SUPPORT DHC

Report on market and regulatory barriers of DHC upgrading at EU and national levels

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Executive Summary

This report (Deliverable 5.2) identifies and analyses the primary market and regulatory barriers hindering the modernization and decarbonization of District Heating and Cooling (DHC) systems across six European countries—Italy, Austria, Germany, Poland, Lithuania, and Ukraine—as well as at the EU level. Findings are derived from a systematic evaluation of expert consultations, structured interviews with key stakeholders, and a comprehensive review of relevant literature and policy documents. This assessment reveals cross-cutting challenges such as regulatory fragmentation, administrative complexities, investment barriers, outdated infrastructure with limited integration of renewable and industrial heat technologies, and a shortage of skilled personnel are being revealed. Additionally, inadequate data availability and uncoordinated planning impede progress. At the EU level, the slow transposition of climate legislation, financing constraints, and persistent fossil fuel subsidies further complicate DHC transformation. Based on the findings, coherent policy frameworks, streamlined permitting, enhanced financial instruments, and capacity-building initiatives as critical enablers for achieving a sustainable and integrated DHC transition aligned with EU climate objectives can be recommended.

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1 Introduction

The upgrading of District Heating and Cooling (DHC) systems in efficient and sustainable systems is often hindered by various barriers and DHC operators as well as authorities require assistance to overcome potential barriers. Among them are barriers on regulatory aspects and market aspects at local level, but also at regional and national levels as well as on the EU level.

An identification and analyses of these barriers are the first step to achieve solutions, that will overcome barriers. This was done in the target countries (frontrunner countries) addressed in SUPPORT DHC (see Figure 1) and also at the European Union (EU) level. Within this report, the results of the identification and analyses are summarized.

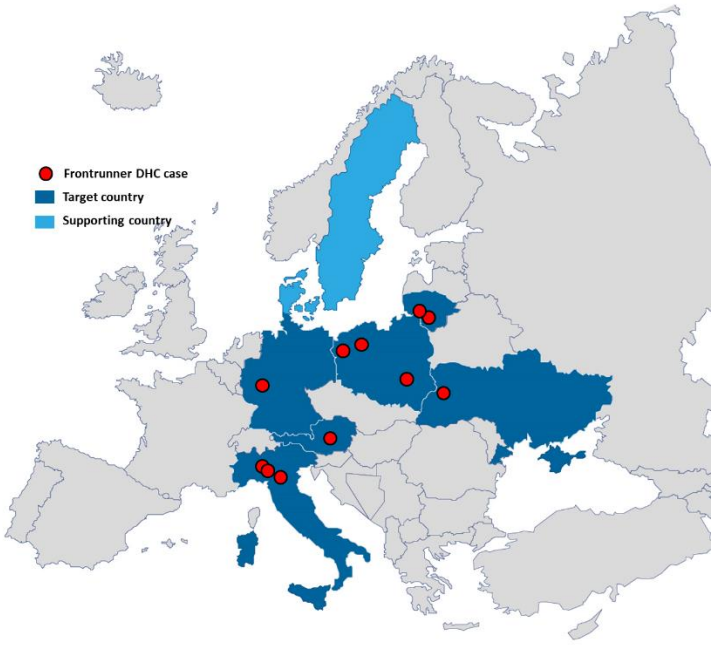

Figure 1: Map of frontrunners, target countries and supporting countries

2 Approach

2.1 General approach

The national project partners in each participating frontrunner country were tasked for the identification and analyses of regulatory and market barriers at the local, regional and national levels. A comprehensive overview of the countries and their respective project partners is presented in Table 1. At the EU level, the analysis was conducted by the project partner Euroheat & Power.

Table 1: Frontrunner countries and national project partners in these countries

Frontrunner country	National project partners
Italy	POLIMI
Austria	AEE INTEC, E-THINK
Germany	AGFW, WIP
Poland	PNEC
Lithuania	LSTA
Ukraine	City Institute

2.2 Identification of authorities and other stakeholders

In the first step, relevant authorities and key stakeholders (e.g., energy agencies) were identified. This work was initiated as part of the stakeholder evaluation in WP2, Task 2.4, its results being summarized within Deliverable D2.4: "Stakeholders Mapping".

Building on the approach established in Task 2.4, the stakeholders were classified according to the predefined categories/fields, ensuring the inclusion of the most representative authorities and stakeholders relevant to Task 5.3.

2.3 Set-up of interviews

Targeted interviews were conducted with the most relevant authorities and stakeholders to gather in-depth insights. These interviews were carried out through various forms, either in-person meetings, via phone or online discussions, or written surveys. The choice of interview format was determined by the national partners, who engaged with identified stakeholders and authorities based on context-specific considerations.

To provide a structured approach for the identification and analyses of barriers, AEE INTEC developed an interview guideline as well as a reporting template for interviews (see Figure 2).

Figure 2: Guideline and reporting template for interviews

2.4 Literature review

Besides the interviews conducted, also insights from relevant literature, reports, and projects were included. Again, this was done by the national partners for their country and included in the summary of results.

3 Market and regulatory barriers at national level

3.1 Market and regulatory barriers in Italy

The analysis of market and regulatory barriers in Italy is based on comprehensive interviews with key national and regional stakeholders, including ARERA (Regulatory Authority for Energy, Networks, and Environment), ENEA (Italian National Agency for New Technologies, Energy, and Sustainable Economic Development), national District Heating (DH) associations (AIRU, FIPER), South Tyrolean Energy Association (SEV), and regional/local authorities (IL Spa, Regione Lombardia, and Province of Bolzano).

3.1.1 Barriers

The barriers identified are primarily grouped under regulatory uncertainties, administrative complexities, financial constraints, market competition distortions, and data and planning gaps.

3.1.1.1 Regulatory Uncertainties and Fragmentation

One of the most critical barriers remains the regulatory uncertainty surrounding DH, which is significantly shaped by the delayed and fragmented transposition of EU directives, especially RED II and the ongoing discourse on RED III. The absence of a harmonized and coherent legislative framework has led to a situation where each directive has been implemented via separate and uncoordinated legislative measures, causing regulatory fragmentation and inconsistencies. This situation generates ambiguity regarding the role and future integration of renewable and waste heat in DH systems, thereby discouraging long-term investments and limiting policy effectiveness.

Moreover, the lack of a stable and long-term regulatory framework specifically designed for DH complicates planning and innovation efforts. Investors face uncertainties about future market conditions and regulatory requirements, undermining their willingness to commit capital to new projects or system upgrades. Compounding this issue, the existing tariff system is rigid and poorly aligned with the unique operational and economic characteristics of DH, which would require a more flexible, location- and context-specific approach to ensure sustainability and cost-effectiveness.

