Enhancing and Decarbonising District Heating and Cooling in Italy: Capacity Building as a Key Driver

Although district heating and cooling (DHC) meets only a small share of Italy's thermal demand and relies mainly on fossil fuels, it is set to grow. The EU-funded SupportDHC project promotes decarbonisation by tackling barriers and boosting collaboration between operators and stakeholders by structured capacity building activities.

The present study originates from activities carried out within the EU Life SupportDHC project, which, among other techno-economic supporting measures, activated an effective stakeholders mapping and developed a national capacity building (CB) programme to foster dialogue among DHC operators and stakeholders in five European target countries: Austria, Germany, Italy, Polland and Ukraine.

In Italy DHC represents a small contribution to thermal energy demand satisfaction and it is mostly based on fossil fuels, but it is expected to grow. Increasing the share and decarbonising DHC becomes crucial, considering that Italy has endorsed the European long-term vision by committing to a 55% reduction in greenhouse gas emissions by 2030 (relative to 1990) and full carbon neutrality by 2050 in its National Energy and Climate Plan. In addition, Italy has recently started the national implementation of the Energy Efficiency Directive (EED 2023/1791) and Renewable Energy Directive (RED III 2023/2413), which intensify the definition of "efficient" district heating and impose stepwise renewable energy sources and waste-heat penetration. Furthermore, this path is in accordance with the recast Energy Performance of Buildings Directive (EPBD 2024/1275) that imposes zero-emission buildings, favouring connection to low-carbon networks

The EU-funded SupportDHC project includes activities to implement a structured CB programme with operators (owners and operative managers of the DH systems) and stakeholders (e.g. local administrators, associations, authorities). The following steps have been implemented to create a structured CB program:

- stakeholders and operators mapping, highlighting their roles and influence;
- preliminary activities to investigate perception, barriers and drivers and to identify the most proper and effective engagement and CB activities.

Materials and methods

By a review of recent scientific literature focusing on European and Italian DHC sector, a draft overview of the technical and non-technical barriers, drivers, and challenges associated to DHC and its decarbonisation was accomplished. Then, exploiting the opportunity provided by the EU Life SupportDHC project, CB activities were designed in two parallel streams, one specifically targeted at institutional stakeholders and another at DHC operators, each with tailored engagement strategies. The overall methodological framework for these two groups was similar, with some adjustments based on specific audience requirements.

Stakeholders and operators on-line surveys and data processing

Preliminary online surveys were conducted among both stakeholders and operators to identify both the main interests, lacks and criticalities, important barriers and drivers, and the availability and willingness to be involved and organisational preferences for CB implementation (workshops, roundtables, interactive sessions and logistical considerations). This process was conducted by tailored questionnaires developed for each stakeholder category and operators.

After collecting feedback, data processing was performed to identify common perspectives and interests across different stakeholder groups and operators. A specific data collection template was created for this purpose. The template used for processing stakeholders' and operators' responses were similar; the one adopted for operators is reported in Figure 1. Based on the feedback, program, timelines, relevant key topics, and methods for the CB events (for stakeholders) and courses (for operators) were determined.

Design of the CB activities

Based on the data collected through the preliminary surveys, the CB programmes were designed taking into account the specific needs, expectations and organisational preferences expressed.

