Tool 9

SUPPORT DHC

DISTRICT HEATING NETWORK SEPARATION TO TRANSITION TOWARDS LOW-TEMPERATURE SYSTEMS

INTRODUCTION TO THE TOOL



The integration of low-temperature renewable and waste heat sources into existing district heating (DH) systems offers significant opportunities to improve energy efficiency and reduce greenhouse gas emissions. However, conventional DH networks often operate at relatively high supply temperatures, making the direct utilisation of low-temperature heat sources challenging. Reducing the supply temperature of an entire DH network may require extensive modifications to building heating systems, substations, and network infrastructure. An alternative approach is to separate a suitable part of the existing network and operate it as a low-temperature subsystem supplied primarily by a new heat source. This enables a more gradual and targeted transition towards low-temperature district heating.

A key challenge in implementing this approach is identifying which part of the existing DH system should be separated. The selected area should be spatially connected, compatible with the available heat source capacity, and preferably include buildings suitable for low-temperature operation. Identifying such areas can be particularly challenging in large DH systems, especially when detailed information on the existing pipe network and individual buildings is unavailable. Therefore, a method that relies on more readily accessible spatial data can provide valuable support for preliminary planning and assessment.

To address this challenge, a MATLAB-based DH network separation tool has been developed. The tool uses a spatial heat demand density map, in which the DH area is divided into geographical cells characterised by their heat demand and building age. Three main criteria are considered: proximity to the new heat source, heat demand density, and building age. These criteria are combined into a priority index used to rank individual cells according to their suitability for separation.
The algorithm applies a region-growing procedure, starting from the cell closest to the new heat source and progressively expanding the selected area based on the calculated priority indices. Additional procedures address spatial gaps and disconnected areas to improve geographical coherence. An iterative calibration process adjusts the size of the selected area so that its design heat load is compatible with the available heat source capacity and an assumed contribution from the remaining DH network during peak demand.

The tool allows users to investigate different separation scenarios by modifying the location and capacity of the new heat source. It generates datasets containing the selected DH cells and their calculated priority indices, together with spatial visualisations of the results. The algorithm has been demonstrated using the DH system of Reggio Emilia, Italy, considering different heat source locations and capacities.

The tool is intended for DH operators, energy planners, engineers, and researchers investigating opportunities for stepwise transitions towards low-temperature district heating. It supports preliminary spatial screening rather than detailed hydraulic or technical design, and the identified areas require further assessment before implementation. The corresponding MATLAB code, example input data, Technical Description and Methodology report, and User Guide are available as Tool 9 in the Support DHC Replication Hub.