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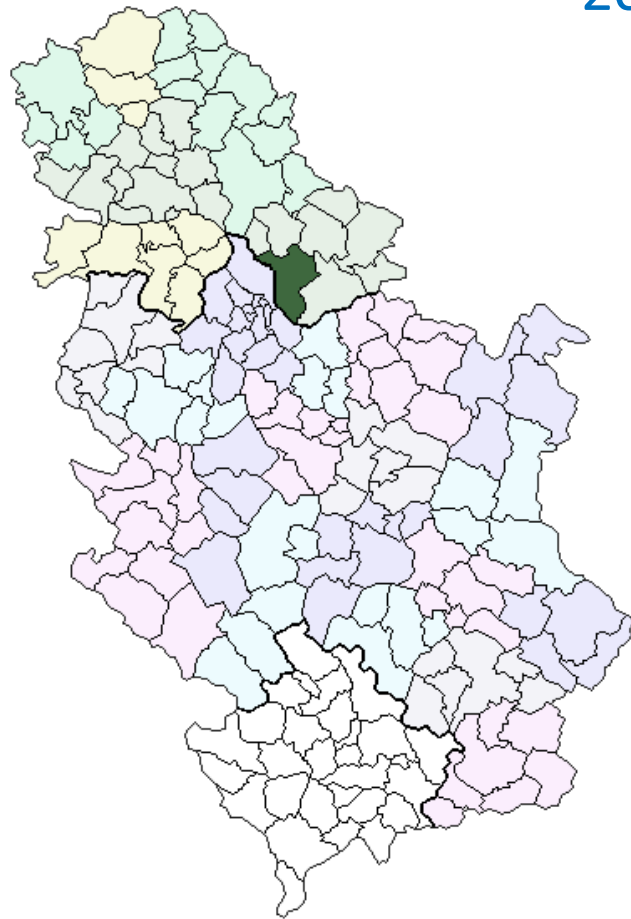
Public Utility Company JKP Grejanje Pancevo Energy Efficiency Projects in the District Heating

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CITY OF PANCEVO

20 km NORTH-EAST FROM BELGRADE



The City of Pancevo

123,414 inhabitants in administrative area (9th)

75,914 inhabitants in urban area (7th)