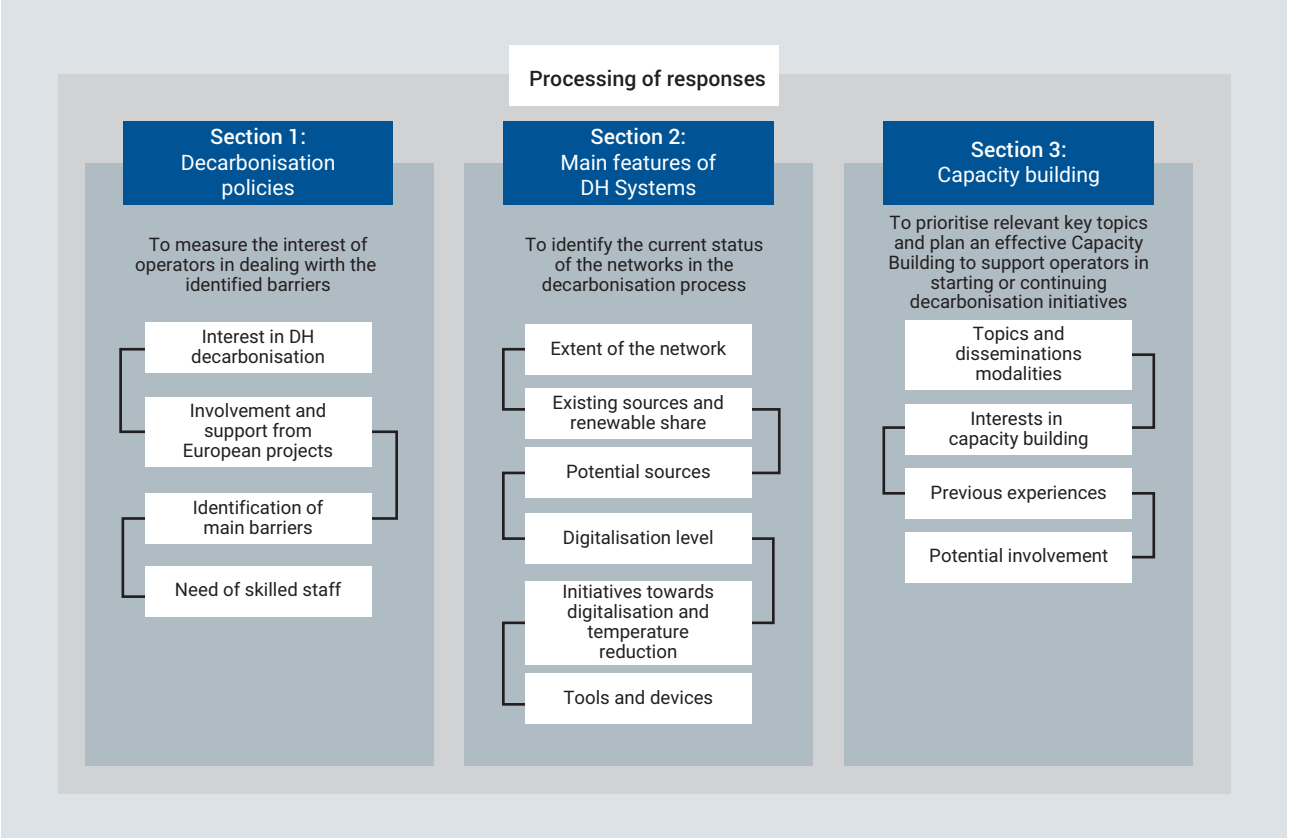

Figure 1. Template for processing operators' responses

The preparatory activities included the identification and invitation of speakers, moderators, and participants. Four main steps were followed:

- development of materials for both speakers and participants;
- selection and invitation of the target audience;
- identification of suitable speakers according to topics and stakeholder profiles; and
- organisation of logistics, including the collection of preferences regarding schedules and locations.

All phases were documented using standardised templates to ensure traceability, reproducibility, and transparency throughout the process.

Results and discussion

The CB program for the Italian DHC sector was promoted by a launch event and organised in two one-day in presence events mainly targeted on stakeholders (winter 2024-2025) and three one-day in presence courses mainly targeted on operators (spring 2025). The two events were focused on non-technical and technical barriers and solutions for the decarbonisation of the Italian DHC sector, respectively. The three courses were focused on providing competences, tools and other techno-economic support for a set of Italian DHC operators, enhancing also pear to pear exchanges at national and international level.