3.1.1.2 Administrative Complexities and Bottlenecks

Administrative and bureaucratic complexities present a further barrier, particularly long and inconsistent approval processes, inefficiencies in permit granting, and discrepancies between national and regional regulatory requirements. These challenges are especially critical for system refurbishments, new system development, and the integration of waste heat into existing networks.

3.1.1.3 Financial Constraints and Investment Barriers

From a financial perspective, the high capital intensity of DH systems and long payback periods constitute a significant barrier to expansion and decarbonization. Although financial support mechanisms for energy efficiency exist, their practical implementation has been slow and often ineffective, with limited availability and execution of funds specifically dedicated to DH.

Furthermore, the lack of a stable and predictable carbon pricing mechanism under the EU Emissions Trading System (ETS) generates uncertainty regarding the long-term competitiveness of renewable and waste heat sources. Investors are thus reluctant to invest in innovative and low-carbon solutions. Local and regional authorities, while acknowledged as essential actors in promoting DH, have not fully assumed a proactive role in supporting or facilitating DHC investments and integration.

3.1.1.4 Market Competition and Distortions

In terms of market structure, current national policies and fiscal incentives tend to favour individual heating solutions (i.e., electrification via heat pumps or condensing gas boilers) over collective solutions like DH. This technology-biased policy framework, lacking a neutral approach that would allow DH to compete fairly with other heating options, undermines the competitiveness of DHC. The absence of a level playing field in fiscal and regulatory policies further hinders the potential for DH to emerge as a viable, low-carbon solution, particularly in urban areas where collective solutions could provide systemic efficiency gains.

3.1.1.5 Data Gaps and Planning Deficiencies

Another critical barrier concerns the lack of reliable, standardized, and interoperable data sets necessary for comprehensive energy and DH planning. Fragmented data systems and the absence of open and consistent datasets make it difficult to assess available waste heat potentials, optimal network design, and synergies with other energy sectors. Efforts to develop open-data platforms remain regional and uncoordinated, preventing the establishment of a robust knowledge base at the national level.

Moreover, limited interoperability between datasets on buildings, energy systems, and DH networks further complicates integrated spatial and energy planning, hampering efforts to deploy renewable and waste heat sources efficiently. These gaps are particularly problematic when identifying economically and technically viable expansion areas, or when assessing opportunities for multi-sectoral coupling, such as integrating DH with local renewable electricity and mobility systems.

3.1.2 Key Solution Takeaways

The stakeholders interviewed identified a series of comprehensive solutions aimed at overcoming the critical regulatory, financial, and administrative barriers impeding the modernization and decarbonization of DHC systems in Italy. The proposed measures are structured around regulatory and policy improvements, financial and market mechanisms, as well as collaboration and capacity building, reflecting an integrated approach to sectoral transformation.

3.1.2.1 Regulatory and Policy Improvements

Stakeholders emphasize the urgent need for a coherent national strategy for DHC, aligned with EU directives, to provide clear and stable guidelines for the integration of renewable energy sources and waste heat. Such a strategy should address current regulatory fragmentation and offer long-term visibility for investors and policymakers.

To overcome administrative bottlenecks, stakeholders recommend streamlining approval processes for DHC projects, particularly those integrating RES and WH, through simplified and standardized permitting procedures, taking inspiration from the Obbligo di Incremento dell'Energia Rinnovabile Termica (OIERT) framework.

The development of standardized contract models for waste heat integration is proposed to reduce legal uncertainties and facilitate cooperation between industrial suppliers and DHC operators.

Further recommendations include introducing technology-neutral support schemes, ensuring that all sustainable heat sources, including biomass, geothermal, and industrial waste heat, are incentivized equally. Additionally, stakeholders highlight the need for fiscal measures, such as applying a reduced value-added tax (VAT) rate of 10% for DHC networks that meet energy efficiency criteria, in line with EU fiscal guidance for sustainable heating solutions. Guarantees of Origin (GO) models for DHC customers are also proposed to enhance market transparency and consumer confidence in the renewable share of DH.

3.1.2.2 Financial and Market Support Mechanisms

To improve financial viability, stakeholders propose reforming existing tariff structures to ensure cost-reflective pricing that balances affordability for consumers and economic

sustainability for operators, suggesting dynamic pricing mechanisms, responsive to seasonal variations and demand fluctuations, to enhance operational flexibility and cost-efficiency.

Another critical recommendation is to strengthen the EU Emissions Trading System (ETS) as a tool to provide stable and predictable carbon pricing, which is essential for incentivizing the transition from fossil-fuel-based DH to renewable and waste heat solutions.

3.1.2.3 Collaboration, Data, and Capacity Building

Recognizing the fragmented governance landscape, stakeholders stress the importance of improving coordination among national, regional, and local authorities, DHC operators, and associations. They propose establishing permanent technical working groups, including ministries and regulators, to ensure better alignment of planning, regulation, and investment frameworks.

The development of national open-access data platforms is identified as essential for effective sector planning. Such platforms should integrate data on heat demand, available waste heat sources, and network capacities, allowing for more transparent, coordinated, and data-driven decision-making processes.

In addition, stakeholders call for capacity-building measures, including structured training programs for public authorities, utilities, and DHC stakeholders, to enhance understanding of regulatory, technical, and financial frameworks. These programs would ensure that actors are better equipped to navigate the complexities of DHC development and modernization.

Finally, public engagement and awareness-raising strategies are emphasized as key to improving societal acceptance and understanding of DH. Educating citizens on the economic and environmental benefits of DHC is seen as crucial for fostering community support and participation in future projects.

3.2 Market and regulatory barriers in Austria

This summary presents the main market and regulatory barriers in Austria, based on the results of expert interviews conducted with two energy agencies, two DHC associations, and the national funding agency, complemented by findings from literature and insights from other national projects.

3.2.1 Interviews Overview

One of the most prominent market-related barriers identified is the requirement for substantial investments to decarbonize DHC systems. These investments must primarily be undertaken by network and plant operators. Although a transition to renewable energy sources has the potential to stabilize and even lower heat prices in the long term, the initial capital outlays are significant and would typically require gradual cost recovery through higher end-user tariffs. However, such price increases are socially and politically sensitive, making external public funding essential to facilitate renewable energy integration without causing customer price shocks. Without sufficient public support mechanisms, these necessary investments are at risk of being postponed or abandoned.

Additionally, securing long-term contracts for external heat suppliers remains highly challenging. Third-party suppliers, particularly those offering renewable or waste heat, struggle to enter the market due to uncertainties in long-term contractual commitments, which undermines the development of new decentralized supply sources.

From a spatial planning perspective, the lack of available land for renewable heat production facilities, such as large-scale solar thermal plants, represents a major barrier, especially in densely populated urban areas. While peri-urban and rural municipalities might have available land, there is often a reluctance to allocate such land for projects serving city centres, reflecting a conflict between local interests and broader national decarbonization objectives. This points to the absence of a coherent national-level spatial planning strategy that prioritizes DH development areas and ensures fair distribution of infrastructure siting.

