



17th Energy Efficiency Coordination Group Meeting
Belgrade, Chamber of Commerce, 06.06.2018.

MODERNIZATION OF THE DISTRICT HEATING SYSTEM IN BELGRADE

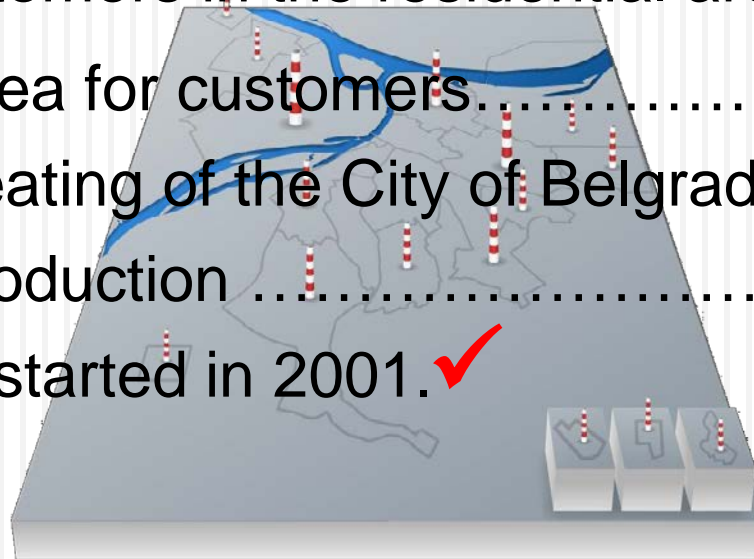
Bojan Bogdanović, PUC “Beogradske elektrane”



PUC "Beogradske elektrane"

2

- Installed capacity2,850MW
- Number of Heat Sources.....43 ✓
- Length of the network route730km
- Number of substations8,800 ✓
- Number of customers in the residential area... 330,000
- Total heated area for customers.....22 mil. m²
- Share in the heating of the City of Belgrade.....51%
- Annual heat production3,500 GWh
- Modernization started in 2001. ✓





Modernized substations

3

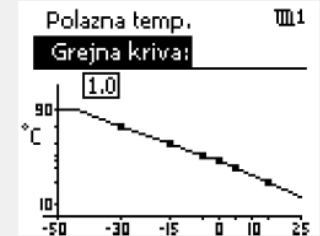
- All substations are equipped with modern measurement and control system:
 - Measurement of the delivered heat energy.
 - Regulation in accordance with outdoor temperature and programming to meet customer needs.
 - Delivery of heat to the consumer when he wants, where he wants and how much he wants.

In progress:

- Remote reading and control of all substations
- Mobile applications and portals for occupants

Podesavanja	III1
Polazna temp.:	
▶ Grejna kriva	1.0
Temp. max.	90 °C
Temp. min.	10 °C