Implementation of the three courses for operators

The preliminary consultation with DH operators has revealed a strong and clear interest in decarbonisation, with a particular focus on how key barriers, both technical and non-technical, have been addressed from other DH operators in other countries. Key topics identified included the most promising technologies for integrating renewable energy and waste heat into existing district heating networks, with a special interest on heat pumps, temperature reduction strategies and non-technical barriers.

Building on this valuable input, a series of three thematic courses was planned (Figure 2), aimed at deepening the conversation on decarbonisation by leveraging the extensive expertise of the consortium's partners that have been involved as speakers.

The first course, held on 23rd January 2025, focused on decarbonisation from the perspective of planning and roadmap development, featuring valuable contributions from project partners AGFW and Halmstad University.

The second course, held on 17th March 2025, explored the technological dimension, examining the integration of renewable and

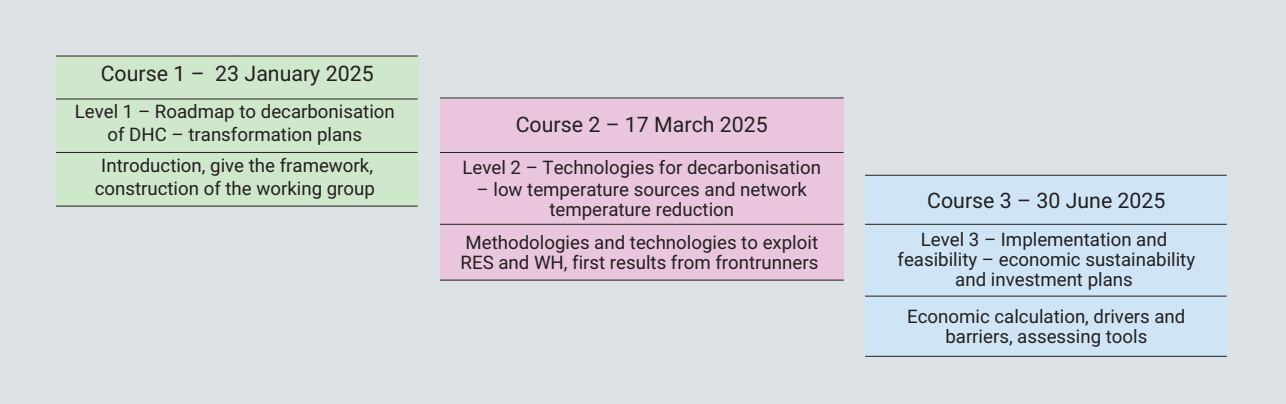

Figure 2. Program of the CB for operators in Italy

low-temperature waste heat. This included both the enabling generation technologies, particularly high temperature heat pumps, and practical experiences and methodologies for lowering the temperatures of distribution networks. This session also benefitted from the contributions of Halmstad University and the consulting firm Plan-Energi.

The final course, held on 30th June 2025, addressed project feasibility, with a particular emphasis on economic sustainability and supporting methods for feasibility assessment, such as the evaluation tools developed by the Austrian partner E-think.

Each course was planned with a morning of speakers presentations followed by an afternoon dedicated to peer-to-peer knowledge exchange, where operators and engineers could share first-hand experiences and insights. This interactive format fostered an open dialogue and mutual learning among participants. Beyond the high level of interest and appreciation for the content, a significant outcome emerged from these discussions: decarbonisation is increasingly viewed by operators as an opportunity, with efficient DH seen as a key enabler for the decarbonisation of urban areas. However, the uncertainty surrounding the regulatory framework, particularly due to the delayed national implementation of the revised EED, EPBD, and RED, and the absence of dedicated incentives, combined with the ongoing tax reductions for natural gas, make the rollout of decarbonisation projects highly uncertain. As a result, assessing economic feasibility remains a considerable challenge.

Implementation of the two events for stakeholders

The preparatory stages allowed the elaboration of the topics to be faced and of the agenda of the two events (30th Oct. 2024 and 19th Feb. 2025 at Politecnico di Milano; Figure 3).

