

Factsheet T.2.2

In depth analysis of the case study
in Ljubljana

April 2025

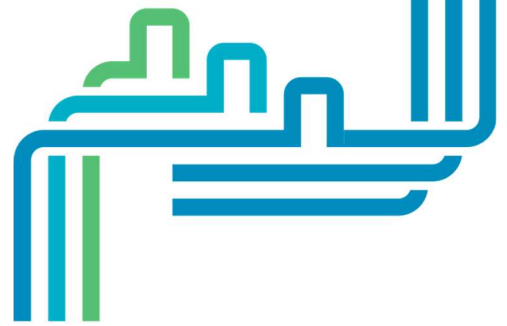
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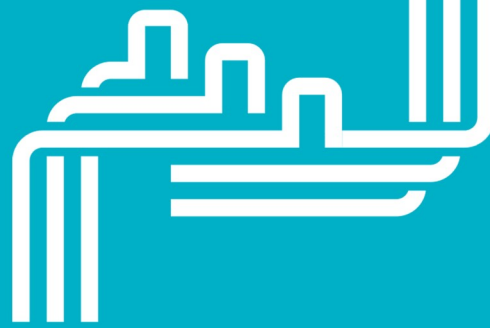


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TABLE OF CONTENTS

INTRODUCTION	5
Description of district heating in Ljubljana	6
Heat generation.....	6
Heat distribution.....	9
Upgrading Measures	11

INTRODUCTION

The district heating system in Ljubljana is operated by Energetika Ljubljana, managing both generation and distribution. Established in 1966, the system covers the central part of Ljubljana, supplying hot water for heating and domestic hot water to over 48% of residential customers.

Heat is produced at two plants operated by Energetika Ljubljana. The primary generation unit is the TE-TOL plant, which generates 95% of the heat for the district heating network. The remaining 5% is generated by the TOŠ unit. Both plants also provide steam for industrial use in the nearby industrial region in both areas of the city.

An important goal for the future is to identify flexible and efficient technological solutions for district heating systems, focusing on renewable energy sources and waste heat. The joint optimisation of the electric power networks and district heating systems will also result in cost reduction for the development of the electric power networks due to a smaller number of electric heating devices, which would otherwise enter at medium and low voltage levels.