Menja se nagib



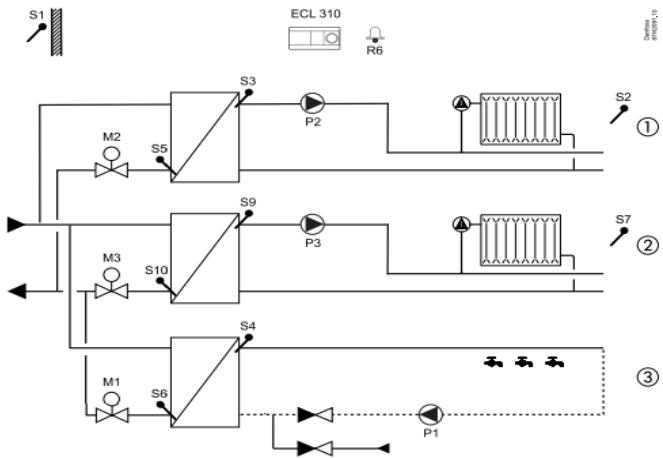
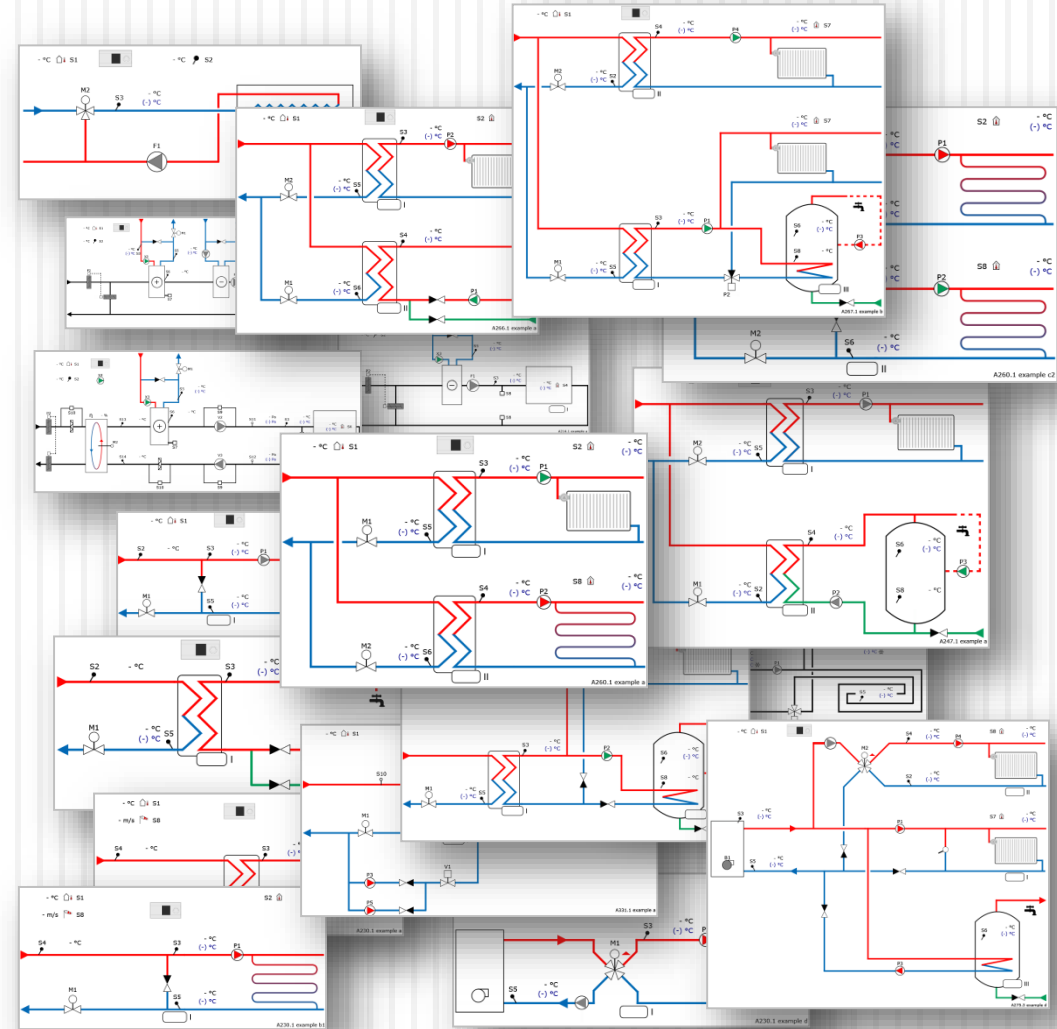
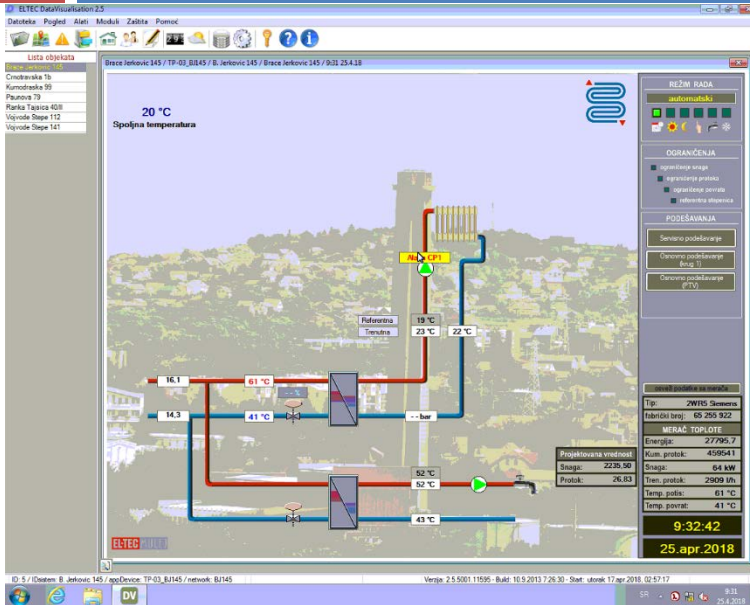
Menja se koordinata