total 27,600 households in urban area

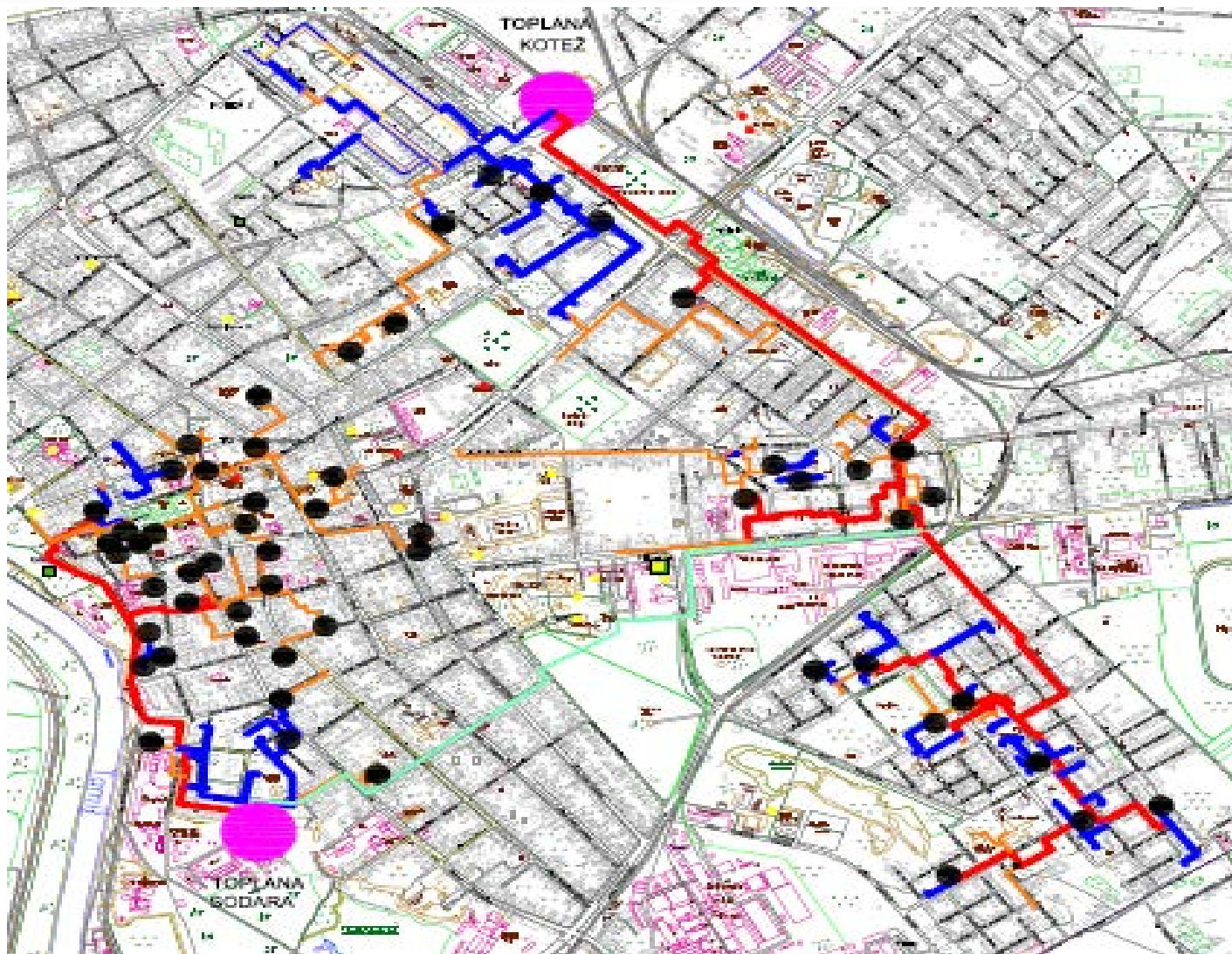
13,000 (12.600+400) flats, public and business facilities connected to the district heating network (46%)

2,000 households uses natural gas

13,000 households uses electricity, wood, coal

Today district heating system of the City of Pancevo is 5th system in Serbia according to the number of users

- Heating plant Kotez 53,6 MW (2x23,3MW+7MW)
pumping capacity 1600 m³/h, (100MW of users)
- Heating plant Sodara 26,5 MW (2x10,5MW+5,5MW)
pumping capacity 930 m³/h, (60MW of users)
- Boiler room Jastrebacka 1MW,
- Boiler room Sindjeliceva 0,8 MW
- Boiler room Svetog Save 0,14MW
- Total installed capacity 82 MW
- 12.600 flats and 400 public and business users
- 650.000 m² in flats and 180.000m² in public and business users
- Total 830.000 m² heated space
- 2.200 users of hot sanitary water



red: 15 km new hot water pipeline built in the project rehabilitation and modernization of district heating systems funded by the EAR (4,5 mill. Eur) 2007-2008.

orange: 30km a new hot water pipeline built by our own fund or funded by new users from 2003-2014. year

blue: 28 km old hot water pipeline ages of 30 to 40 years

73 km of hot water pipeline

45 km new pipeline and 28 km old pipeline



Central and District Heating in Pancevo

- The first central heating systems in buildings was constructed in early 60's
- during the late 60's and 70's the industry grew
- about 7,000 flats were built followed by construction of a large number of single building and block boiler rooms in buildings basements, mainly on a heavy oil (over 55 boiler rooms)
- late 70's and early 80's construction of independent heating plants started; Sodara 26,5MW (1976) and Kotez 53.6MW (1983)