The contributions were organised to provide a complete panorama of the main technical and non-technical barriers and to stimulate a constructive discussion to find-out possible solutions, not only at the end of the event but also between the two scheduled events.

According to the results of the preparation stages, for both the events the morning session was conducted with the approach of a seminar, while the afternoon session with interactive activities including round tables and debates to detect the barriers of the decarbonisation of DHC. The events ended

Figure 3. Evidence of one event for stakeholders

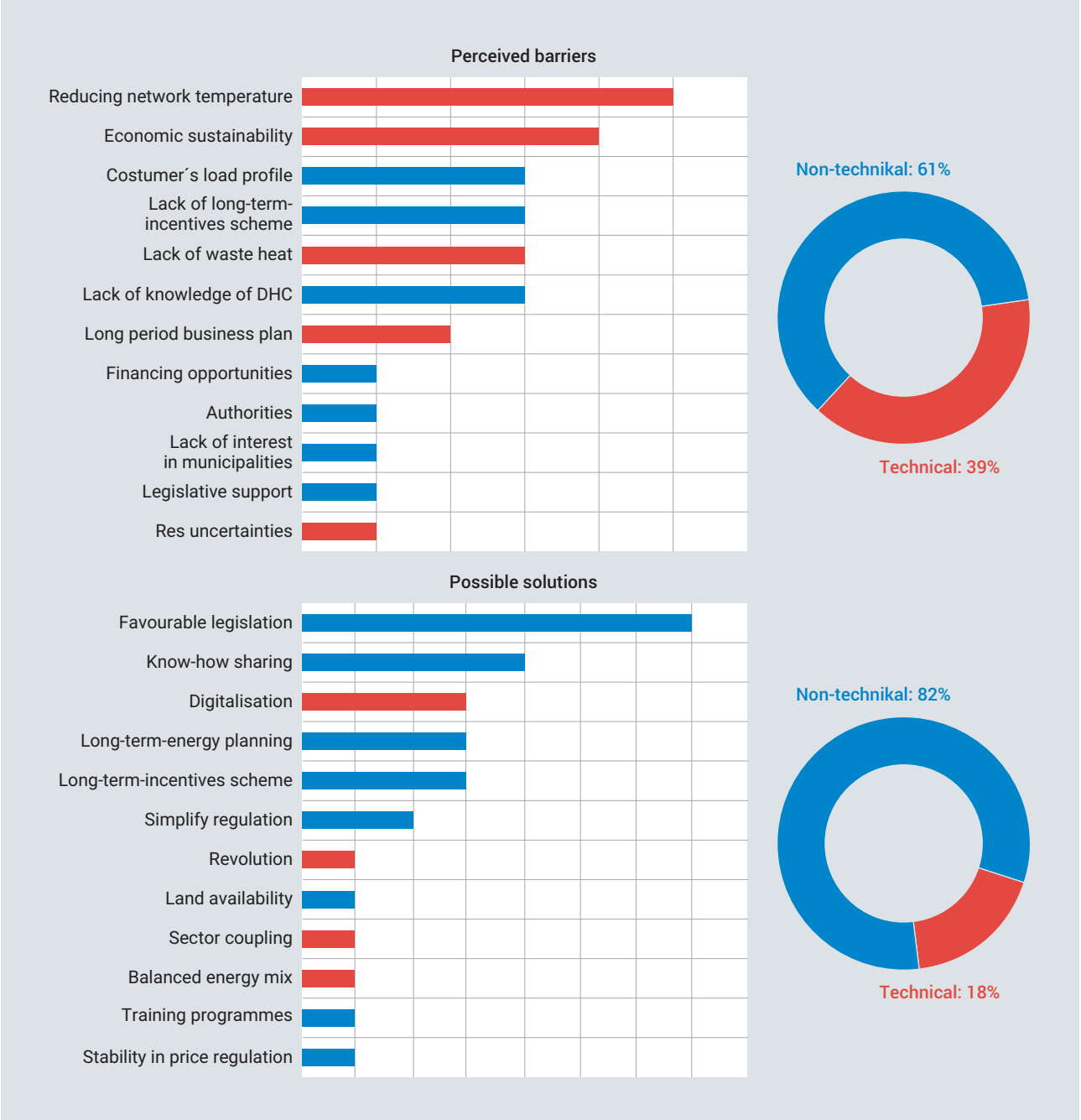

Figure 4. Some results of the CB for stakeholders in Italy

with the co-construction of a "manifesto" and the proposal of follow-up activities with a structured dialogue and technical table. In addition to the project partners, the events reached a relevant and various attendance by associations of DH, regional and local PAs, national authority, national institutions of research, engineering companies and representatives of some key DHC operators, revealing the success of the initiatives.

The follow-up was accomplished including:

- satisfaction survey to collect feedback about the event from participants;
- reporting of the details and outcomes;
- draft of the shared "manifesto" to be completed and signed with the involved stakeholders.

On the non-technical side, key issues included regulatory and authorisation challenges, insufficient support mechanisms, and a perceived lack of synergy between authorities and DHC operators. Stakeholders emphasised the need for better data quality, skills development, clearer rules on waste heat use, and the creation of a coordinated stakeholder working group. During the first event, the contribu-

tion from AGFW was appreciated by the Italian stakeholders.

On the technical side, discussions covered thermal energy storage, waste heat recovery, digitalisation, and innovative technologies like bidirectional substations. While viable technologies exist, non-technical barriers remain dominant. Further, integrating large-scale heat pumps and utilising waste heat are still challenging due to economic and technical limits. Stakeholders highlighted the importance of applied research, stronger cooperation among industry, policymakers, and suppliers, and the need to adapt infrastructure (e.g., lowering network temperatures) to meet decarbonisation goals (Figure 4).

The success of the activity was demonstrated by the large participation by relevant Italian stakeholders and by the contributions as presenters and moderators of members of national authorities, PAs, research institutes and design and consultant companies. Endorsement by important affiliations and request to share the materials presented with the associate of the DHC sector at national level confirmed the success.