Remote supervision and control of heating substations

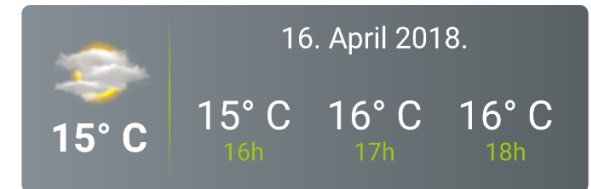
4





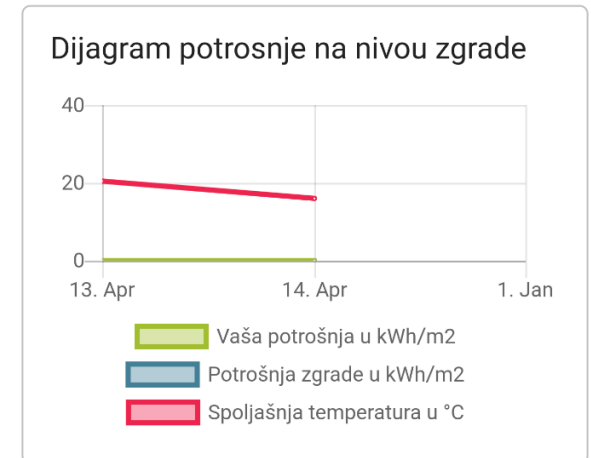
Mobile applications and portals

5



Potrošnja za poslednja 3 meseca

Jan 2018.	Feb 2018.	Mar 2018.
477.00 kWh	519.50 kWh	373.80 kWh





Digitalization in the production process

6

Up to 2001.



1st phase 2002.



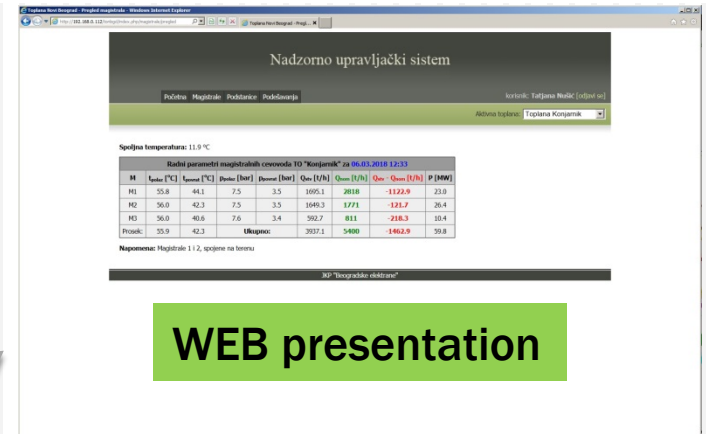
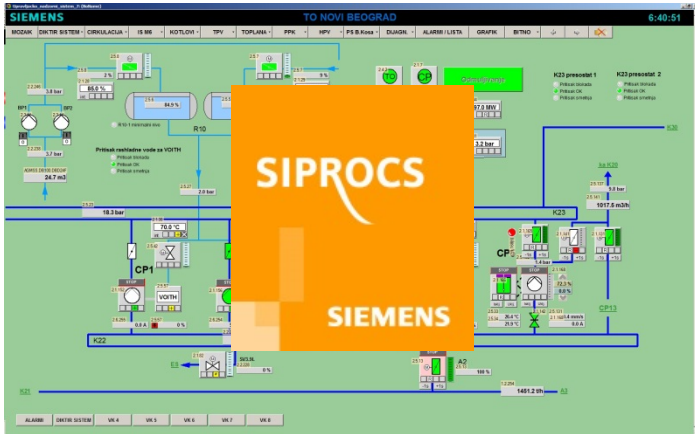
Now



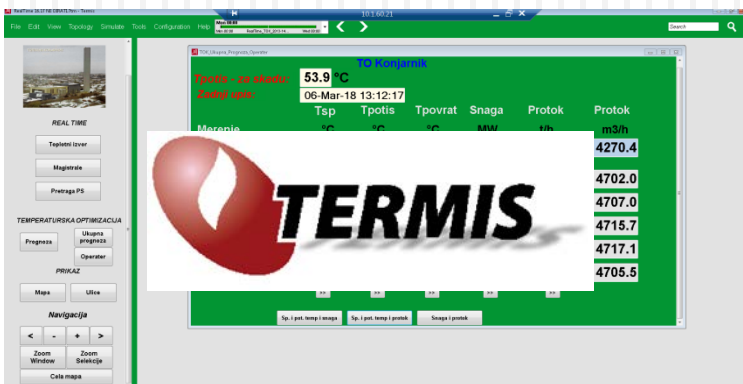


Digitalization in the production process

7



Central database (LINUX)



Production Information System





Development strategy by 2025.