The absence of mandatory opt-out regulations for fossil-based energy systems and the lack of dedicated DH priority zones are further regulatory barriers. Such instruments are crucial for providing planning security and long-term market stability for DH operators. Without these regulatory frameworks, operators face increased risks in planning and justifying the expansion and transformation of their systems.

Furthermore, legal uncertainties cause a climate of hesitation among stakeholders. Although laws aimed at accelerating renewable energy expansion and introducing renewable gas have been formally passed, their implementation is stalled, leaving stakeholders without clear guidelines or incentives. These gaps undermine confidence in the regulatory landscape and discourage investment.

The instability and complexity of funding schemes also pose significant barriers. While numerous funding opportunities exist across national, regional, and local levels, the rapid changes in eligibility criteria, availability, and program structures make it difficult for operators, particularly smaller municipalities, to track and access them. Moreover, many operators lack the internal capacity or resources to monitor and apply for these funding schemes, adding to the challenge.

Delays in funding approvals are an additional constraint. Even when operators commit to renewable energy projects, lengthy funding processes can result in the suspension or cancellation of these investments, undermining the overall transition pace.

The shortage of qualified personnel is another critical structural barrier that significantly limits the capacity to implement and expand DH systems. Across Austria, operators report a lack of technical and operational staff, including installers, electricians, welders, plumbers (particularly for the primary side), and civil engineering craftsmen. Furthermore, there is a notable shortage of qualified planners and designers for DH systems. This shortage of human resources is particularly acute in the context of rapid system expansion and modernization needs.

Moreover, smaller communities face substantial capacity limitations to develop DHC projects. Local knowledge and expertise in the design, planning, and implementation of DH systems are often lacking, leaving these communities dependent on external support, which is not always available or affordable.

A recurrent recommendation from stakeholders is the establishment of a stable, long-term, state-supported funding instrument that can provide multi-year planning security for both

operators and end-users. Such an instrument would mitigate investment risks and allow for strategic planning and stepwise transformation processes.

Finally, from the funding agency's perspective, it is emphasized that renewable energy-based DH must achieve economic viability. Public funding schemes should be structured to bridge the current cost gap between fossil-based and renewable heat sources, enabling fair competition and supporting the long-term sustainability of renewable DH investments.

3.2.2 Literature Study and Other Projects

A key regulatory barrier in Austria arises from the need to align national frameworks with EU directives, notably the Renewable Energy Directive II (RED II) and the Energy Efficiency Directive (EED). Although the Renewable Energy Expansion Act (EAG) provides a national foundation for renewable integration, its implementation is delegated to regional authorities, leading to substantial inconsistencies across provinces. These disparities complicate the integration of renewable energy into DH networks and slow decarbonization efforts. Moreover, the Act lacks specific focus on DH, leaving the sector underregulated within Austria's energy transition.

Another barrier is the absence of mandatory Third-Party Access to DH networks. While European legislation promotes access for renewable and waste heat, Austrian operators retain full discretion, often rejecting third-party connections due to alleged technical or economic constraints. This limits opportunities for decentralized heat sources and obstructs innovative market solutions.

From a governance and administrative perspective, Austria's fragmented multi-level governance causes significant bottlenecks. The division of authority between federal and regional levels results in overlapping responsibilities and inconsistent application of national regulations, including permitting and environmental assessments. Non-uniform administrative procedures delay renewable project approvals and hinder DH development. Additionally, the absence of standardized permitting guidelines for industrial waste heat projects and poor coordination between operators, industrial partners, and authorities further exacerbate delays and inefficiencies.

At the national regulatory level, DH operates under a decentralized structure without a coherent national standard, causing significant regional variation in feed-in provisions and renewable integration. Many regions prioritize heat supply security over market opening and decarbonization, undermining consistent national action.

From a market perspective, three major barriers are identified: financial challenges, market distortions and competition, and limited market competitiveness.

First, financial barriers stem from high investment costs for network expansion and modernization. Though some subsidies for renewable integration exist, they are limited in scope and scale, and targeted financial instruments for technologies like deep geothermal are lacking. Current funding schemes are not designed to support the significant investments required for full decarbonization. Moreover, DH pricing regulations, though aimed at consumer affordability, lack transparency and consistency, complicating operators' financial planning. The absence of stable, coordinated funding instruments further limits capacity for system transformation.

Second, market distortions arise from the monopolistic structure of DH networks, where operators control access, pricing, and infrastructure. This restricts third-party access and inhibits renewable integration. Additionally, subsidies for fossil fuels distort market conditions, making fossil-based systems more economically attractive. Inconsistent and low compensation for industrial waste heat feed-in further limits renewable contributions, discouraging industrial actors from engaging in heat supply contracts.

Third, market competitiveness is hampered by weak regulatory incentives and unclear feed-in conditions for renewable suppliers. Lack of transparency and predictability in contractual arrangements creates uncertainty, reducing the willingness of renewable providers to participate. Furthermore, the absence of established business models hinders collaboration. Nonetheless, some successful examples of cost and risk-sharing agreements between operators and industrial partners demonstrate that well-structured business models can enhance market dynamism and facilitate waste heat integration.

Besides the findings from interviews and literature, key regulatory and market barriers have also been highlighted through three national projects in Austria: “Open Heat Grid,” “Vienna,” and “Stadt Haag.” These projects have provided valuable insights into both regulatory barriers (including decentralized regulatory frameworks, complex permitting processes, and spatial energy planning challenges) and market-related barriers (such as high investment costs, monopoly-like structures, unregulated pricing mechanisms, and affordability concerns).

Collectively, these projects demonstrate a strong focus on identifying and addressing systemic regulatory and market obstacles that hinder the modernization and decarbonization of DHC systems in Austria.

3.3 Market and regulatory barriers in Germany

This section outlines the key regulatory and market barriers hindering the modernization and decarbonization of DHC in Germany. The assessment is based on policy analysis, expert consultations, surveys, and sectoral reports, highlighting obstacles in implementing climate-neutral heat technologies, financing mechanisms, permitting procedures, and infrastructure expansion.

3.3.1 Regulatory Barriers

3.3.1.1 Policy Stability and Long-Term Strategy Implementation

Germany has recently improved its regulatory framework for DHC, with new laws and financial programs enhancing the sector’s transformation. However, maintaining policy continuity and stability is crucial to sustaining progress. Uncertainty in long-term policy commitments poses a risk to investor confidence, municipal planning, and the financial viability of large-scale heat projects.

