to facilitate the use of waste heat
  - Incentives for higher customer participation and energy communities in DHC systems
  - Improved transparency (e.g., information obligations)

How to decarbonize?

- Decarbonization of DH systems must be systematically structured and carefully planned.
- It is essential to act on:
  - Demand side to increase energy efficiency to lower overall demand,
  - Supply-side to replace fossil fuels with more sustainable, carbon-neutral energy sources.
- Engineering solutions:
  - Replacing fossil fuels with RESs and waste heat,
  - Electrification of heat supply by increased utilization of heat pumps and electric boilers,
  - Introduction of green hydrogen (Power to x),
  - Thermal energy storage
  - Increasing use of high-efficiency combined heat and power (CHP) generation.

Basic Scenario*



RES	Period	Biomass	Heat pump	Solar	Municipality waste	Biomethane	Hydrogen	Electric boilers
Contribution	2025-2030	446,955	119,113	321,135	-	-	-	-
	2031-2035	64,972	221,032	-	178,869	-	-	-
	2036-2040	92,206	254,204	-	-	18,400	-	5,200
	2040-2050	-	300,000	160,568		155,625	155,625	311,250
Total in 2050		604,133	894,349	481,703	178,869	174,025	155,625	316,450

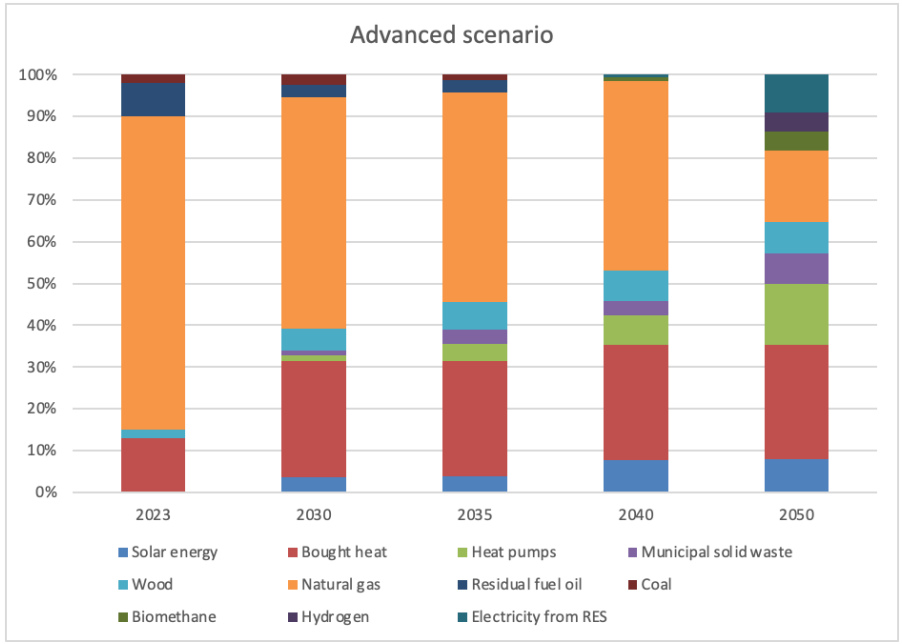
Emissions	2023	2030	2035	2040	2050
CO2, (1,000 t)	1,163.33	1,184.81	1,000.50	866.23	577.96
CH4, t	39.07	94.84	126.26	129.74	165.13
N2O, t	5.42	85.63	71.18	72.34	52.14
CO2ekv, (1,000 t)	1,165,87	1,250.98	1,018.73	884.38	595.53
kg CO2/kWh	0.230	0.192	0.169	0.142	0.097
kg CO2eqv/kWh	0.231	0.195	0.172	0.146	0.100

Based on the implementation of ongoing programs ReDeWeb (Novi Sad, Niš, Kragujevac, Kraljevo, Bečej, Vršac, Pančevo, Kruševac, Novi Pazar), KFW (Majdanpek, Prijepolje, Novi Pazar, Vranje, Niš), and Air quality (Niš, Zaječar, Valjevo, Smederevo).

Advanced Scenario (Basic Scenario +)

- Adoption of Regulation Defining the Conditions and Manner of Third-Party Access to District Heating Networks
- Adoption of specific development plans for district cooling systems
- Establishment of additional financial mechanisms to support the use of RES and waste heat in the DH&C systems
- Development of a GIS Model for Waste Heat and High-Efficiency Cogeneration Potential from Industrial Facilities, Energy Production Plants, and the Service Sector for Use in DHSs,
- Introducing the Obligation to Prepare a Special Document on the Potential Use of Waste Heat in DHS for industrial and commercial entities
- Harmonization of Regulations Related to the Use of Hydrogen in DHSs
- Adoption of Regulation on Guarantees of Origin for Biomethane and Green Hydrogen, and on Sustainability of Biomethane Production

Advanced Scenario



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	2036-2040	92,206	254,204	-	-	18,400	-	5,200
	2040-2050	-	600,000	321,136		355,100	373,500	741,800
Total in 2050		604,133	1,194,349	642,271	178.869	373.500	373.500	747,000

Emissions	2023.	2030.	2035.	2040.	2050.
CO2, (1,000 t)	1,163.33	1,184.81	1,000.50	832.10	294.78
CH4, t	39.07	94.84	126.26	129.13	160.08
N2O, t	5.42	85.63	71.18	69.90	32.44
CO2ekv, (1,000 t)	1,165,87	1,250.98	1,018.73	854.67	307.96
kg CO_2/kWh	0,230	0.192	0.169	0.133	0.050
kgCO_2eqv/kWh	0,231	0.195	0.172	0.136	0.052

Conclusions

- The share of RES and waste heat could reach 15.7% in 2030, and depending on scenarios, between 33.3% and 37.6% in 2040, and 54.3% and 76.6% in 2050.
- At the same time, the reduction of GHG emissions should be in the range from 24% to 27% in 2040, and even 51% to 75% in 2050.
- Each DH system should be treated individually

Period	Basic scenario			Advanced scenario		
	No of projects	MW	Mil.EUR	No of projects	MW	Mil.EUR
2025-2030	23	424.8	228.75			
2031-2035	10	264.9	378.78			
2036-2040	10	297.2	201.21	10	656.4	324.16
2040-2050	>3	844.8	293.53	>3	1,490.0	650.87
Total	46	1,831.7	1,102.27	46	2,836.1	1,582.56

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THANK YOU!

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