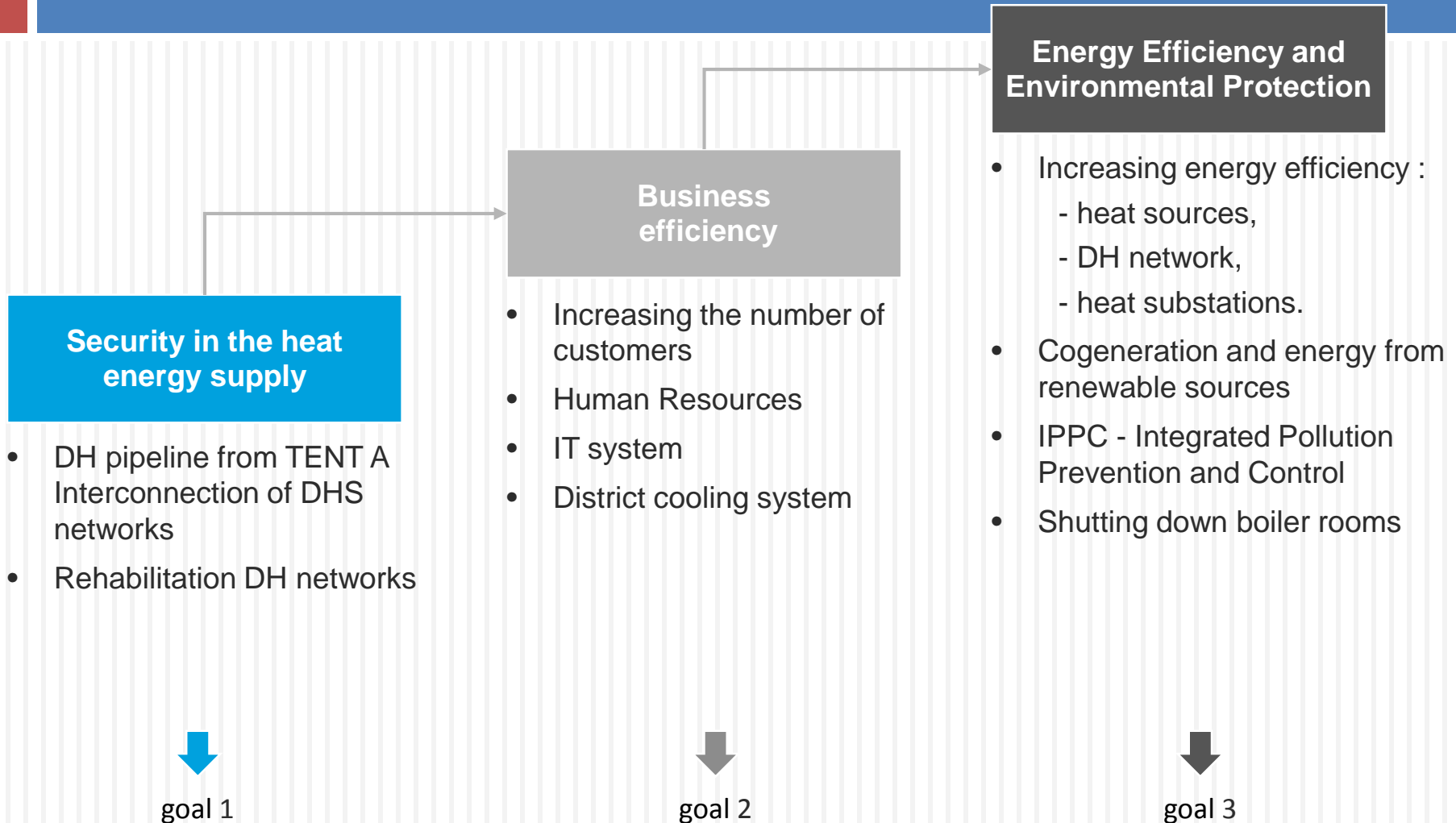
8





Strategic goals of the Company

9



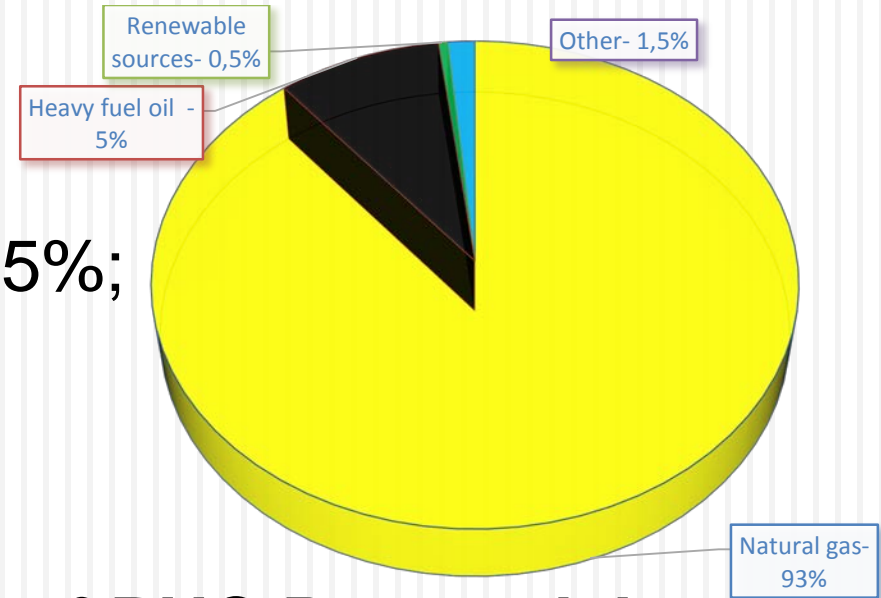


Share of fuels at PUC BE - now

10

Now:

- Natural gas– 93%;
- Heavy fuel oil– 5%;
- Renewable sources– 0,5%;
- Other (fuel oil) – 1,5%.



