D.1.1.1b
Analysis of results regarding regulatory and administrative gaps in Alpine territories

Interreg
Alpine Space

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Executive Summary

This report presents and discusses the outcomes of the ALPHA D1.1.1a online survey, which had asked project partners to identify existing regulatory and administrative gaps and challenges that hinder efforts for the decarbonisation of the H&C sector in their territories.

Based on survey responses from regional authorities and organisations, the assessment identifies common challenges and structural barriers in key policy areas, including governance frameworks, energy integration, spatial planning, permitting processes, financial support, workforce capacity, data sharing, public awareness, and waste heat recovery.

The report first provides a detailed presentation of regional findings, highlighting the specific gaps reported by each partner. This is followed by a comparative assessment, drawing connections between shared obstacles across different territories. Additionally, the analysis shortly discusses initiatives and good practices that have been implemented to address these regulatory and administrative challenges, offering insights into potential solutions.

By identifying transalpine patterns and policy misalignments, this report aims to support harmonised energy strategies, improved regulatory frameworks, and enhanced collaboration among Alpine regions to accelerate the decarbonisation of H&C systems.

Table of Contents

Introduction

The ALPHA project aims to coordinate and accelerate the implementation of 5th Generation District Heating and Cooling (5GDHC) networks in the Alpine Space to reduce greenhouse gas emissions and increase the share of renewable energy in the heating and cooling (H&C) sector. Bringing together nine partners from five Alpine countries —Italy, France, Germany, Austria, and Slovenia—ALPHA strives to develop a unified yet adaptable planning approach for 5GDHC networks, strengthen policy and financing frameworks, and establish scalable solutions for decarbonising H&C systems and the building stock in the region. The project provides policymakers, energy planners, and operators with innovative tools, strategies, and frameworks to drive investment and promote clean energy transitions across the Alpine Space.

This document is part of Activity A1.1 of the project, which focuses on identifying and addressing regulatory and administrative barriers to H&C policies in the Alpine region. Led by the Lombardy Foundation for the Environment (FLA), project partners have mapped some of these these barriers within their respective. The insights gained from the survey are compiled into this report aimed at facilitating knowledge exchange and supporting the removal of regulatory and administrative obstacles, ultimately contributing to the decarbonisation of H&C systems in the Alpine Space.

As part of activity A1.1, an online workshop will be held on February 12, 2025, where partners will present their findings, collectively assess best practices, and explore how they can be adapted to local contexts.

Overview of the Data Collection Process

Methods & Tools

To ensure that all information from ALPHA partners was documented in a consistent and clearly structured manner, the survey employed a common, online questionnaire. The latter aimed at supporting project partners to collect and document data regarding regulatory and administrative gaps and challenges in their territories, which can act as barriers to efforts for the decarbonisation of H&C networks.

Data collection guidelines

Partners were advised to employ various methods to collect necessary information, such as conducting desk research for their territories to gather as much detailed and comprehensive evidence as possible. Additionally, they were encouraged to engage with relevant authorities and stakeholders —such as public authorities and governing bodies at different levels, policymakers, industry representatives, research institutions, and civil society actors— to gain deeper insights into existing regulatory and administrative gaps and challenges.

Partners' roles

Partners were advised to first explore regional or local challenges across different policy areas related to H&C and report it. In case there were no available data for their territory, partners were advised to conduct this research at national level.

Table 1 below outlines the geographic areas targeted by each partner.

Table 1: ALPHA project partners and the geographic areas targeted,

Partner	Regional Level	National Level
Lombardy Foundation for the Environment (FLA)	Lombardy	Italy
Liguria Region (LIGURIA)	Liguria	Italy
Eurac Research (EURAC)	South Tyrol (Alto Adige)	Italy
National Institute of Applied Science – Lyon (INSA Lyon)	Auvergne-Rhône-Alpes	France
Chamber of Commerce and Industry of Nice Côte d' Azur (CCI NCA)	Provence-Alpes-Côte d'Azur	France
Technical University of Munich (TUM)	Bavaria	Germany
Austrian Society for Environment and Technology (ÖGUT)		Austria
European Center for Renewable Energy Güssing Ltd. (EEE)	EcoEnergyLand	Austria
Municipality of Trebnje (Trebnje)		Slovenia

Presentation and Analysis of Partners' Input

Drawing upon the input provided by the project partners, this section presents each region's (or country's, for that matter) main regulatory and administrative challenges. These challenges are organised across different policy areas and analysed by taking into the consideration the regions' particular characteristics. A brief conclusion sums up existing gaps and weaknesses at the end of each presentation.

