Rehabilitation of District Heating in Serbia


Euroheat & Power
Enlarged Working Group Energy Policy
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DH Companies in SERBIA
Serbia lays between 19° and 23° of east geographic length and 41° to 45° of north geographic width.
The climate is continental moderate.
Population 7,5 million.
Capital, Belgrade with 2 million inhabitancies is situated on 132 m altitude and has an average temp. of 11,9 °C and rel. hum. of 71%.
Due to moderate climate individual heating in small places and parts of big cities is present, while DH is presented in bigger towns.
**HEATING IN SERBIA**

- **Individual heating:** electrical, woods, coal, natural gas
- **Local boiler station:** coal, light fuel oil, heavy fuel oil
- **District Heating:** natural gas, heavy fuel oil, coal

<table>
<thead>
<tr>
<th>Number of flats in Serbia</th>
<th>3,200,000</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flates with electrical heating</td>
<td>1,440,000</td>
<td>45%</td>
</tr>
<tr>
<td>Flates connected on DH or local boiler stations</td>
<td>800,000</td>
<td>25%</td>
</tr>
<tr>
<td>Flates heating with woods, coal etc.</td>
<td>640,000</td>
<td>20%</td>
</tr>
<tr>
<td>Flates on individual heating with natural gas</td>
<td>320,000</td>
<td>10%</td>
</tr>
</tbody>
</table>
District heating

DH in SERBIA

✓ In 55 towns
✓ Installed capacity 7000 MWth (45% in Belgrade)
✓ Average age of:
  - BOILERS 30 years
  - NETWORK 25 years
  - SUBSTATIONS 25 years
Association - Today

DH association of all DH companies from Serbia

Members 55 DHC
Total DH production capacity 7000MW

Annual Heat Production 6-7,000 GWh
District heating

- Average annual heat supply 6000 GWhth
  - 20% households (640,000 flats)
- Average annual fuel consumption around 590,000 toe
  - 65% natural gas, 18% HFO, 2% LFO, 15% coals
  - DH switched to NG, if access was available
  - No use of biomass at all
  - No use of solid waste at all
- No use of cogeneration
- Several studies for small cogeneration in large DH plants
District Heating Development


- New Boilers – coal
- New Boilers – HFO/LFO
- New Boilers - NG
- Investment in DH
- RES
District heating

Structure of average fuel consumption in DH (toe)

- NG, 420000
- HFO, 102000
- Coal, 60000
- LFO, 8000
DISTRICT HEATING IN SERBIA AT THE END OF YEAR 2000. (1/2)

- Economic situation in country, especially in companies for district heating was very bad. It is result of atrocious political situation and not adequate relation of preliminary government about heating and electrical energy prices.

- The prices of heating energy are doesn’t change for several years, beside inflation from about 100% per year and growth of prices HFO and gas on world market.

- That induces for all companies for district heating to work with great losses. Therewith were not financial resources for annual repairs in heating plants.
- Deteriorate pipelines wasn’t methodical changed, and equipment in substations is also deteriorate and outdated.
- Measurement of delivered energy is into practice only in some business objects, not in all.
- After Political transformation which are appear in the end of year 2000, situation enable better working condition for DHC, thry providing auspicious credits and donations for modernization of plants and substitution of deteriorate pipelines, equipment in substation (pump, heat exchangers, heat meters), etc.
Priority in DH sector

- Rehabilitation of existing heat sources:
  - Increasing energy efficiency
  - Emissions reduction
  - Decreasing heat losses
  - Modernisation of network and substations (heat meters, thermostatic valves, heat coast allocators)

- Rational use of fuels, increasing of NG use
- Increasing use of biomass fuels and introduction of new technologies, more efficient and more environmental friendly
History

- In last decade of XX century, no investment, production at the edge of technical and economical capabilities in DH sector
- Reformation in energy sector in Serbia (2001-2005) together with activity of IFI was start point for rehabilitation of DH sector
- During 2001 in 3 biggest towns in Serbia (Beograd, Nis, Novi sad), implementation of the programme started
Investment in DH rehabilitation

- First donation was from Danish government at the end of year 2000. – 1.1 mil DEM in spare parts
- From 2001. – GRANTS AND LOANS
- The biggest implemented project - KfW
  - Grant is in total 17.7 Mil € for rehabilitation of DH in Beograd, Novi Sad and Nis
  - Modernization of heat production process
  - Replacement of out-of-age pipelines
  - Reconstruction and replacement of substations
  - Education of staff
  - Pilot-projects as a demonstration for a new tariff system
**KfW Project**