In the future?

- **Development strategy of PUC Beogradske elektrane** stipulates that it can and must be changed



Renewable energy sources and waste heat

11

Indicative energy prices with investment repayment included

- **Natural gas - heat only boiler – 45 €/MWh**

Renewable energy sources:

- Heat from the municipal waste incinerator – 30 €/MWh.
- Solar thermal – 22 to 40 €/MWh.
 - After repayment of the investment- 2 €/MWh.
- Biomass – about 35 €/MWh.
 - Price of chemical energy 21 €/MWh.
- Geothermal energy ≤ 40 €/MWh – depending on the location.
- Heat pumps – 35 to 40 €/MWh.

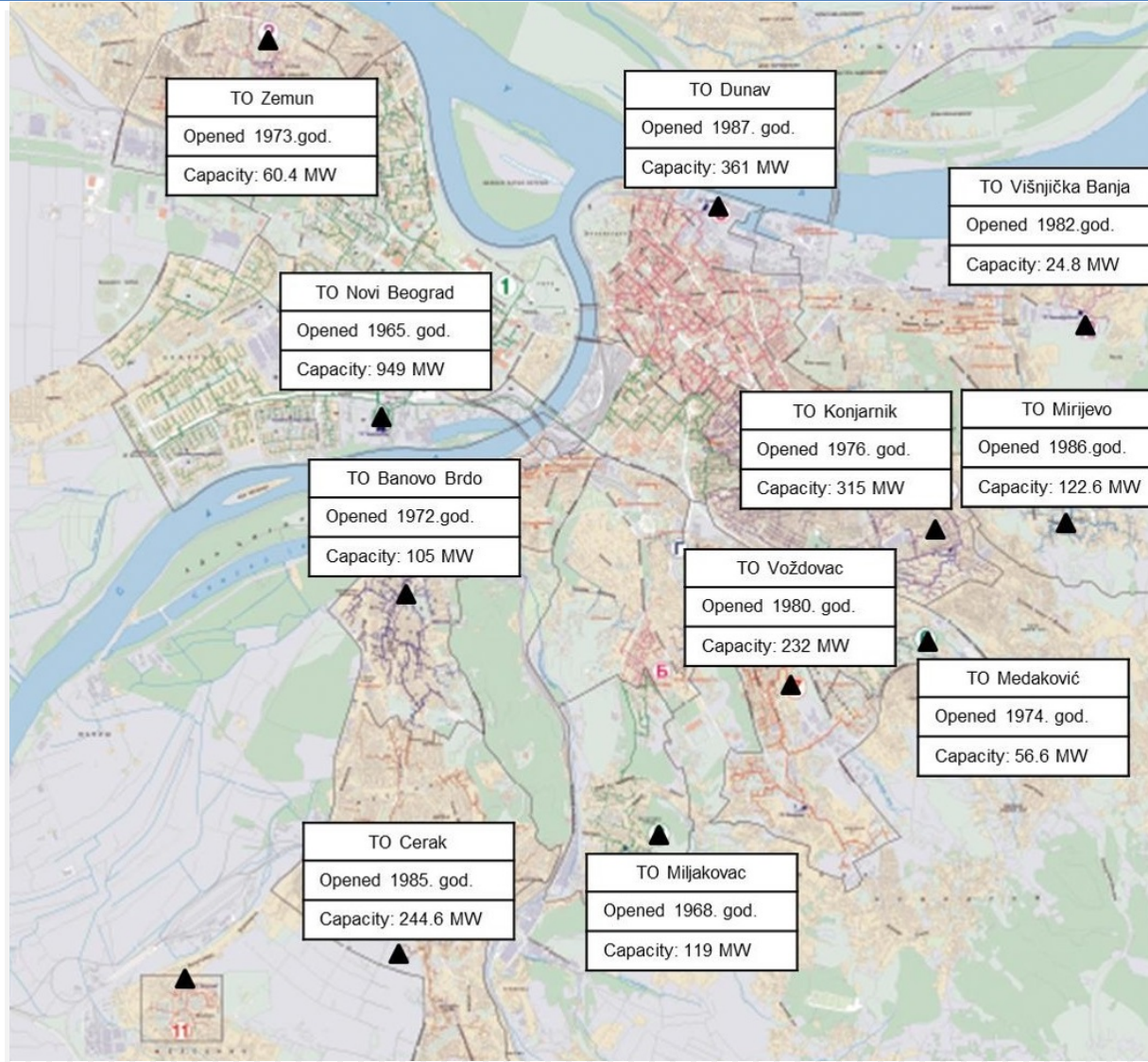
Waste heat and cogeneration:

- Cogeneration (**waste heat**) from TENT A – less than 25 €/MWh.
- Waste heat (data centers, industry, refineries...)
- Cogeneration on natural gas



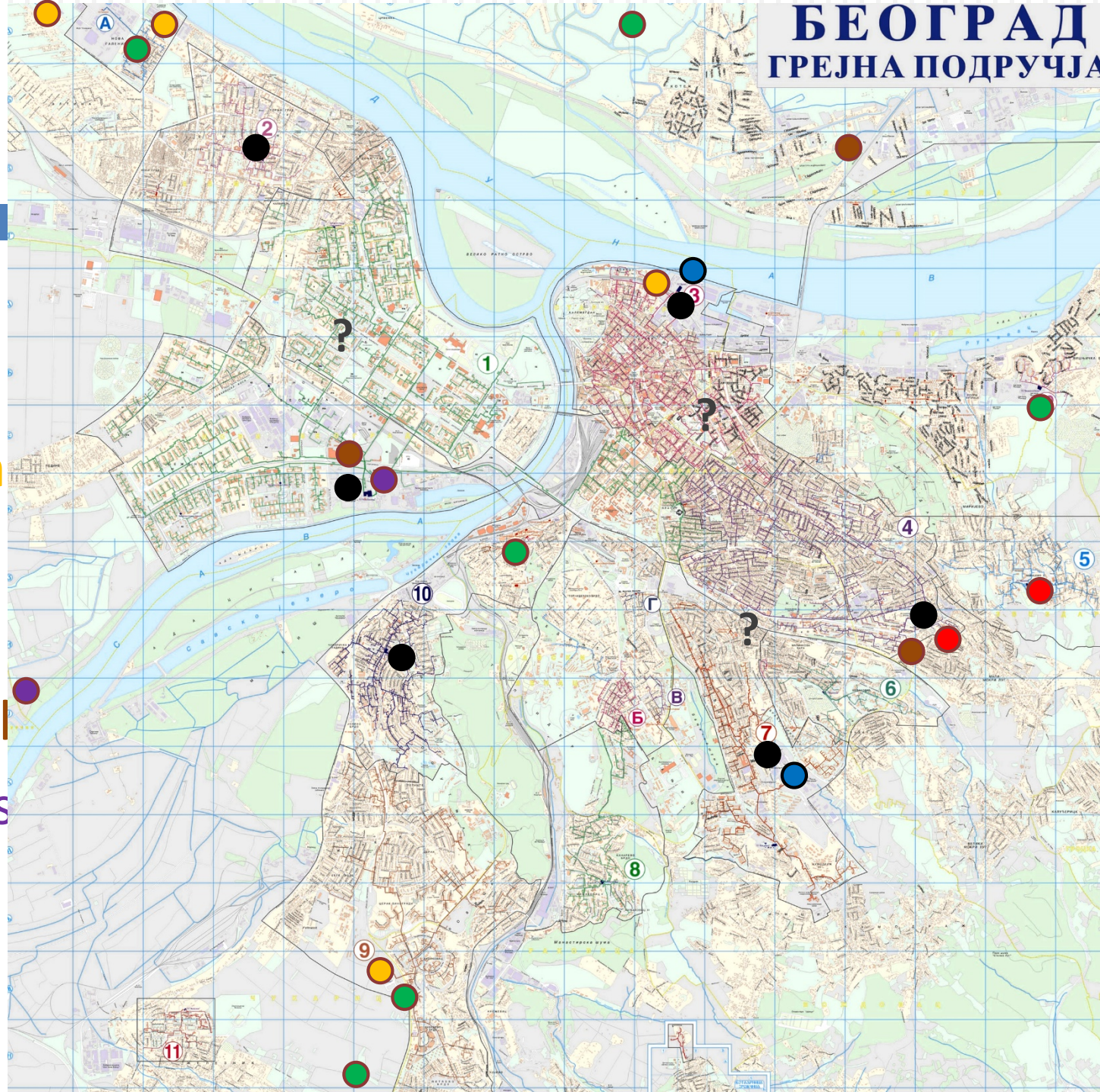
Energy mapping– supply side

12





- ✓ TENTA A
- ✓ EFW
- ✓ Solar therm
- ✓ Biomass
- ✓ CHP
- ✓ Geothermal
- ✓ Heat pumps
- ✓ Waste?