- The boiler rooms were maintained by house councils
- Due to lack of maintenance and poor management the boiler rooms are completely ruined
- The city takes over the management of boiler rooms in 1989/90, but it does not manage to repair the situation in a short time
- In winter 1993/94 Pancevo had collapse of the system, during 180 days of heating season we had only 80 poor heating days
- It was thought about the complete shutdown of the district heating system

Public Utility Company JKP GREJANJE

was founded in 1993

10.100 flats and 220 public and business users

620.000 m²

the specific point of the system is a large number of block boiler rooms with total installed capacity of 160 MW

And of only 68MW used

there is a large range of power boiler rooms from 0,1 MW to 53 MW

that contain 2 natural gas heating plants

9 natural gas boiler rooms

17 heavy oil boiler rooms

7 light oil boiler rooms

1 coal boiler room

total 36 boiler rooms

total 55 boiler units



The Biggest Problems of the System

- huge leakage of water on the net
- the net was insulated with bitumen resin, which is actually a poor thermal insulator
- very poor quality of heavy oil which cause major problems with burning and combustion
- huge problems with hydraulics that lead to great differences in the quality of heating the flats, so many flats were overheated and others barely heated

- 268 substations were without any automation without heat exchangers, with pumps that are few times oversized, because in the past every hydraulic problem was solved by a new stronger pump
- 36 boiler rooms demanded over 74 operators that were engaged seasonally and who were significantly different each year

How Did We Solve the Problems?

1. Hydraulic Problems

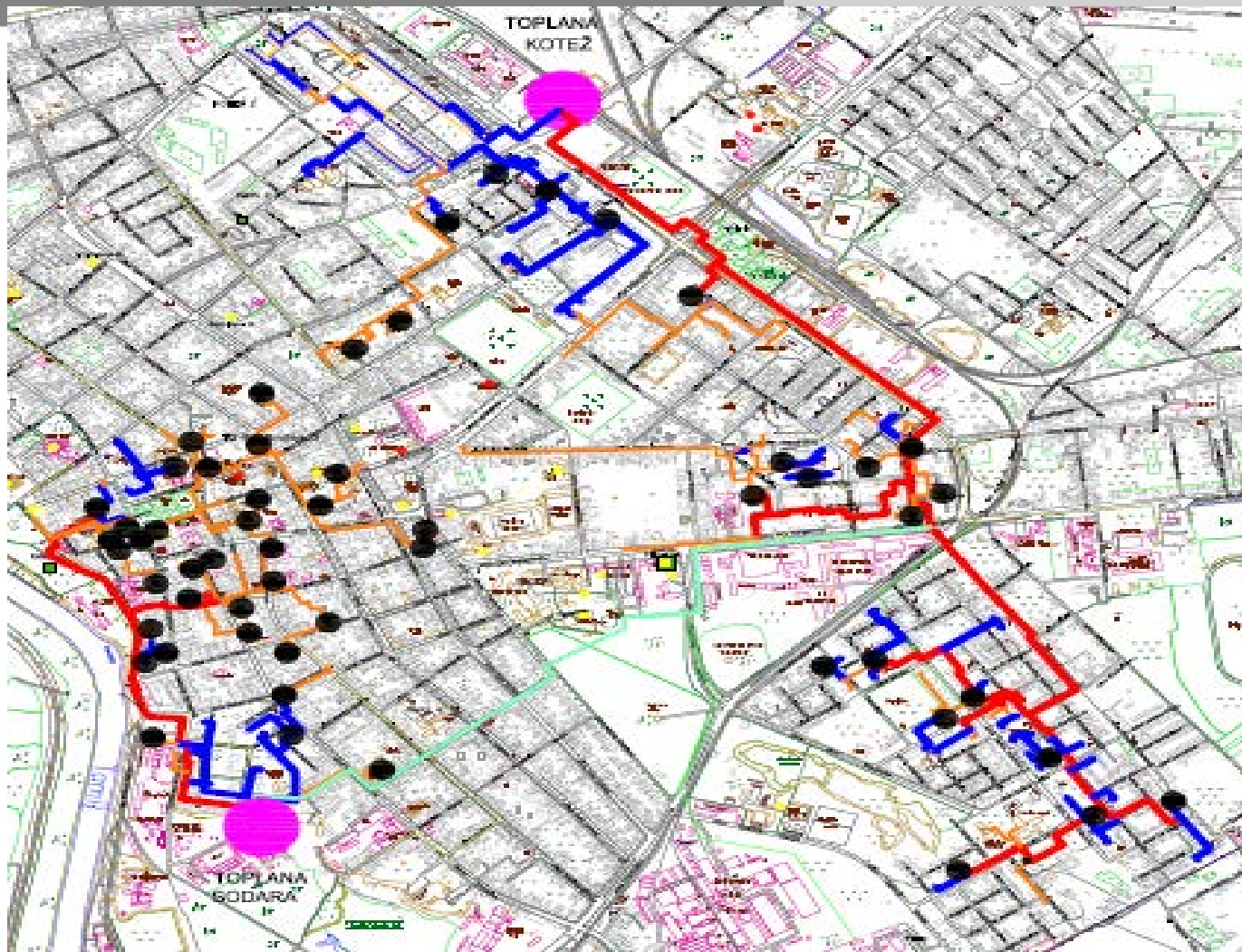
- from 1999 to 2002 we installed more than 400 balance valves in pipeline system and in substations, from DN25 till DN350
- the balancing valves have been able to directly measure the flow by electronic device and lock the valve to the set value
- thanks to these measures, the number of pumps has been reduced from 650 to 430, the electric power of the pumps has been reduced by 540kW in the substations and by 60 kW in the heating plants
- the quality of the service was incomparable to the previous state
- taking into account savings on heat and electricity these measures were repaid in the third month after installation
- After hydraulic regulation has been created, the conditions for the automation of the substations were made