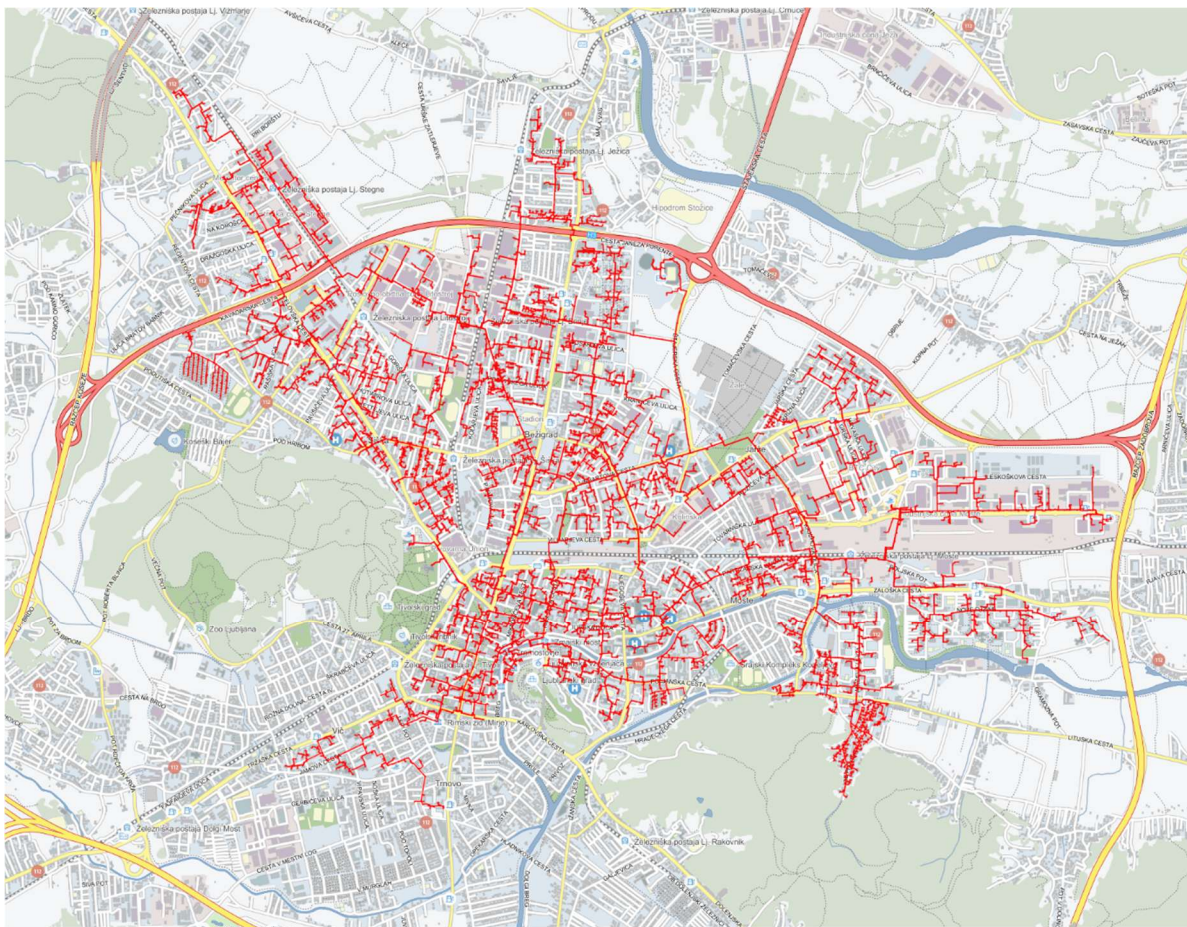


Figure 1: Map of district heating network

Description of district heating in Ljubljana

Heat generation

There are two plants serving the district heating system: TE-TOL and TOŠ. The first is located in the eastern part of the city while the second one is located in the northwestern part. Both are located in the industrial zones.

Plant	Location	Installed thermal power, MW _{th}	Supplied yearly energy, MWh/year	Year of construction
TE-TOL	Toplarniška ulica 19, Ljubljana	442	787.000	1967
TOŠ	Verovškova 62, Ljubljana	234	195.400	1984

The older and larger unit is TE-TOL, where heat is produced with boilers and cogeneration. The plant was commissioned in 1966. Since 2002, it has switched to environmentally acceptable coal with low sulphur and ash content to generate energy, and in 2008 one unit was redesigned to work with combination of coal and woodchips. In 2024 the plant was upgraded with a combined cycle gas turbine CHP unit, that will replace part of the coal-based technology. The total heat generation provided for the district heating network is 95%.

Unit	Technology	Installed thermal power MW _{th}	Year of installation	Planned year of decommissioning
B1	Coal boiler & steam turbine	60	1967	2026
B3	Coal & biomass boiler & steam turbine	140	1984	2030
PPE	CCGT	120	2025	/
VKLM1	Hot water boiler	58	1982	/
VKLM2	Hot water boiler	58	1982	/

B1	Biomass boiler & steam turbine	55	2028	/
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In addition to the primary generation source, Energetika Ljubljana also manages a peaking and redundancy plant, the TOŠ unit, which generates 5% of total heat. Peaking and redundancy plants are used to supplement the necessary energy in cases of insufficient generation from a primary source. The TOŠ unit also includes a cogeneration with a gas turbine to supply technological steam to the nearby industrial customers.

Unit	Technology	Installed thermal power MW _{th}	Year of installation	Planned year of decommissioning
VK1	Hot water boiler	58	2015	/
VK2	Hot water boiler	58	2015	/
VK5	Hot water boiler	116	1985	/

At the TE-TOL site, there is also a 20,000 m³ storage unit with a capacity of 850 MWh. The maximum operating temperature of the storage unit is 97°C.

The total amount of heat generated by both plants is around 1,150,000 MWh/year, of which approximately 1,000,000 MWh is used for heating systems. Heat demand has been decreasing over the past few years, as shown in the table below.

	2021 [MWh]	2022 [MWh]	2023 [MWh]	Average [MWh]
Production of hot water	1,150,475	1,015,321	976,666	1,047,487
TOŠ	212,707	119,409	174,946	169,021
TE-TOL	937,768	895,912	801,720	878,467
Production of steam	266,884	277,375	173,231	239,163
TOŠ	80,831	79,787	78,998	79,872
TE-TOL	186,053	197,588	94,233	159,291
Total production of heat	1,417,359	1,292,696	1,149,897	1,286,651

Most of the heat produced for the district heating system in both plants comes from cogeneration (66.8%), the rest is produced by boilers (30.7%), reduced production (2.1%) and waste heat (0.4%). Waste heat is recovered from a pharmaceutical factory near the TOŠ plant, the amount of energy is around 3,300 MWh per year.

The types of fuels consumed are: coal (20,83 TJ), biomass (827 TJ) and natural gas (78,726,000 Nm³). Natural gas is used in both plants for CHP and boiler operation, including electricity and steam generation, while coal and biomass are only consumed at TE-Tol plant.