Finally, a "manifesto" was drafted at the end of each event to translate the shared reflections and priorities into a concrete, actionable commitment. The document was conceived not merely as a summary of outcomes, but as a tool for continuity, an operational reference to be brought to institutional tables and used to promote real change in the governance and development of the DHC sector. Its contents were refined during further follow-up sessions held remotely after each event. The "manifesto" was signed by all participants, who thereby formalised their commitment to continued cooperation and collective action towards the expansion and decarbonisation of DHC in Italy.

Conclusions

The opportunity offered by the EU Life SupportDHC project allowed to raise the gaze towards the international context and lay the foundations for interesting synergies. Furthermore, the CB activities had an essential role and allowed the deployment of resources to clearly identify and seek solutions to the main barriers, identifying and promoting effective methods, mechanisms and tools.

Based on the concluded experience, the opportunities to interact and create a network and a direct and structured engagement of operators and stakeholders' into technical and non-technical debates can substantially accelerate the expansion and decarbonisation of Italy's DHC systems. Indeed, the direct engagement of stakeholders and operators allowed to grasp information and perspective difficult to be achieved by other methods, as mentioned in the previous sections.

Public acceptance and awareness also play a pivotal role in the future of the DHC sector. Building trust through transparency, effective communication, and highlighting local economic and environmental benefits is seen as essential to promoting broader adoption.

Further, the importance of skills development was emphasised. There is a clear need for targeted training programs to support municipalities, technical professionals, and other key-players in navigating the complex regulatory, technical, and planning landscape of modern DHC systems.

The CB has represented a strong, collective commitment to overcoming current obstacles and driving the decarbonisation and expansion of DHC in Italy. Dialogue, cross-sector cooperation, and a coordinated policy approach are fundamental. Only through such integrated efforts can the DHC sector fully realise its potential in contributing to the country's climate and energy goals.

Acknowledgement

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