Lombardy, Italy (FLA)

The Lombardy region in Italy has achieved a moderate level of decarbonisation in its H&C sector, with 30–60% of its energy still reliant on fossil fuels. FLA has rated the contribution of existing regulatory and administrative gaps to hindering the decarbonisation of the sector as moderate. In what follows, the challenges identified by FLA are presented and analysed, along with some relevant initiatives that have been undertaken to address these challenges.

Governance structures and policy frameworks

One critical challenge identified is the inconsistency among existing policies and governance structures. While regional authorities are tasked with implementing H&C networks, the absence of a cohesive national policy has led to disparities in planning and execution. This misalignment causes inefficiencies, duplicated efforts, and missed opportunities for synergy across regions, often disrupting efforts for the decarbonisation of the H&C sector.

Another regulatory issue involves the mismatch between resource allocation and public authority responsibilities. This challenge was found to have a high level of disruption. Funding is centralised under national programs like the National Recovery and Resilience Plan (PNRR) and the National Energy Efficiency Fund, which allocate significant resources to district heating systems of different scales. However, planning and implementation responsibilities lie with regional authorities. This creates coordination challenges, particularly with the involvement of ARERA (the Italian Regulatory Authority for Energy, Networks, and Environment), which oversees tariffs

and regulations. The impact of these coordination challenges is considered high, reflecting significant barriers to effective governance and facilitation of decarbonisation efforts.

Lombardy

Level of decarbonisation: Moderate

FLA's responses highlight significant challenges in **governance**, **energy integration**, **financial mechanisms**, and **infrastructure planning**. While regional programs like the PREAC address some of these gaps, implementation remains inconsistent. Key areas requiring immediate attention include addressing the mismatch between resources and public authorities' responsibilities, introducing stronger mandates and targets for the introduction of RE in H&C, and mitigating conflicts between building regulations and H&C development.

Energy integration

Another identified challenge causing high levels of disruption pertains to the lack of explicit mandates or targets for renewable energy in H&C. Italy is not required to meet the EU's 48% renewable energy target for district heating and cooling under RED III Directive, leading to weak policy incentives. Lombardy's Regional Energy Environment and Climate Program (PREAC) aims to increase district heating penetration from 4% to 20% by 2030. However, the absence of robust mandates undermines these efforts, creating a high level of disruption.

Similarly, supportive policies for critical infrastructure are limited. While the PREAC outlines supportive measures, aiming to enhance the resilience and efficiency of energy networks, the implementation remains insufficient, causing moderate disruptions to decarbonisation efforts.

Lombardy also lacks comprehensive energy resource maps or tools for district heating planning. Among other maps, the region's geoportal[1] includes maps related to the energy sector; in addition, the Innovation and Procurement Regional Company's website offers a map depicting the location of district heating networks, classified by the type of energy supply; it also includes data for each network,

[1] https://www.geoportale.regione.lombardia.it/atlante-ptr

including installed capacity, network length, and the municipalities served. However, the maps' utility is constrained by incomplete data integration, as a georeferenced atlas combining demand and resource availability, which could serve as a vital planning tool, is absent. The PREAC emphasises the need for such a tool but does not outline concrete steps for its development

Spatial planning and zoning

Insufficient integration between spatial and energy planning was identified as another significant challenge. The PREAC highlights the importance of aligning energy strategies with local authorities, yet coordination remains weak. This has led to moderate disruptions, limiting the feasibility of studies and delaying project implementation.

Additionally, building regulations often conflict with —or at least, do not take into account— the goals of district heating. According to FLA, the disruption caused by this gap is high. For example, Italy's "Superbonus 110%"[2] incentive program prioritised building insulation (and the deployment of solar shading and photovoltaic systems) over district heating connections, significantly undermining efforts to expand and decarbonise H&C networks.

Permitting processes

Complex and outdated permitting requirements also create delays in project implementation in Lombardy. The need for coordination among multiple administrative bodies complicates these processes further. For instance, the need to align urban planning and industrial needs with energy goals often leads to bureaucratic delays. The disruption level for these challenges is rated as moderate. On top of this issue, smaller municipalities face additional difficulties due to limited administrative capacity and technical expertise. The PREAC mentions plans to provide support to municipal technicians, but the scope of these efforts remains unclear.

Financial support and incentives

The inadequacy of financial support schemes was addressed as a persistent challenge by FLA. Mechanisms like the "White certificates" (Certificati bianchi) scheme

[2] https://www.agenziaentrate.gov.it/portale/superbonus-110%25

promote energy efficiency but lack specific provisions for decarbonisation. While high-efficiency cogeneration projects are eligible for support, the inclusion of fossil-fuel-based systems undermines the program's decarbonisation objectives.

Access to funding is further hindered by fragmented and complex regulations. The coexistence of multiple funding sources at national and regional levels makes coordination difficult. Smaller municipalities, in particular, lack the expertise to design and implement funding programs, relying heavily on external consultants or utilities to navigate these processes.