3.3.1.2 Limitations in the Subsidy Scheme (BEW) and Funding Framework

The Federal Ministry for Economic Affairs and Climate Protection (BMWK) funds the Bundesförderung für effiziente Wärmenetze (BEW) program, supporting DH expansion and decarbonization. However, current budget allocations fall significantly short of demand, with

total required investments estimated at €120 billion by 2045, while only €2.98 billion is allocated until 2028. The scheme requires an annual increase to at least €3 billion, an extension beyond 2035, and conversion into a legally binding federal funding law. Additionally, processing times for funding approvals are excessively long, and technology-specific funding conditions require revision to ensure effective allocation.

3.3.1.3 Challenges in Permitting Procedures

The Heat Planning Act (WPG) designates climate-neutral heat supply as a superior public interest, but its implementation remains ineffective due to administrative bottlenecks. Permitting processes are too slow, requiring increased personnel capacity, digitalization, and fast-track procedures for standard cases. Local authorities lack expertise in approving new heating technologies, necessitating knowledge transfer programs and standardized federal guidelines to streamline approval processes. Establishing a regional coordination body could help resolve regulatory deadlocks and accelerate project deployment.

3.3.1.4 Obstacles in Heat Planning Implementation

Since January 2024, municipalities are required to develop local heating plans under the WPG. Large cities (above 100,000 residents) must finalize plans by June 2026, while smaller municipalities have until June 2028. However, several obstacles limit the impact of heat planning:

- Public administrations lack motivation and expertise.
- Service provider quality varies, affecting the accuracy and reliability of heat planning.
- Renewable energy source assessments at the municipal level remain insufficient due to data unavailability.

A systematic data collection and sharing platform is needed to improve the integration of RES into local heat plans.

3.3.1.5 Shortage of Skilled Personnel

A severe shortage of skilled workers across the DHC sector (i.e., welders, plant assemblers, engineers, project planners, and administrative personnel) exists. Dedicated training and qualification programs are missing, especially for interdisciplinary collaboration across technical, economic, and regulatory domains. Expanding DHC-specialized educational programs is critical for long-term workforce capacity.

3.3.2 Market Barriers

3.3.2.1 Financing Mechanisms

Transforming DHC requires a diverse mix of financing tools involving both public and private resources. However, current funding gaps hinder investment viability, particularly for municipal utilities, which require stronger equity mechanisms to maintain financial stability. Limited access to capital constrains investment in large-scale decarbonization projects and delays infrastructure upgrades.

3.3.2.2 Technology-Specific Barriers

Heat Pumps

Data on local heat sources is insufficient, limiting effective integration into municipal heat planning. Expanding large-scale heat pumps requires addressing supply chain constraints in mechanical engineering and implementing a national industrial policy to support manufacturing capacity.

Deep Geothermal

Geothermal exploration remains slow due to long permitting processes and financial risks in drilling operations. A national support framework is required, including geothermal resource mapping and risk-mitigation financing to accelerate deployment.

Solar Thermal

Land availability is a key constraint. Identifying and securing suitable land areas for solar thermal plants must become part of municipal heat planning and public zoning strategies.

Waste Heat

A uniform and legally binding definition of unavoidable waste heat is absent in German energy laws, hindering regulatory clarity and project development. A waste heat registry must be formed, and mandatory utilization policies should be introduced. Contractual risks between waste heat suppliers and DH operators also need mitigation through regulatory support and standardized agreement models.

3.3.2.3 Market Structure and Investment Uncertainty

Germany's DHC market remains highly regulated, and while policies encourage decarbonization, market structures do not always support investment confidence. Private-sector engagement is limited due to long payback periods, complex approval procedures, and uncertain long-term subsidies. To unlock private capital, market structures need reform, including clearer risk allocation, stable incentive mechanisms, and investment security guarantees.

3.4 Market and regulatory barriers in Poland

The modernization and decarbonization of DHC systems in Poland face significant regulatory, financial, technological, and organizational barriers that hinder the sector’s transformation. Although efforts are underway to align with EU targets and modernize the aging infrastructure, the pace of change remains slow, constrained by fragmented policy frameworks and limited investment capacity.

3.4.1 Regulatory and Political Barriers

One of the main regulatory barriers stems from the absence of a comprehensive long-term strategy for the DHC sector, which is not expected before 2025. Although the Energy Regulatory Office (URE) introduced a new investment-oriented regulatory model in 2021, enabling companies to include modernization investments within their regulatory asset base, the lack of clear long-term policy direction prevents operators from planning systematic investments.

Additionally, the upcoming requirement to comply with a new definition of "efficient DH systems" by 2028 will impose significant modernization obligations on operators. Many DH companies are currently unprepared for such extensive upgrades due to outdated infrastructure and limited technical and financial capacity.

Moreover, the politicized nature of the decarbonization debate in Poland complicates consensus on necessary reforms. Frequent changes in political leadership, especially within key ministries, and the absence of a unified approach to energy transition policies delay crucial regulatory decisions, introducing uncertainty and slowing down investment and modernization processes.

3.4.2 Financial Barriers

Financial constraints remain one of the most critical barriers to decarbonizing DHC in Poland. The high costs of replacing coal-fired generation units with cleaner alternatives, such as biomass, geothermal, heat pumps, or integrating large-scale heat storage, pose a significant challenge. Although funding opportunities from the EU and national programs have expanded, a large portion of DH companies (estimated at 30%) are not creditworthy, limiting their ability to secure loans or co-financing for large-scale investments.

Furthermore, uncertainties in EU policies, combined with delays in implementing national funding mechanisms, cause a volatile investment environment. Even when funding is available, companies often struggle to meet complex and demanding application requirements, further restricting access to much-needed financial support.

The lack of stable, long-term financial instruments dedicated to DH modernization exacerbates these problems, leaving operators without sufficient economic incentives to initiate transformative projects.

3.4.3 Technological Barriers

Poland's DHC sector is the most coal-dependent in Europe, making technological transformation particularly challenging. Modernizing heat generation and distribution requires advanced solutions (i.e., heat pumps, energy storage, geothermal integration, and smart heating networks) that are expensive, complex, and require specialized technical expertise.

However, many companies lack the qualified personnel and technical know-how necessary to plan and implement these advanced technologies. The integration of modern solutions into aging and inefficient infrastructure adds another layer of complexity, often requiring costly and extensive system overhauls.

Furthermore, the absence of national guidelines and standardized procedures for integrating innovative technologies leads to uncertainty and inconsistency in how these solutions are deployed, slowing down the modernization process and increasing risks for operators.

3.4.4 Organizational Barriers

On the organizational side, although the Ministry of Climate and Environment established a task force in October 2024 to support DH transformation and draft regulations, cooperation between public institutions and private companies remains hindered by administrative and procedural inefficiencies.

One of the key organizational barriers is the inconsistency and fragmentation of strategic documents and policies, which require coordination between local and national authorities. This often leads to delays and conflicting decisions in the implementation of investment projects, particularly for complex and large-scale modernization efforts.