2. Network

From 1993 to 2003, all the human capacities were dedicated to repair boiler rooms and only 100 flats were connected to the district heating system and less than 1km of hot water pipeline was built

From 2003 to 2017

- we have restored investor confidence and offered an acceptable and safe solution for heating
- 2.500 flats connected to the district heating system which is an increase of 25% and 45 km of hot water pipeline from DN32 to DN400 were built or reconstructed which is 60% of total network, 230.000m² of apartments, public and business facilities were connected in the system which is an increase of 34%
- 31 boiler room connected to district heating system and 8 boiler rooms of public and commercial buildings are closed and their users were transferred to the heating plants Kotez and Sodara
- today 98% of the capacities are covered from the Kotez and Sodara heating plants, although their capacity has not been increased

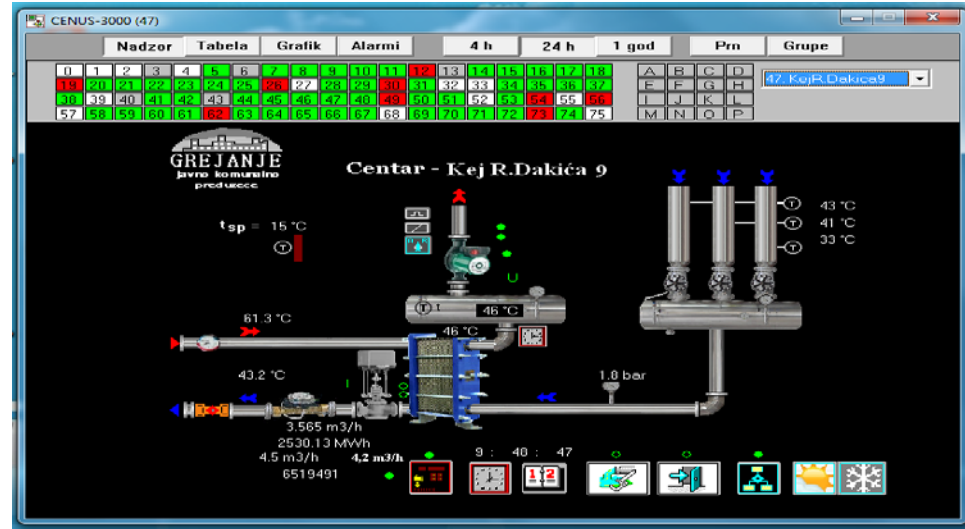
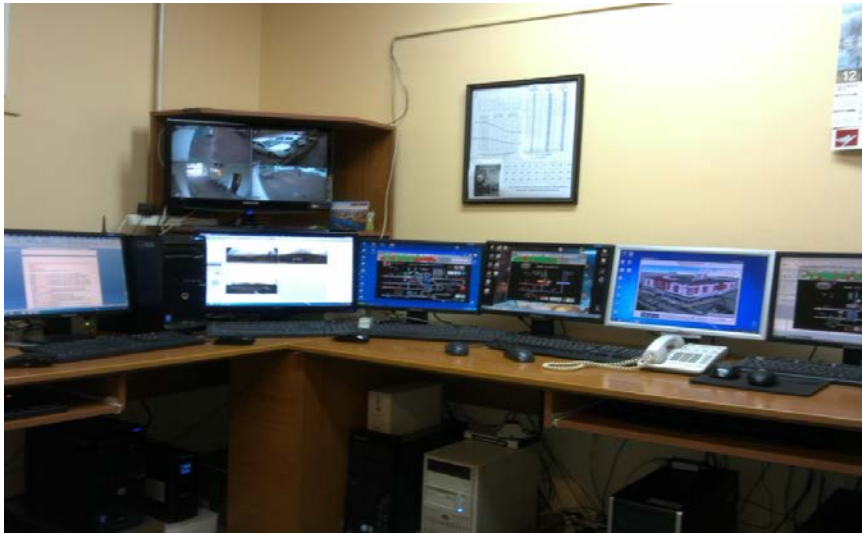


Today the only energy used is natural gas, which is very important for air quality, because Pancevo is an industrially polluted city

black spots represent the closed boiler rooms of residential buildings and public institutions

3. Automation of Substations

- from 2003 to 2008 268 substations have been reconstructed: automation and power cabinets, new pumps, electromotor valves and heat exchangers were installed
- from the very beginning, great importance was given to the realization of communication between the control equipment in the heating substations and the dispatch center. In the beginning, it went through leased phone lines, and after two years this system was abandoned and from 2005 a communication system was developed using GPRS modems
- today 330 substations are connected to the remote system and we are the only large system in Serbia with 100% coverage of remote control and substation management
- since 2002 every new flat has an individual pipe connection with a cabinet in which the heatmeter can be placed
- since 2011, every new flat has its own heatmeter that is reading remotely from the dispatch center
- currently, 330 heatmeters in the substations and 890 heatmeters in front of the flat have been remotely read



- SCADA for substation management has been developed according to our needs and experiences and gives excellent results in energy savings