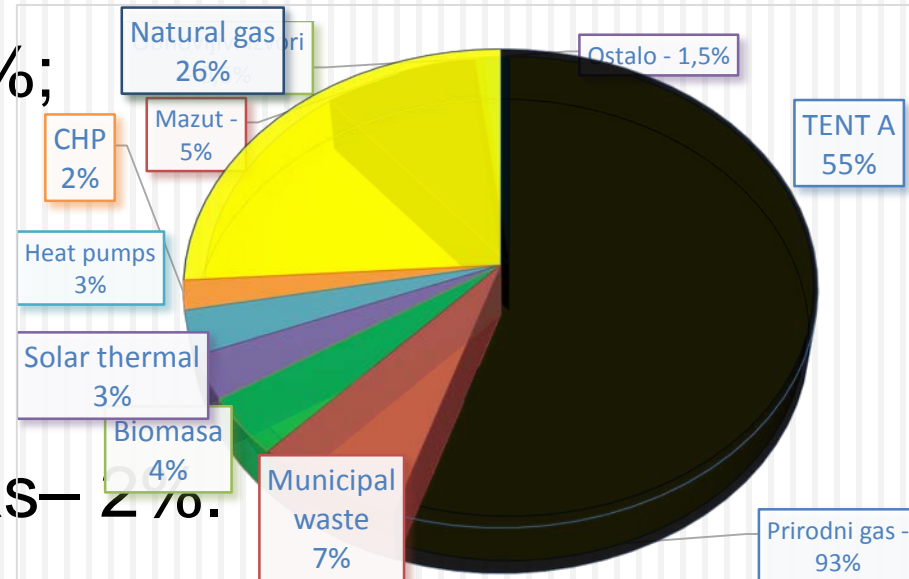


Fuel share – 2025.

14

One of the optimistic scenarios until 2025.:

- Waste heat TENT A – 55%;
- Municipal waste(EFW) – 7%;
- Biomass– 4%
- Solar thermal– 3%;
- Heat pumps– 3%;
- Cogeneration on natural gas– 2%.



In this case the share is:

- Natural gas– heat only boilers– 26%

Integrated permit and shut down of boiler rooms

15



Over the past 20 years, more than 1,000 boiler rooms operating on solid fuel and heavy fuel oil have been shut down.

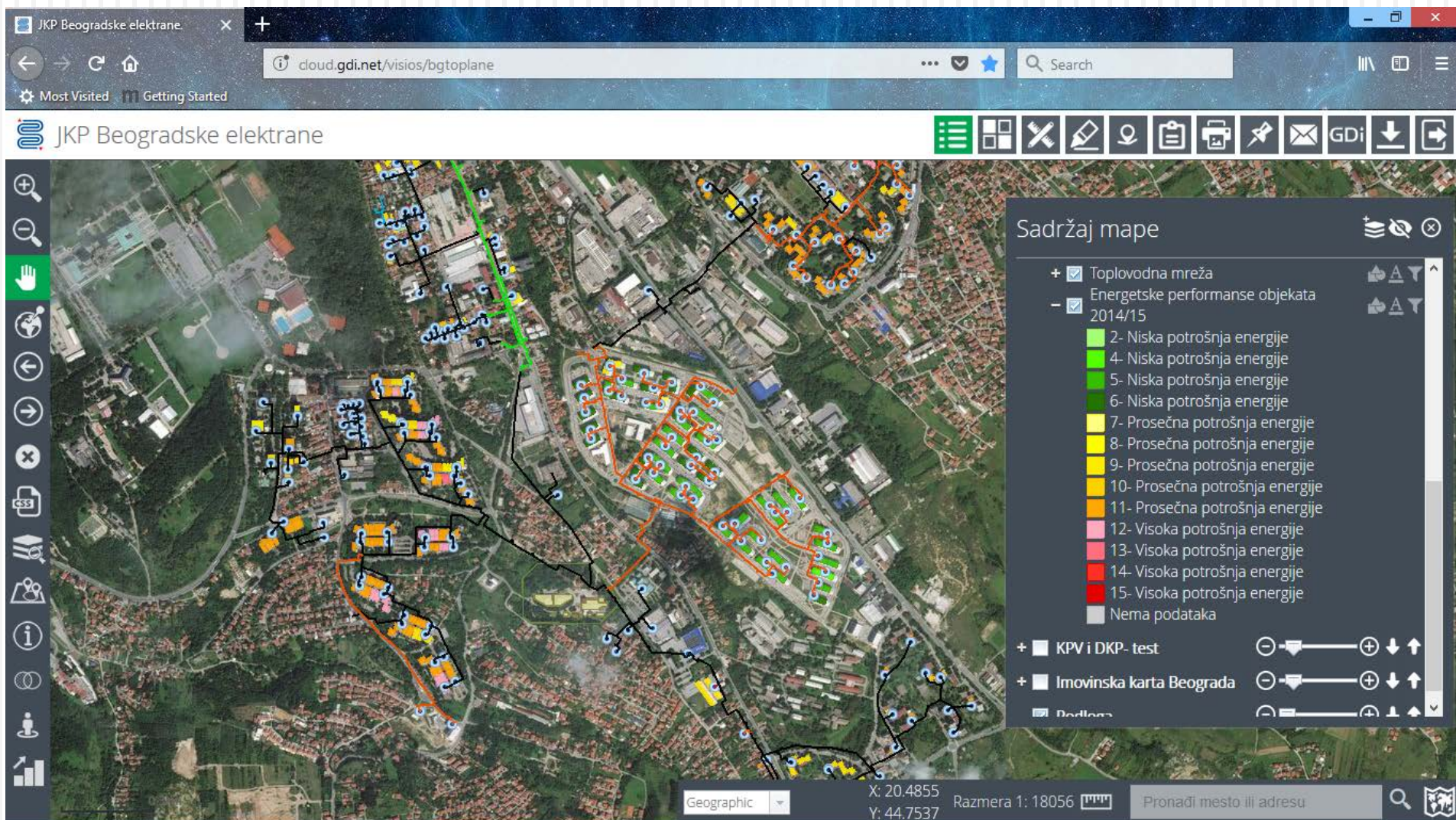
Law on Integrated Pollution Prevention and Control – IPPC