In addition, the lack of a well-coordinated framework for aligning local and national strategies prevents the development of integrated and long-term plans necessary for systematic DHC transformation. Administrative obstacles and unclear mandates between different governance levels slow decision-making and increase the uncertainty faced by DH operators and investors.

3.5 Market and regulatory barriers in Lithuania

The following analysis presents a comprehensive summary of the key market and regulatory barriers for DHC modernization and decarbonization in Lithuania, based on interviews conducted with three DH companies, the Association of Local Authorities, the Ministry of Energy, and the Lithuanian Energy Institute, as well as reviews of national legislation, internal discussions, and stakeholder meetings. These findings highlight persistent legal, financial, technological, and organizational obstacles that hinder the transformation of the Lithuanian DHC sector.

3.5.1 Interviews Overview

A core regulatory barrier is the overly detailed and restrictive national framework, particularly regarding pricing principles and tariff determination. The complex and non-transparent pricing methodology, applied by the National Energy Regulatory Council (VERT), leads to financial losses for DH companies, while limiting their flexibility to reallocate costs to address emerging technical and human resource needs. Legal acts governing DHC operations need revision and simplification to enable more efficient and responsive system management.

There is a lack of a dedicated support framework for diversifying renewable energy sources beyond biomass, despite growing needs for solar thermal, geothermal, and heat pump integration. Inequitable market conditions between regulated DH companies, which bear full responsibility for secure and continuous heat supply, and independent heat producers, who do not contribute to system reliability, exacerbate operational and financial challenges.

Moreover, the absence of long-term heat planning obligations aligned with municipal decarbonization goals and restrictions on long-term contracts and price negotiations undermine trust between suppliers and consumers, slowing the development of sustainable and efficient DH solutions.

Financial limitations are among the most critical issues for DH operators in Lithuania. While solid biomass has historically helped maintain lower prices, heavy reliance on biomass introduces risks, such as future supply constraints due to stricter sustainability requirements and rising exports, potentially increasing heat prices for end-users.

DH companies face severe funding shortages for infrastructure upgrades, including pipeline modernization and system interconnection, with state aid for pipeline replacement and

merging of DH networks currently suspended. The lack of "public interest" status for DHC infrastructure means no dedicated governmental support is available for essential upgrades.

Additionally, regulated DH companies cannot accumulate financial reserves, depending solely on delayed consumer payments while needing to immediately compensate independent producers. This creates liquidity issues, reduces investment capacity, and weakens collateral for borrowing. Moreover, higher subsidies are urgently needed to support the replacement of aging gas boilers with renewable alternatives, as loans (even under favourable conditions) would increase final heat prices for consumers.

The Lithuanian DHC sector remains dominated by biomass and waste, constituting over 80% of the fuel mix, which hinders diversification into other renewable technologies such as heat pumps and solar thermal systems. Economic factors make heat pumps uncompetitive with existing biomass-fired solutions, while the lack of national guidelines for innovative technology integration further limits the sector's transformation.

There are also serious technological incompatibilities with building-level systems, especially given the requirement to renovate internal heating and hot water systems in apartment buildings by 2026, and the difficulty of shifting to low-temperature supply (4th generation networks) without full system upgrades. A unified approach to technical management from supply to substations is necessary yet currently lacking.

In addition, a large share of biofuel boilers is outdated and inefficient, unable to handle the decreasing quality of biomass fuels. Without state-backed investments, smaller municipalities are unable to replace these assets without dramatically increasing heating costs.

The sector faces a critical shortage of qualified engineers and technical personnel, especially in smaller towns where recruitment is nearly impossible, and staff turnover is high. Low public sector wages drive skilled workers to the private sector, creating a persistent expertise gap that jeopardizes the implementation of modernization projects, including digitalization and the deployment of advanced technologies.

Additionally, the regulatory cost framework prevents flexible reallocation of budgets, limiting companies' ability to hire necessary IT and engineering staff and to adjust to technological innovations. Existing employees often lack the skills to manage modern technologies, and new professionals are insufficient in number to address ongoing transformation needs.

As Lithuania plans for broader renewable energy and sector integration, DHC systems face emerging cross-sectoral challenges. With greater shares of variable renewable electricity, the need for balancing capacities, flexibility, and storage solutions grows. However, there are no specific support schemes for integrating energy storage or for cross-sector coupling, including the potential use of residual heat from future hydrogen production.

Current electricity grid connections in DH boiler houses are underutilized outside peak heating seasons, but uncertainties in regulation and pricing policies prevent their use for flexibility services. Likewise, no support mechanisms exist for small-scale storage deployment within DH systems, limiting their ability to contribute to energy system balancing.

The renovation of buildings remains one of the biggest challenges, as achieving lower network temperatures for efficient operation will depend on deep renovation and adaptation of building-level systems. However, lack of consumer engagement and awareness hinders

progress, with economic considerations outweighing environmental concerns in consumer choices. Legal frameworks do not support long-term partnerships between DH companies and consumers, and mandatory consumer connections to efficient systems are not enforced.

3.5.2 Literature Study

Lithuania has established a clear legal framework for third-party access to DH networks, following a priority ranking system based on technology and energy sources. Amendments to the Heat Law (2023) introduced the priority purchase of surplus industrial waste heat outside auctions, aiming to enhance renewable integration. However, structural issues remain. Independent heat producers, while expanding their market share, financially weaken DH operators without contributing to system-wide efficiency. Discrimination among heat types persists, as waste heat from industrial CHP plants is prioritized, while residual heat from DH-operated CHP is excluded. Moreover, independent producers are not obliged to participate in auctions during heating seasons, creating uncertainty in supply and investment risks, as the heat purchase model lacks revenue guarantees for new projects.

Municipal Heat Plans and 10-year investment strategies are mandatory, but misalignment between national decarbonization goals and municipal implementation hinders progress. Municipalities often prioritize economic factors over climate objectives, and state-municipal coordination is weak, leading to fragmented infrastructure development.

VERT's rigid and complex pricing methodologies exclude unavoidable costs, undermining DH companies' financial sustainability and discouraging investments. Inconsistent benchmarking and administrative overregulation complicate pricing and hinder long-term planning.

Slow renovation of buildings and substations also hampers DH modernization. Although mandatory modernization of heating and hot water systems is required by 2026, progress is stalled due to owner passivity, organizational gaps, and weak enforcement. The transfer of substations to apartment owners (2010–2012) has left 40% of substations outdated and unautomated, blocking low-temperature (4G) transitions. State support remains insufficient.

Land use restrictions severely limit DH network expansion, as private landowners resist pipeline installations, and DH lacks "public interest" status, delaying connections and growth. Legal instruments to ensure land access are missing.