The total primary energy consumption is around 7,300,000 GJ per year, and the primary energy factor is 0.771. The total GHG emissions are 364.000 tCO₂-equivalent per year.

Plans for the future include shutting down the remaining coal powered units and converting one of them to operate on biomass. There is also a plan to build a waste incineration plant, that will also be connected to the district heating system.

Heat distribution

The length of the hot-water network is 277 km, and the length of the steam pipeline system is 6 km. The peak load of the hot-water system was rated at 1,192 MW in 2023, while the active load is rated at around 450 MW at a minimum ambient temperature. There are 5,098 heat meters and 13 steam meters connected. The total heat sold in 2023 was 979,213 MWh of which 817,054 MWh was hot water and 162,159 MWh was steam. When we compare the consumed heat with production, we can calculate that hot water network losses are 16.3%.

Connected to the district heating network are all types of buildings: flats and houses, public buildings, commercial buildings and industrial buildings.

The total area of all buildings connected to the district heating network is estimated at around 10,123,500 square meters. The size of connected customers is between 20 kW and 8 MW.

The heat price is divided between a fixed price for connection and a variable price for usage. Connection price is 1,950.29 €/MW for flats and households and 2,258.29 €/MW for public, commercial and industrial buildings. The price for used heat is the same for all users and is 75.89 €/MWh.

Temperature moderation is based on the season and time of day. Temperatures are based on the outside temperature and are displayed in the following graph. The black line is the supply, red is the return line, and green and blue lines are for renovated and new buildings.

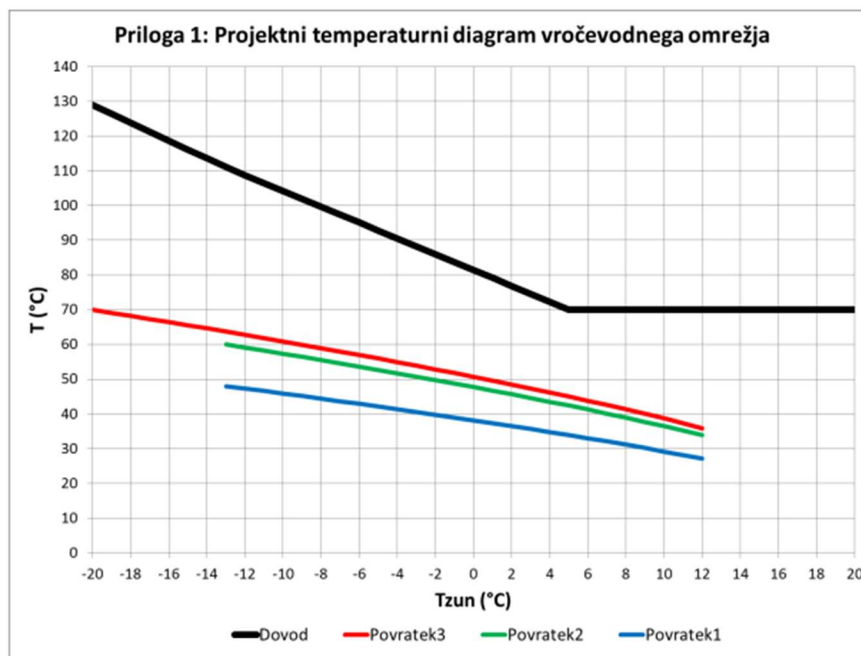


Figure 2: Projected temperature regimes in district heating network

The network was constructed in 1967 and has been expanded and upgraded over time. Every year, some parts of the network are repaired or replaced, so the actual age of the network varies between sections. Due to the age of some parts of the network, the main problem is hot water leakage. To fix this problem, every year, part of the investment is used to repair the leaking system.

Maintenance costs vary throughout the year, based on the scope of work. In the years between 2021 and 2023, they ranged between 2 and 5 million Euros.

The pipes are made of steel, pre-insulated and placed in utility ducts, which is a specified design by Energetika Ljubljana.

Other network investments include upgrading/renewing the piping, expansion of the network and reduction of temperature levels.

In addition to network investment, there are also investments on the production side, which were higher in past years due to the construction of the new cogeneration plant, as mentioned before.

Upgrading Measures

While the conversion to biomass of the coal-fired units is being investigated in activities parallel to the ENABLE DHC project, the main upgrading measure to be analysed revolves around RES integration, mainly in the form of heat pumps, either from river water or wastewater treatment plants.

Technical and economic feasibility will need to be assessed in order to define an optimal design and financial strategy, as well as the related uncertainties.

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