Antonio Garrido Marijuan
TECNALIA
antonio.garridomarijuan@tecnalia.com

Title: District Heating De-Carbonisation in Belgrade. Roadmap.

Introduction

The operation temperatures of today's DHs are too high for a massive integration of renewable systems, while the current control systems are no able to properly introduce weather-dependent, distributed heat sources such as solar systems. The DH strategy for the city of Belgrade (Serbia) addresses these barriers with the focus to de-carbonising the city on a multi-year transition plan, including large investments, greater interconnection levels with large solar thermal plants and waste incineration plants, and the conversion of a power plant into CHP, among others.

The size of the Belgrade DH, one of the biggest of Europe with >12PJ heat sales only compared to few DHs networks such as Copenhagen's (>30PJ heat sales) or Stockholm´s DHs (>25PJ heat sales), makes its de-carbonisation highly relevant and challenging, requiring advanced technologies to reach the goals.

DH of Belgrade

Originally with steam as heat carrier, this DH dates from 1961 and is today a lower temperature system that delivers pressurized water at about 80°C to consumers, in contrast with modern DHs where heat is supplied at 60-70ºC in combination with new HVAC systems operating at 60°C/30°C.

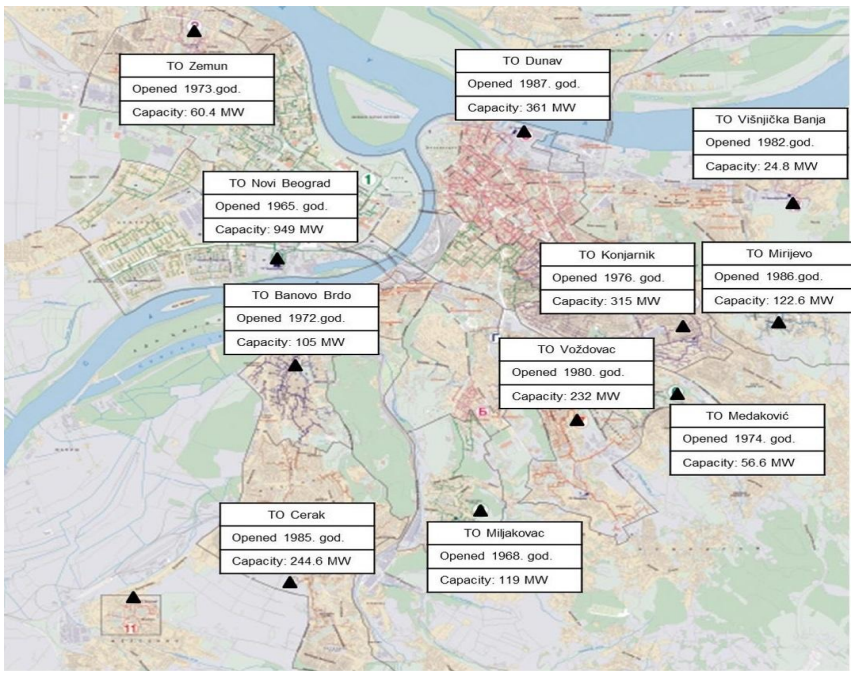

Figure 1: Capacity and location of the main central plants of the Belgrade DH (Source: BE Management and Deloitte analysis).

This Project has recieved funding from the European Union's Horizon 2020 research and innovation programme under gran agreement Nº 768567.

In the process of the DH modernization, more than 8,000 substations were updated since 2015 with required equipment to enable automatic operation, measurement of delivered heat energy and thus the realization of pay by consumption for residential objects.

Capacity of the DH

The DH relies on 14 heat plants and 47 individual boilers with a total capacity of 2,819 MW and an annual production of 3,600 GWh of heat energy, with 8,686 substations connected by a 1,460 km network. 89% of the total is gas based, while RES only accounts for 0.38% of produced energy, being the total fossil fuels consumed equal to 14.1 billion Serbian Dinars in the heating season 2014/15.

The surface covered is 21,882,862 m^2 by 02/2016, growing annually at 411,278 new m^2. The costumers are 81% residential (305,000 households, about 50% of all households in Belgrade) and 19% commercial area.