<table>
<thead>
<tr>
<th>Phase Type</th>
<th>Year</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>I phase GRANT</td>
<td>2001</td>
<td>7.7 mil €</td>
</tr>
<tr>
<td>II phase GRANT</td>
<td>2002/03</td>
<td>10 mil €</td>
</tr>
<tr>
<td>III phase LOAN/GRANT*</td>
<td>2006/07/08…</td>
<td>12 + 8 + 2+5.5 mil €</td>
</tr>
</tbody>
</table>

* **Towns:**
  
  Niš, Kragujevac, Kraljevo, Pirot and Sombor
Other projects

- Belgrade DH rehabilitation project
  - Loan from EBRD + donation from SIDA
  - In total 20+2 Mil € for rehabilitation of DH in Beograd
- Feasibility Study for new CHP plant in Belgrade is started
- Several small projects like EU/EAR EE Fund with towns contribution (for 6 towns). Implementation of the projects: Serbian Energy Efficiency Agency
EAR DH rehabilitation project

- Donation of 3,8 mil € (per city) for equipment and work will be received by Subotica, Pančevo, Čačak, Valjevo, and Užice. Total amount around 22 mil €

- With this project will be covered:
  - Replacement of out-of-date boilers with new
  - Replacement of the pipelines
  - Reconstruction with modernisation of the substations including measuring of delivered heat energy
  - Monitoring and control of the process of production and distribution of heat thermal energy by implementation of PLC and SCADA systems.
DH in Energy Low

- Adopted on 01 August 2004.
- Full responsibility and jurisdictions, including tariff systems, are on local authorities!
- Heat metering billings become a **Obligation**
- Producers which use **RES or waste**, meeting requirements regarding energy efficiency
Priority for LA and DHC

- Improving the quality of the service and reducing the costs
- Implementing tariff system that promote energy savings
- Improving the financial situation of Toplana`s
- Supporting low-income households
- Installing Heat Metering in substations
- Achieving cost covering tariffs
- Releasing municipal budgets from direct payment (investment) subsidies for DH
Rehabilitation of the DH system in the Novi Beograd area was implemented by KfW project.

- 110,000 customers
- 6,500,000 m² of heating area
- 1,000 MJ/s connected load

Production plant “Novi Beograd”

- Modernisation of the thermal energy production process control on 4 boilers, 116 MW each
- Central Hardware unit PLC S7-400 was installed
- Whole process is managed by Siemens SIPROCS-SCADA
- Measuring of delivered heat on all (6) main pipelines
Thermo-command room

MODERNISATION RESULTS

- More Secured processes
- Significantly faster response for all events
- Reduced time in technical production stops
- More system information for operator

Efficiency is increased and production costs are reduced by 5%
PIPELINES

- Replacement in total amount of 10 km of worn-out classic main pipelines with preinsulated; diameter $\phi$ 88-600 mm
- Replacement of 80 compensators $\phi$450 - $\phi$650

RESULTS: Losses in water (leaking) are reduced by 100% in this area, e.g. 10% in NBGD area
Thermal SUBSTATIONS 1/2

- Reconstruction and modernisation of 600 substations (with variable flow)
  - Flow regulation (“combo valve”)
  - Regulation of pressure and overflow valve
  - Ultrasonic measuring of the flow (heat meter)
  - Automatic cabinet with controllers
Basically, substation is operating with local regulation with controller S7-200 in the function of the outdoor temperature.

Prefabrication of the substation was done in BE workshops, with BE stuff; this provide that total amount per substation (650kW) e.g. procurement, montage and installation are not excide 4000 €

BENEFIT: In period when out-door temperature is higher then 5 °C (40% of heating period), needs for delivered heat is reduced by 20%
Pilot PROJECT

- Installing of the Heat Cost Allocators and thermostatic radiator valves

Results:
- Reduction in delivered energy 15%
- Reduction in electrical energy 40% (variable flow pumps)
EBRD + SIDA Project

- Realisation in progress
- This loan is used for rehabilitation of the heating area of DUNAV, KONJARNIK and VOZDOVAC
  - No of flats: 55,000
  - 800 MJ/s connected load
  - Modernisation of the product. sources
  - Inst. big heat exchanger
  - Inst. of the econom. for boilers
  - Installing of DCS + BMS
  - Installing of the frequency regulation on main circ. pumps
  - Modernisation of 1600 substations
SIDA Donation

- Consultants services on realisation of the project
- Modernisation of 85 substations in Zemun heating area
- Shutting-down of the local boiler station “Ivankovacka” (coal fired in the center of the town) and connecting all buildings of the Technical University Center to district heating network
Needs for investment