Although €102 million from EU funds (2021–2027) is allocated to DH upgrades, implementation delays (2020–2024) have halted progress. Funding is insufficient for pipeline modernization and biomass boiler replacements, far below sector needs.

The shift from subsidies to financial instruments (loans + grants) is problematic, particularly for small municipal DH companies lacking bankability. Delayed heat price adjustments worsen financial viability. Moreover, as municipally owned entities, DH companies are classified as large enterprises, excluding them from higher aid intensities available to SMEs, creating market distortions favouring independent producers.

Bad debts and energy poverty are major concerns, with 8% of consumers indebted—many from social housing—while the Regulator does not fully recognize bad debts in price settings.

The 36% workforce decline since 2015, coupled with fewer engineering graduates, results in a shortage of qualified staff, limiting modernization efforts.

Finally, despite legal obligations, economic and technical barriers hinder DH participation in grid flexibility services, and no clear framework or incentives for CHP or sector coupling exist. New unfunded mandates for 24-hour supply resilience and cybersecurity compliance (NIS2) will add further strain on DH operators, especially small ones.

3.6 Market and regulatory barriers in Ukraine

The assessment of market and regulatory barriers for DH in Ukraine, as derived from Ukrainian Resilience Week Minutes and complementary literature review, latter reflecting two distinct periods: the pre-war situation, characterized by long-standing structural deficits, and the post-war context, marked by aggravated vulnerabilities due to wartime destruction and economic disruption.

3.6.1 Interview Overview

A fundamental governance barrier lies in the insufficient coordination and oversight among state, local authorities, and regulators, undermining a unified approach to DH system management. Fragmented responsibilities and weak accountability mechanisms impede the effective implementation of national programs. The absence of systematic coordination platforms prevents efficient hazard prevention and resilience-building, particularly critical under wartime conditions. Enhanced multi-level communication and cooperation between local governments, national authorities, emergency services, and utility providers is urgently required to ensure alignment in emergency preparedness and strategic response to energy system disruptions.

The current tariff system is structurally unsustainable, excluding investment components and failing to reflect real heat supply costs. Tariff gaps undermine DH companies' financial viability, while unstable and frequently changing tariffs generate operational uncertainty. Despite a memorandum between local governments and the Cabinet of Ministers on state compensation for tariff gaps, these compensations remain unpaid, pushing DH utilities into deeper financial distress. As of 2024, accumulated sector debt stands at 47 billion UAH, with projections of reaching 64 billion UAH, threatening the operational solvency of municipal DH providers. The freezing of tariffs by state mandates further blocks reinvestment and modernization, locking DH companies in a cycle of underfunding and service degradation.

Ukraine lacks an integrated national strategy for DH modernization and resilience, including technological, financial, and pricing reforms necessary for sustainable transformation. The ongoing war exposes the vulnerability of critical energy and DH infrastructure, which remains highly susceptible to attacks, significantly threatening operational capacity and winter heat supply security. Yet, no coordinated resilience framework exists to ensure DH systems' robustness during wartime and post-war recovery. An integrated approach must address interdependencies between DH, water, sanitation, and waste management, ensuring city-wide resilience.

Although draft Law No. 11301d aims to provide debt relief for pre-October 2024 liabilities, this measure is insufficient to close the broader resource gap for DH modernization and recovery. The existing legal framework lacks provisions for sustained support or recovery strategies, and

financial deficits remain unresolved, severely limiting DH companies' capacity to maintain and upgrade essential infrastructure. Moreover, unclear tax redistribution mechanisms leave municipalities without adequate financial tools to support local DH systems, further widening the investment gap.

Current Public Service Obligations (PSO) frameworks are non-transparent and inequitable, concentrating funds towards Naftogaz as gas supplier, with insufficient allocation to DH companies. PSO mechanisms lack fairness in resource distribution, undermining system-wide sustainability. Reform of PSO models is necessary to ensure balanced, transparent, and sufficient funding to support DH operators, especially under the stress of wartime operations and recovery efforts.

Land use restrictions and the absence of public interest status for DH infrastructure continue to hinder system expansion. Private landowners often obstruct pipeline installations, causing significant delays and complicating efforts to connect new consumers. Moreover, no state aid is available to support the necessary pipeline upgrades, even as DH networks remain essential for achieving energy-efficient urban development, aligned with A++ building energy codes.

The DH sector has lost 36% of its workforce since 2015, facing a critical shortage of qualified engineers and technical staff, especially in small municipalities. Low regulated salaries, combined with the war's impact, have further reduced workforce availability, creating severe constraints on the implementation of modernization and digitalization projects essential for future-proofing the sector.

Although DH operators are legally required to assess opportunities for grid flexibility, the economic viability remains unclear, with expensive and limited electricity connections hindering practical implementation. The lack of investment incentives and guarantees prevents the development of CHP plants and sector coupling (e.g., hydrogen, storage), despite their potential role in enhancing system flexibility and resilience. Ukraine has one of the lowest shares of CHP heat production in Europe, a missed opportunity for efficient energy use, especially critical under war conditions.

The vulnerability of DH infrastructure under wartime conditions presents a critical challenge for urban resilience. Continuous attacks on energy systems threaten minimum service provision and survival during winter seasons. Regulatory requirements for ensuring 24-hour operational resilience in the event of power outages remain unfunded and unrealistic, particularly for small DH companies already facing severe financial constraints. Furthermore, upcoming NIS2 cybersecurity obligations will impose additional financial and technical burdens, for which small municipal DH operators are unprepared.

3.6.2 Literature Study

3.6.2.1 Pre-War Market and Regulatory Barriers

Prior to the Russian invasion, Ukraine's DH sector faced deep-rooted regulatory, market, and financial challenges, undermining efforts for modernization and decarbonization in line with EU energy transition goals.

From a regulatory perspective, the sector was hampered by fragmented and outdated frameworks, incomplete alignment with EU directives (Energy Efficiency Directive, Renewable Energy Directive), and lack of enforcement capacity. Tariff-setting mechanisms were rigid, non-

transparent, and politically influenced, preventing cost-reflective pricing and excluding investment components necessary for infrastructure upgrades. Third-party access and competition were limited by legal ambiguities, technical constraints, and lack of supply security, with municipal monopolies dominating the market and stalling private sector participation.

Administrative bottlenecks further delayed DH projects due to complex permitting processes, outdated technical standards, and bureaucratic inefficiencies, hindering the adoption of modern technologies and renewable heat sources.

Financially, DH companies operated under chronic deficits, driven by tariffs set below cost recovery levels and a lack of stable compensation mechanisms. Massive debt accumulation and dependence on external donor financing for modernization persisted, while state subsidies distorted the market and disincentivized efficiency improvements.