General energetic plan

The energetic development strategy of Belgrade aims to have an annual growth rate of 1.7% of connected households until 2025, as well as an optimization of the DH with the following interventions until 2030:

- Introduction of district cooling technologies.
- Improvement of the current DH to the level of fourth generation district heating and cooling.
- Increase in the DH efficiency, with systematic heat pipeline network replacement and increase on the use of cogeneration and RES, with the objective of increasing the former to 15%.
- Connection of the largest power plant in Serbia (17.263 GWh annually) with the DH through the heat pipeline known as “TENT-A: Obrenovac – TO Novi Beograd”. This will include a capacity of 600 MW in the DH.
- Connection of existing heating areas into a single heating system of Belgrade, with possible development of heat storages as an integrative part of the system.
- Lower water temperature in the distribution system.

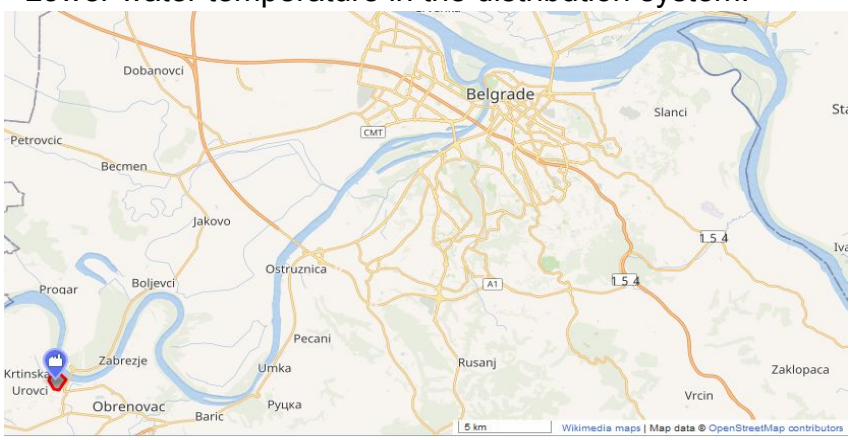

Figure 2: Map of Belgrade area, where it can be observed the distance that the TENT-A pipeline will cover (plan in progress).

This Project has recieved funding from the European Union’s Horizon 2020 research and innovation programme under gran agreement Nº 768567.

- Users' change from electricity to DH for heating.
- Better management of the DH through the deployment of ITC.

The network conversions need to be carefully scheduled, taking advantage of summer seasons whenever possible. The total budget goes up to 300M€ with a time plan until 2025.

Impact of the DH network to meet the Sustainable Development Goals
The DH De-Carbonisation Multi-Year transition plan here presented for the city of Belgrade has a large contribution to meet the following goals:

- SDG 7_AFFORDABLE AND CLEAN ENERGY: through the increase in energy efficiency of the main DH in Belgrade and the integration of renewable energies (RES) into this system.
- SDG 11_SUSTAINABLE CITIES AND COMMUNITIES: through the decarbonization of the main city in Serbia by providing a low carbon heating at urban level.
- SDG 12_RESPONSIBLE CONSUMPTION AND PRODUCTION: the city of Belgrade has been modernized to enable automatic measurement of delivered heat energy and thus the realization of pay by consumption for residential objects, resulting in more responsible and aware consumers.
- SDG 13_CLIMATE ACTION: by supporting the city's views and expanding to more municipalities in the short-medium term.

Conclusions
The renovation plans for the District Heating network of the city of Belgrade have been summarised above. This ongoing upgrade and improvement on the technologies used has a great impact over the carbon balance of the city, including the importance on the operation at low temperature. The reduction on the temperature of the DH not only reduces the energy demand, but also allows the integration of renewable energies such as large solar thermal plants and waste incineration plants.

After the execution of the de-carbonisation roadmap, it is expected that the DH system will reduce its carbon intensity by 50%.

This Project has recieved funding from the European Union's Horizon 2020 research and innovation programme under gran agreement Nº 768567.