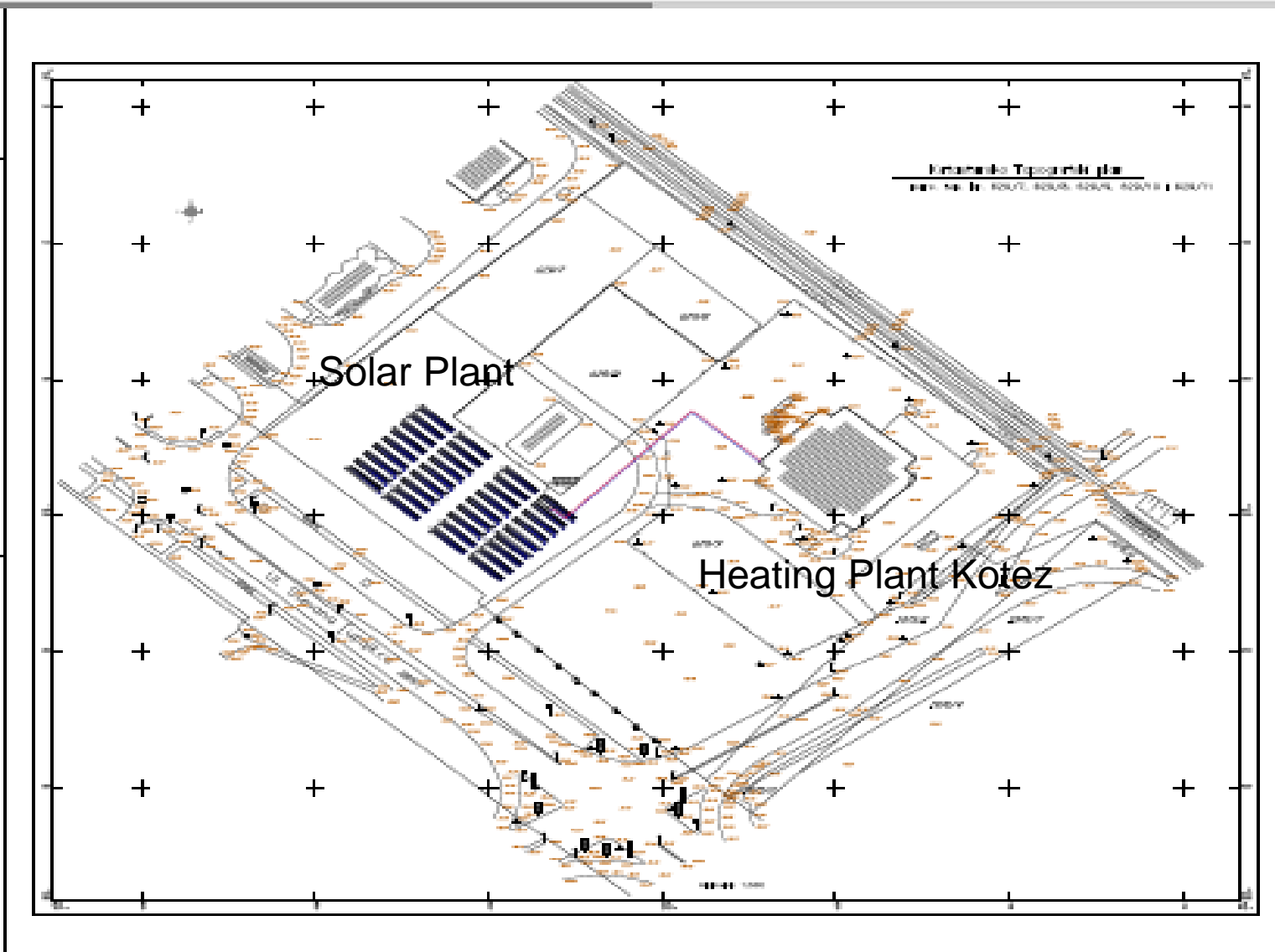
Hot Sanitary Water

- Pancevo is one of only four cities in Serbia in which the system of remote supply of hot sanitary water was built
- The system is designed to work in combination with district heating as a three-pipe-system, the first pipe is for heating, second for hot sanitary water and third is a common return pipe
- the system with a common return pipe proved to be very inefficient from May to September because there was a large disproportion in the required flow and the nominal flow of the common return pipe

- by measuring, it was found that losses on the distribution network in the period of May to September exceeded 47% with losses in the substations of up to 62%
- in 2012, we are building a network separated from the heating network of pre-insulated plastic pipes, 3 km long
- by these measures, transport losses were reduced by 32%, the effect would have been even greater if it had been possible to build an entire network of plastic pipes, but the first 280m of the three-pipe-system DN200/500/400 had to stay because it was passing below the international road and replacing this part of the pipeline had to wait for the time when the heating pipeline would be changed, which could be this year