Data collection and sharing

FLA noted that data collection and sharing are centralised through the state-owned company GSE (Energy Services Manager), which manages energy-related data nationwide. Consequently, the impact of gaps in this area is assessed as low. Similarly, Italy's program for replacing smart meters funded by the PNRR ensures adequate infrastructure, mitigating technical gaps in data collection.

Waste heat recovery

Policies promoting waste heat recovery remain underdeveloped. While the PREAC references the potential of waste heat, specific incentives or regulations are lacking. There are, however, several local projects underway in Lombardy, which are expected to explore the use of waste heat for district heating.

Public awareness and engagement

Public awareness campaigns on decarbonisation solutions are insufficiently detailed in the PREAC. While the program emphasises the need for communication efforts, specific initiatives have not been outlined.

Research and innovation

Support for research and innovation in green H&C technologies is limited. Although the PREAC evaluates the feasibility of low-temperature networks and other innovations, such advancements require significant redevelopment efforts.

Summary

FLA's responses highlight significant challenges in governance, regulatory frameworks, and infrastructure planning. While regional programs like the PREAC address some of these gaps, their implementation remains inconsistent.

Key areas requiring **immediate attention** include addressing the mismatch between resources and public authorities' responsibilities, introducing stronger mandates and targets for the introduction of RE in H&C, and mitigating conflicts between building regulations and H&C development.

On a **moderate base**, gaps relate to limited access to energy resources maps, lack of supporting policies for critical infrastructures, inadequate financial schemes, complex regulations for funding, limited capacity and expertise within local authorities, absence of explicit policies to promote waste heat recovery, low public opinion engagement, conflicting or outdated requirement for the permitting processes.

Addressing these gaps will require coordinated efforts across national, regional, and local levels.

Lombardy: Gaps and Challenges	
High level of disruption	Mismatch between resources and public authorities' responsibilities, Mandates or targets for the use of renewable energy in H&C Incompatible building regulations
Moderate level of disruption	Inconsistent and conflicting policies and directives Policies for critical infrastructure Access to energy resource maps Integration between spatial planning and energy planning Permitting requirements Administrative capacity and technical expertise in permitting offices Financial support schemes Regulations inhibiting access to funding Capacity and expertise for funding programs Policies and incentives for waste heat recovery Public awareness and engagement
Low level of disruption	Protocols for data collection Proprietary data practices Data expertise and infrastructure Policy support for research and development

Liguria Region, Italy (LIGURIA)

The level of decarbonisation of Liguria's H&C sector is considered low, as more than 60% the energy used comes from fossil fuels. According to the region's assessment, the existing gaps and barriers present a major hindrance to decarbonisation efforts. The main regulatory and administrative challenges faced by the region are presented and analysed below.

Governance structures and policy frameworks

Liguria highlighted the challenges posed by inconsistent and conflicting policies. Most of the region's territory is subject to landscape constraints, which complicate the coordination among technicians and landscape authorities. The lack of harmonisation between energy efficiency regulations and territorial protection laws exacerbates these difficulties. To mitigate these issues, Liguria has introduced roundtable discussions with relevant permitting entities and published simplified guidelines on its website to clarify the regulatory framework for RES plants.

Energy integration

The region identified the need to map suitable areas for renewable energy development to facilitate regional energy planning. This gap is highly disruptive, as the absence of such maps hinders the exploitation of renewable resources. To address this, Liguria has initiated dialogues with stakeholders and regional offices. After the approval of the regional Law, Liguria will provide territorial facilitation for the small municipalities to map potential areas for renewable energy deployment, supported by directives from the European Commission and Italy's Ministry of the Environment and Energy Security.

As far as broader energy resource maps or tools are concerned, there are some open-source

REGIONE LIGURIA

Liguria

Level of decarbonisation: Low

Liguria's responses highlight significant challenges across **policies for critical infrastructure**, **access to funding, energy integration and spatial planning, data collection, and public awareness**. While some efforts, such as roundtables and mapping initiatives, are underway, many critical issues remain unaddressed.

portals at the national level providing guidance on territorial characteristics, such as the location of water reservoirs and woodlands, which can aid in renewable energy planning. The region has emphasised the enhancement and integration of these resources to guide investment decisions better.

Spatial planning and zoning

Spatial and energy planning integration is a critical issue in Liguria. The region's aging building stock, characterised by structures primarily constructed in the 1970s, poses another significant challenge. These buildings lack adequate insulation and efficient heating systems. Furthermore, historic and protected buildings are subject to technical, administrative, and permitting constraints, making energy efficiency upgrades more complex.