- It is obvious that thru all existing project was covered only 10 cities
- Our estimation is that this 10 towns need around 50 mil € for finalisation of rehabilitation and modernisation of DH systems
- Other 45 towns need at least 150 mil € in next 10 years for rehabilitation of DH systems
- Such big amount of funds can not be provided by the IFI’s, but PPP will be necessary approaches for co-financing in DH rehabilitation
ABOUT COMPANY

PE “Beogradske elektrane”
At the beginning...
About Company

- Established 03. Jun 1965. with 315 MW installed capacity at location of Novom Beogradu
- No of heating source: 66
- Capacity: 2,600 MW
- Pipeline trace: 570 km
- Thermal substation: 6235
- No of connected flats: 292,560
- Business consumers: 8,200 objects
- Total heating area: 19,478,942 m²
- Employees: 2,400
RES & ENEF

- Several projects are ongoing
- Using of **geothermal** water energy – Heat pump for climatisation of our building in Konjarnik
- Using of **solar energy** for preparing of domestic hot water in area of Cerak
- FS for 350MWe **CHP** – Novi Beograd in progress
- Using of **solid biomass** instead of coal
- Saving primarily energy through Modernisation and automatisation of biggest production plant`s and distribution systems with automatisation of thermal substation`s
- Introducing of measuring of energy and new tariff`s system
Contribution to ecology

- In last 30 years “Beogradske elektrane” shut down 1000 local boiler station`s – running on coal and HFO
- Existing customers are connected to large heat sources
- This is a great contribution to Belgrade Clean air
- Due to technical reasons – it is not possible to shut down all
- We have to find best solution for them, acceptable from economical and environmental side
Using of coal

- In total fuel consumption coal is tacking around 1%, but in total amount is around 10,000 t for one heating season
- Projection for next five years is reduction to 5,000 t with further shutting down of LBS
- This amount of coal during the combustion realise significant amount of pollutants in the air (sulphur oxides, nitrous oxide, soot…)
- Special problem is spreading out of small parts and coal dust in surrounding during the transport and delivering, possibility of self combustion during storaging, cleaning of boiler from residues and ash, storaging and manipulation with ash…
- Because of this, BE conduct a special test – running several heat sources during last heating season on biomass without any technical modification. **BE IS PIONEER IN THIS AREA - FIRST IN SERBIA RUN BIG PLANTS ON PELLETS AND/OR BRIQUETS**
Choosing of Heat Sources

- With 5 different heating sources we “cover” all types of boilers for solid fuels, transport and dosing of fuel, controlling of combustion air with making of results representative.
- Types of boiler: block, casted, membranes
- Fuel transport: elevators, rolling with tapes, manual
- Dosing of fuel: mechanical (snail or impuls) and manual
- Combustion air: forced by fan and natural circulation
- Separation of solid parts in duct channels
- Chosen heating plants:
  - Barajevo, Sremcica, Senjak, Bogoslovija and Mirijevski bulevar
Practical work

- High trained team and certified laboratory was collecting all data with usual operating with coal
- Next day, from morning start, all procedures and activities was repeated with biomass
- For science analysis, we also prepared mixture of 25% and 50% of coal and biomass
- All test was finished within a month, and another month for analysing of data and preparing a Report
- Biomass used: PELLETS AND BRIQUETS
## Boiler station ”BARAJEVO”

### TECHNICAL DATA

<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating since</td>
<td>1987</td>
</tr>
<tr>
<td>Installed capacity</td>
<td>7,675 MW</td>
</tr>
<tr>
<td>Number of boilers</td>
<td>5</td>
</tr>
<tr>
<td>Single boiler capacity</td>
<td>1,535 MW</td>
</tr>
<tr>
<td>Boiler type</td>
<td>REMAX-GA</td>
</tr>
<tr>
<td>Boiler manufactured</td>
<td>1986/89</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>110/70 °C</td>
</tr>
<tr>
<td>Consumers capacity</td>
<td>4,26 MW</td>
</tr>
<tr>
<td>Heating area</td>
<td>35903 m²</td>
</tr>
<tr>
<td>Substation type</td>
<td>direct</td>
</tr>
<tr>
<td>Distribution system</td>
<td>110/70 °C</td>
</tr>
<tr>
<td>House installation regime</td>
<td>90/70 °C</td>
</tr>
</tbody>
</table>
Combustion of briquettes

Boiler station:
“Mirijevski bulevar”, “Uralska”, “Bogoslovija”
Reality…

- It is possible to operate in status “as it is”
- BUT…
- Real ecological effect's and maximum of energy efficiency will be reached with complete reconstruction and modernisation of production plants
- For that, we need financial support, presently not available
IT IS TIME FOR DECISIONS!!!
THANK YOU FOR THE ATTENTION!
VIELEN DANK FÜR IHRE
AUFMERKSAMKEIT!

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