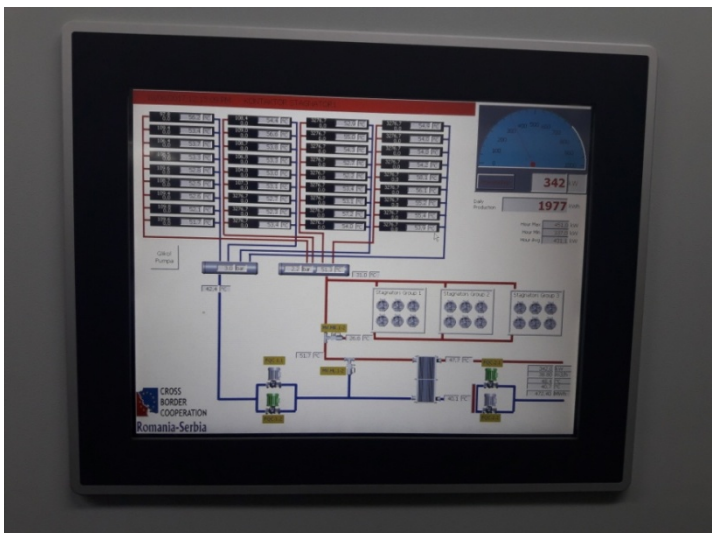
- one of the ways to make the hot sanitary water system sustainable was also an investment in alternative energy sources.
- In December 2011, we applied to the IPA Fund for a project to promote the use of solar energy together with the town of Lugoj from Romania.
- In October 2015 partners were offered to invest into the project but the project would have to be completed in 12 months which is twice shorter time than originally required
- despite many difficulties, the project is completed in time

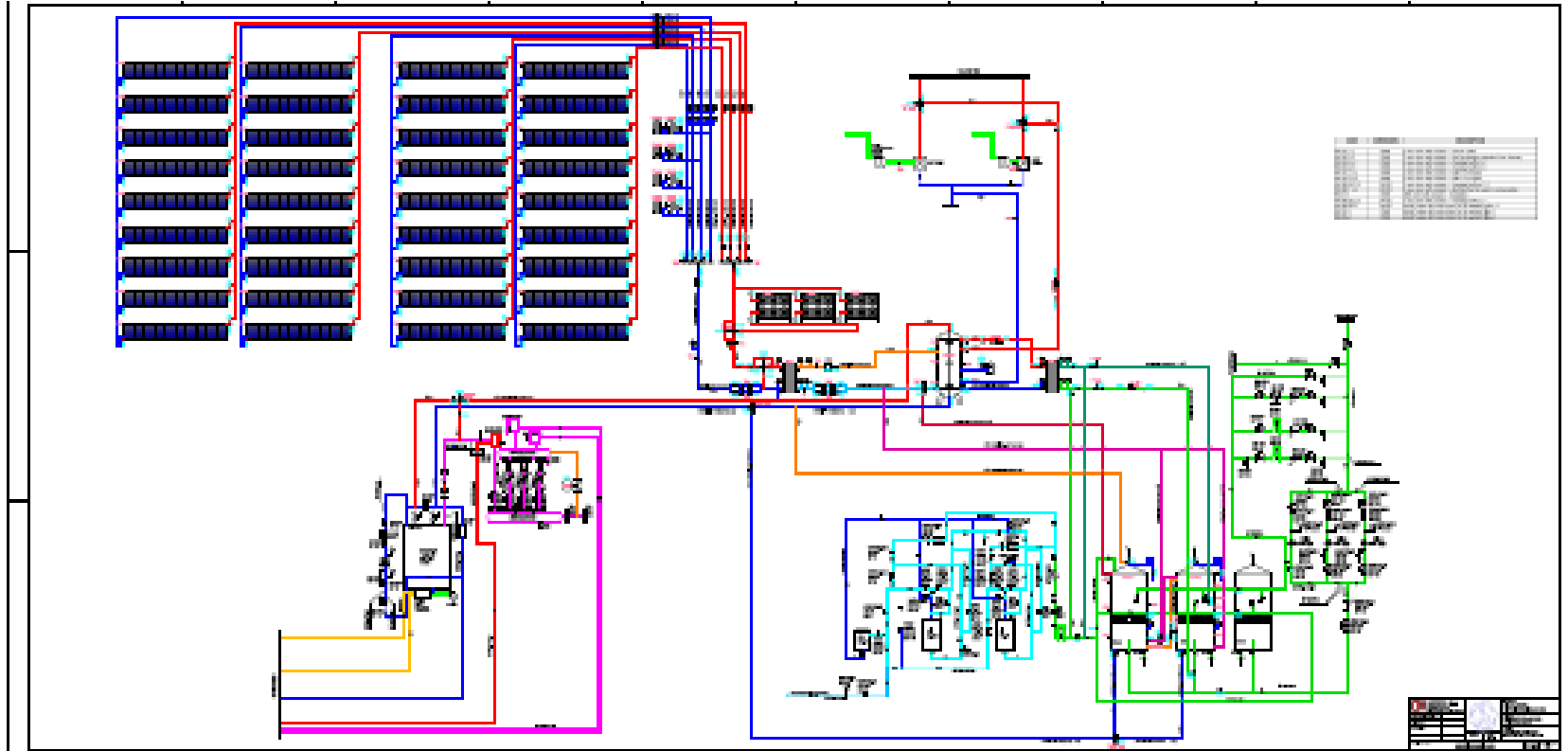
- In addition to other activities to promote the use of solar energy, the project in Pancevo included building of a pilot plant with the surface of 906m² which consisted of 360 panels of solar collectors and supporting equipment that would distribute the energy received from the sun.
- In this way, more than 600 MWh of annual heat energy is obtained, about 92,000 m³ of natural gas is saved and CO₂ emissions are reduced by 200 tons per year.
- also 8-10% of the annual energy required for the preparation of hot sanitary water will be substituted by solar energy.