Finally, monopolistic structures, combined with the absence of competitive pricing or alternative suppliers, limited incentives for innovation, operational efficiency, and renewable integration. These structural constraints left Ukraine's DH sector financially unsustainable and technically outdated, unable to meet national decarbonization and modernization targets even before the war.

3.6.2.2 Post-War Recovery Barriers

Ukraine's post-war DH strategy addresses urgent short-term energy security needs and long-term modernization and resilience goals.

Short-term measures focus on protecting and stabilizing DH systems against wartime damages, ensuring continued heat supply during winters, and mitigating humanitarian risks. Priorities include infrastructure reinforcement, rapid repairs, supply chain stabilization, temporary market interventions, and deployment of decentralized modular heating solutions. Immediate integration of renewable and flexible technologies (e.g., solar thermal, small-scale CHP, heat storage) and temporary financial mechanisms are essential to sustain operations. Cybersecurity enhancements are also critical to defend energy systems under ongoing attacks.

Long-term planning aims to rebuild a resilient, efficient, and market-oriented DH sector, aligned with EU energy and climate directives. Reforms emphasize cost-reflective tariffs, gradual privatization, and unbundling of heat production and distribution to foster competition and attract private investment. The integration of renewable energy sources (biomass, solar, waste heat), sector coupling technologies (power-to-heat, storage, district cooling), and low-temperature DH will drive decarbonization and efficiency.

A comprehensive modernization program is needed to replace outdated infrastructure, improve insulation, and digitalize operations (smart metering, consumption-based billing). Innovative financing (e.g., green bonds, public-private partnerships) should support investments, while performance-based subsidies incentivize efficiency.

Strategic heat planning must coordinate urban development with DH expansion, reinforced by zoning regulations to mandate DH connections in urban areas. Cross-border energy cooperation and targeted infrastructure investments (resilient pipelines, thermal storage) will enhance system reliability and integration with EU markets.

4 Market and regulatory barriers at EU level

As the EU works towards decarbonising its energy systems, the transformation of DHC networks to integrate low-grade renewable energy and waste heat is imperative. Decarbonising existing networks while developing new climate-neutral systems in line with the EU targets presents significant challenges. These barriers at the EU level, spanning regulatory, financial, social and market-related issues, often hinder the timely and effective implementation of sustainable DHC solutions. Overcoming these obstacles is essential to unlock the full potential of sustainable and efficient DHC systems and to ensure the progress toward the EU's climate and energy objectives. The following sections outline the key barriers at the EU level identified by the Support DHC project consortium, which must be addressed to facilitate the transition to more sustainable and energy-efficient DHC networks.

The summary of the most significant barriers at the EU level reflects on discussions within Euroheat & Power's Energy Policy (EnerPol) Committee, an expert group focused on policy and advocacy matters related to DHC. This committee consists of EU policy representatives from various member organisations of Euroheat & Power. EnerPol members make informed decisions by integrating technical input from relevant working groups, briefings from the Euroheat & Power secretariat, and insights from ongoing discussions on the EU level, but also considering the situation and national legislation in EU Member States.

Regulatory and Policy Barriers		
1	**Market Barriers and Regulatory Uncertainty**	The heating sector is predominantly market-driven, creating challenges for DH expansion. Existing suppliers, particularly gas utilities, may resist change, and environmental harms are not fully reflected in fuel prices. Additionally, **grid extension costs for individual heat pumps are not adequately considered in electricity pricing, leading to market distortions**. In some countries, private operators must reapply for operating licences every set number of years, making them less willing to commit to long-term investments. The EU should ensure that pricing structures reflect fair environmental and infrastructural costs to ensure fair competition. This will motivate customers to join DHC where it is the most affordable solution for society and encourage utilities to invest in sustainable heating solutions.

2	**Too low threshold for mandatory waste heat assessment**	Most industrial and tertiary processes generate waste heat, however, the possibility of its utilisation is not widely known. The recently adopted *Energy Efficiency Directive* mandates industrial and service facilities to assess the economic feasibility of supplying their waste heat to DHC networks, however, the **EU threshold is too high, resulting in a low amount of assessments**. The EU should ensure that more facilities assess waste heat recovery and create a circular market for energy and driving partnerships between DHC operators with industry and tertiary sectors.
3	**Lack of accessible and reliable data on decarbonised heat sources**	Enabling local heating and cooling plans with a public registry of decarbonised heat sources is crucial for municipalities to develop effective and ambitious local heating and cooling plans. Specifically, it addresses the absence of a public registry that compiles key data such as the locations and energy consumption/waste heat potential of different renewable and waste heat sources, such as data centres and geothermal sources. **This type of information is vital for developers and municipalities to effectively plan and implement decarbonisation strategies, but its unavailability at the EU-level hampers these efforts**. Without proper access to this data, implementing these plans would be much more challenging.
4	**Building Readiness Gap for Low-Temperature District Heating**	The rate of building renovation in the EU is too slow, and much of the existing building stock is not yet prepared for low-temperature DH. Low-temperature DH requires well-insulated and energy-efficient buildings, but many, especially older ones, still rely on heating solutions with high-temperatures. **Without sufficient renovations, these buildings cannot efficiently operate with low-temperature DHC**, limiting the adoption of renewable and waste heat sources. As a result, DHC providers are forced to maintain higher supply temperatures, restricting the integration of renewables and slowing down the decarbonisation of DH networks.
5	**Slow Adoption of "Fit for 55" and EPBD Reforms**	The "*Fit for 55*" package and the *Energy Performance of Buildings Directive* (EPBD) promote the decarbonisation of heating systems. However, **many EU Member States have been slow in transposing these regulations into national law**, delaying necessary reforms for the transformation of DHC systems. This leads to delays and inconsistent application of the reforms across EU countries and creates uncertainty for investors and operators who must navigate different legal requirements in each country.

6	**Challenging and Unrealistic Classification Criteria**	The EU Green Taxonomy aims to guide investment towards sustainable projects, but its classification criteria are **too complex for DHC systems**, particularly those that include gaseous efficient DH and cogeneration as a mean to transition to lower carbon energy sources. As a result, such systems may **not fully qualify** for green financing, even if they are actively reducing carbon emissions and incorporating low-carbon technologies. This lack of clarity **discourages investors** and slows down the transition to more sustainable and renewable-based DHC networks.
7	**Complex Permitting Procedures for Renewable Integration in DHC Systems**	While the EU policies promote the integration of renewable energy into DHC networks, the permitting process for these projects remains bureaucratic and fragmented across EU Member States. Lengthy environmental assessments, unclear permitting requirements, and slow administrative procedures are common, causing delays that can last for years. The **lack of harmonised EU guidelines** for streamlining permitting processes further exacerbates these issues, resulting in inefficiencies that delay the transition to renewable-based DHC systems. Clearer, faster, and more transparent permitting procedures focusing on the production and distribution of heat at the EU level would significantly improve project timelines.
8	**Not a beneficial policy environment for the DHC operators to balance the electricity grid**	DHC networks in connection with large-scale heat pumps and e-boilers could play an essential role in balancing the electricity grid while integrating a significant amount of renewable electricity, while also being able to supply electricity via CHP plants during high electricity demand. The EU should ensure that DHC and its integrated technologies can benefit from the energy price signals and generate revenues for providing flexibility and balancing services to the electricity grid. This would result in a more flexible and integrated energy system.
9	**A risk of poor implementation of local heating and cooling plans**	According to the new EED recast, Member States must ensure that regional and local authorities develop local heating and cooling plans, at least in municipalities with a population exceeding 45,000. However, **without a strong support framework, these plans risk being ineffective or poorly implemented.** Political backing and the involvement of key stakeholders—such as businesses, utilities, and public operators—are essential. Their engagement ensures ownership of the decarbonization strategy and helps maintain the quality and successful execution of these plans.