- Energy efficiency (measuring equipment, energy consumption monitoring, EE indicators, training ...)
- Reducing harmful emissions (continuous monitoring, NOx)
- Switching fuel oil with another type of fuel
- Water protection / wastewater treatment (separators, oil precipitators)
- Land protection (land recovery and remediation)
- Storage of hazardous substances



Energy mapping – demand side

16





Mapping goals - (energy sources)

17

- On the side of the heat source (Supply side)
 - Safety and security of supply due to the diversification of fuel sources.
 - Reduction of costs (heating prices) and DHS sustainable development
 - Increase in the share of renewable energy sources.
 - Increasing competitiveness of DHS compared to alternative sources (heat pumps, individual gas boilers, ...).
 - Education and training of employees.
 - Increasing the reputation of the DHS and the public.



Mapping goals - (customers)

18

- Customers (Demand side)
 - Development of rehabilitation plans.
 - Identifying anomalies and illogical data.
 - Static and dynamic analysis of needs.
 - Planning the development and reconstruction of the DH pipelines in accordance with the changing needs for energy.
 - Transition to collection per consumption.
 - Better information and raising public awareness.



Obligations of the Energy Management System- EMS

19

- EMS, which is regulated by the Regulation and the Ordinance, defines that companies that have at least at one location, which is kept at a singular address, facilities for performing activities whose realized annual primary energy consumption is greater than 2.500 tons of equivalent oil - hereinafter (toe), or 29,08 GWh are obligators of the system
- According to these criteria, BE is obligator to EMS even at 14 locations / addresses, following heating plants: Novi Beograd, Zemun, Batajnica, Konjarnik, Mirijevo, Dunav, Borča, Višnjička banja, Voždovac, Medaković, Mladenovac, Miljakovac, Cerak and Banovo brdo.
- An application for fuel consumption for 2017 calendar year has been completed.
- "Energy Efficiency Program for the district heating system of PUC Beogradske elektrane for the period 2018 - 2020" is adopted
- "The Energy Efficiency Plan of the district heating system of PUC Beogradske elektrane for 2018 is being drafted.



Essential energy questions

20

Questions:

- ✓ 1. Renewable energy sources. Are they more expensive than fossil fuels??
- ✓ 2. How to reduce dependence on fossil fuels that are mainly from import?
3. Why Solar- thermal district heating in Belgrade (and Serbia)?



Why exactly solar thermal district heating in Belgrade?

21

- Belgrade is one of the southernmost cities with a large district heating system and delivery of DHW.
- Low-temperature network in Belgrade (average return temperature 45°C) is highly suitable.
- Installation on the ground is 30% cheaper than on the roof.
- The only real solution for collective residential buildings.
- Pre- feasibility study showed that it is profitable even without subsidies.
- Belgrade has 30% more insolation than Denmark.
- Value of investment in construction is lower than in Denmark.
- Maintenance costs are lower than in Denmark.



Contact

22

**THANK YOU FOR YOUR
ATTENTION!**

Bojan Bogdanović

bojan.bogdanovic@bgdel.rs