Drawing of the base







Scheme of System

- The maximum stable power of the system is 680 kW
- The maximum summer amount of heat is 4 MWh/day
- Flow in the primary part of installation (solar fluid) is 25 m³/h
- The flow in the secondary part varies from 7 to 38 m³/h to get 60°C
- The maximum winter amount of heat for heating the air is 1.2MWh/day

- This is the largest system with solar collectors for the preparation of hot sanitary water in Serbia.
- due to a significantly higher temperature regime in pipeline network, during the winter period, the energy obtained from the solar collectors is used to heat the combustion air, which increases the efficiency coefficient of the boilers for heating.
- before the installation solar plant, the temperature regime was 75/45°C. In order to optimize the operation of the solar plant, the regime was changed to 65/35°C.
- This is achieved by the addition of another plate heat exchanger in the heat substation, which is placed in the order, behind the main exchanger, whose role is to preheat cold water from the water supply system to 38°C, and also as far as possible to lower temperature of water in the return pipe with variable flow

Experience in Project Management in Several Projects worth about 5,5 million EUR with Organizations:

- IPA CROSS-BORDER COOPERATION “BANAT SUN 4 ALL” 2016-2017 SOLAR PLANT
- European Agency for Reconstruction 2007-2008
- REHABILITATION AND MODERNIZATION OF DISTRICT HEATING SYSTEM IN PANCEVO - additional project
- European Agency for Reconstruction 2006-2008
REHABILITATION AND MODERNIZATION OF DISTRICT HEATING SYSTEM IN PANCEVO
- European Bank for Reconstruction and Development 2004-2005
MODERNIZATION OF SUBSTATIONS, INSTALLATION OF THERMOSTATIC VALVES AND HEAT COST ALOCATORS
- USAID 2000-2001
SPARE PARTS FOR BURNERS, CICULATION PUMPS AND FLUE GAS ANALYSER

Thank you for your attention!

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