Financial and Economic Barriers		
10	**Lack of Financing Opportunities**	DH infrastructure requires significant long-term investments, but securing financing can be challenging. **The difficulty of obtaining long-term loans that match the lifetime of grids and production plants makes DHC projects relatively more expensive than short-term individual heating solutions**. Public financial instruments, such as a European-level guarantee scheme similar to Denmark's loan guarantee model, could help bridge this gap and lower investment risks. The EU should facilitate accessible financing solutions to support the development of new DHC systems and ensure cost-effective, long-term decarbonisation of heating.
11	**High Initial Investment Costs for DHC System Upgrades**	Upgrading or expanding DHC networks to integrate renewable energy and waste heat sources requires substantial upfront capital for infrastructure, and grid modernisation. Despite the long-term benefits, including reduced operational costs and carbon emissions, the high initial expenditure often discourages municipalities and private investors, particularly in regions with budget constraints. At the EU level, there is **a lack of clear and consistent financial incentives or guarantees for sustainable DHC investments that would reduce the financial burden during the initial phase.** This lack of targeted financial support or subsidies creates a barrier for municipalities that need to make the transition.
12	**DHC networks can be high-risk investments**	DHC networks utilising a wide variety of locally available sustainable heat sources must address multiple challenges to ensure that infrastructure investments remain viable in the long term. **Operators face risks such as changes in local industry activity, fluctuations in waste heat availability, uncertainties in geothermal well performance or long-term shifts in heat demand.** Additionally, evolving regulations can significantly impact the financial sustainability of these projects over a 20 – 30-year horizon. To mitigate these risks and support the deployment of clean and renewable heat infrastructure, the EU should establish an EU-level de-risking instrument for clean and renewable heat projects in Member States.
13	**Fossil Fuel Subsidies at the EU Level**	In some EU Member States, fossil fuels continue to receive direct or indirect subsidies, making them artificially cheaper compared to renewable alternatives. While the EU is working to phase out harmful subsidies under the Green Deal, the

		pace of reform is slow, and some countries still apply price-distorting measures that undermine the competitiveness of renewable energy-based DHC systems. Furthermore, DHC networks falling under ETS pay carbon taxes, however, individual buildings using fossil heating systems will be included in ETS2 only after 2027, with a capped carbon price. These market distortions create an uneven playing field, as fossil fuels are more affordable in certain regions, discouraging investments in renewable DHC projects. **The lack of EU-wide binding mandates on phasing out fossil fuel subsidies** and promoting market-based mechanisms for renewable energy creates an economic barrier that prevents renewable DHC systems from scaling effectively across member states.
Market and Social Barriers		
14	**Low Public Awareness and Acceptance of DHC Systems**	Many citizens across the EU are unfamiliar with the benefits of DHC, misconceptions about the costs, efficiency, and environmental impact of DHC can lead to public resistance and low adoption rates. While some Member States have introduced local initiatives to raise awareness, there is **no EU-wide strategy or mandate to facilitate public engagement on DHC systems**. A lack of consistent EU-level guidance on how to communicate the benefits of renewable and waste heat-based DHC could delay the acceptance and scaling of such systems.
15	**Lack of information availability to citizens on clean heat transition**	The replacement of domestic heating solutions usually follows unexpected breakdowns. **It favours the cheapest and immediately available solutions, in many cases, fossil-fuel boilers, while installing an individual heat pump or connecting to a DHC network can take months**. To ensure that consumers adopt the most cost and climate-efficient clean heat solution for their building, in line with local heating and cooling plans, the EU must ensure that all households are properly informed about their opportunities to have affordable and sustainable heating solutions.
16	**Lack of Skilled Workforce for DHC System Modernisation**	The transition to modern and efficient DHC systems requires specialised knowledge in areas like renewable energy and waste heat integration, grid management, and digitalisation. However, there is currently a significant **shortage of skilled professionals across the EU in these sectors.** While some

		EU Member States offer vocational training programs, there is a lack of EU-level coordination and investment in creating and promoting a pan-European educational framework for the emerging workforce needs in the DHC sector. Without a focused effort to bridge the skills gap, the transition to advanced DHC systems will be slower and more costly.

5 Summary

This report (Deliverable 5.2) investigates the market and regulatory barriers impeding the transformation of DHC systems across the EU and in six member states—Italy, Austria, Germany, Poland, Lithuania, and Ukraine. The findings are based on stakeholder interviews, literature reviews, and policy analyses.

Key challenges at the local, regional and national level include regulatory fragmentation, unclear policy frameworks, administrative bottlenecks, and insufficient financial mechanisms. The most relevant barriers in each country are summarized in the following. In Italy, regulatory uncertainty due to inconsistent implementation of EU directives hinders investment, while Austria faces spatial planning conflicts and a lack of coherent national strategies. Germany struggles with underfunded subsidy schemes, slow permitting, and a shortage of skilled workers. Poland’s barriers stem from outdated infrastructure, limited financial capacity, and fragmented governance. Lithuania's DHC sector is constrained by rigid tariff regulations, insufficient diversification of renewable sources, and outdated technical systems. Ukraine's DHC faces acute vulnerabilities due to wartime damage, unsustainable tariff systems, and a critical lack of resilience planning.

At the EU level, systemic issues including the slow adoption of key legislative packages (“Fit for 55”, EPBD), complex permitting for renewable projects, high investment risks, inadequate financing, and persistent fossil fuel subsidies were identified as main barriers. Social barriers such as low public awareness, limited consumer information, and workforce shortages further impede progress.

To overcome these barriers, harmonized and long-term regulatory strategies, streamlined permitting, stable and accessible financing instruments, investment in workforce development, and enhanced public engagement can be recommended. It can be emphasized, that there is a need for coordinated action among national authorities, municipalities, and EU institutions to facilitate a sustainable, efficient, and climate-resilient DHC transition.