Permitting processes

Complex permitting requirements are another barrier in Liguria, particularly for small municipalities. The limited number of staff and their lack of training on the latest energy regulations and funding opportunities often result in delays: the fact that small municipalities face difficulties affects their access to regional tenders, while delays can lead to missed funding opportunities due to tight deadlines. On the other hand, now that the permitting legislation views these municipalities as competent for processing and issuing Simplified Authorisation Procedures (PAS)[3], this is bound to lead to delays in issuing such authorizations

Financial support and incentives

Liguria identified several challenges related to financial support. One of them pertains to complexity and fragmentation between the framework regulating the development of H&C solutions (requirements and calculation methodologies) and tenders' framework at the national level. This is further exacerbated by constant regulatory changes that often lead to fragmentation and conflicts. Remaining updated with evolving regulatory frameworks can be a challenge for the officers and technical personnel.

[3] That is, a streamlined permitting process introduced by Italian legislation (Legislative Decree 28/2011) to facilitate the development of renewable energy plants and other infrastructure projects.

This is the case particularly for small municipalities that often lack the technical and administrative skills needed to apply for grants and manage awarded funds. Furthermore, SMEs are often deterred from applying for funding due to direct competition with larger companies for the same funding opportunities and the excessive financial guarantees required.

Workforce skills and technical capacity

A general lack of training programs for public administration staff and technical operators in the H&C sector is another barrier. This gap was reported as moderately disruptive, hindering the adoption of efficient and sustainable technologies.

Data collection and sharing

The absence of standardised protocols for data collection is another significant barrier in Liguria. This lack of standardisation makes it difficult to map existing building stock, plan energy interventions, and compare regional performance with national benchmarks. At the regional level, Liguria has published statistical analyses based on the data of its Information System, but further efforts are needed to improve data accessibility and quality.

Another critical issue is the difficulty in collecting data on actual energy consumption. This data is essential for energy planning, monitoring interventions, and identifying high-energy-demand areas suitable for district heating. Challenges include the lack of metering infrastructure and limited access to information from distributors and energy managers.

Public awareness and engagement

Liguria emphasised the need for greater public awareness and engagement to support decarbonisation efforts. While the region has launched initiatives targeting public entities and municipalities to promote energy efficiency, awareness campaigns aimed at the general public remain limited. The region highlighted the importance of educating citizens about the economic and environmental benefits of sustainability. Liguria has held roundtables to coordinate activities and has called for awareness campaigns to promote guidelines and best practices.

Summary

Liguria's responses highlight significant challenges across governance, financial mechanisms, energy integration and planning, and public engagement. While some efforts, such as roundtables and mapping initiatives, are underway, many critical issues remain unaddressed.

Key areas requiring **immediate attention** include introducing policies for critical infrastructure, integrating spatial planning and energy planning, updating outdated or conflicting building regulations, establishing standardised protocols for data collection, and ensuring resources and capacity for funding and outreach programs.

On a **moderate base**, gaps relate to inconsistent and conflicting policies and directives, lack of administrative capacity and technical expertise in permitting offices, complex and fragmented regulations inhibiting access to funding, insufficient planning and investment in skills training, and inadequate public awareness and engagement.

Liguria: Gaps and Challenges	
High level of disruption	Policies for critical infrastructure Integration between spatial planning and energy planning Incompatible building regulations Capacity and expertise for funding programs Protocols for data collection Limited resources and expertise to organise outreach programs
Moderate level of disruption	Inconsistent and conflicting policies and directives Administrative capacity and technical expertise in permitting offices Regulations inhibiting access to funding Insufficient planning and investment in skills training Public awareness and engagement
Low level of disruption	Access to energy resource maps

South Tyrol Region (Alto Adige), Italy (EURAC)

The South Tyrol (Alto Adige) region in Italy has currently a low level of decarbonisation in its H&C sector, with more than 60% of energy relying on fossil fuels. According to EURAC's assessment, the existing gaps have a moderate impact on decarbonisation efforts. The main gaps and challenges that were identified include:

Governance structures and policy frameworks

One of the primary policy challenges reported in South Tyrol is the lack of harmonisation between energy and environmental objectives. According to EURAC, informal discussions with the local administration revealed both regulatory and administrative challenges brought about by this misalignment, with the geothermal energy sector being a symptomatic case in point. These inconsistencies, however, are not limited to the H&C sector and geothermal energy, but extend to other renewable energy sources like wind power.

eurac research

South Tyrol

Level of decarbonisation: Low

EURAC's responses indicate that South Tyrol faces moderate obstacles to H&C decarbonisation, primarily due to **inconsistent policies and directives**, **limited personnel resources, and gaps in energy resource mapping**. While spatial planning integration and waste heat surveys are promising developments, challenges related to policy harmonisation, critical infrastructure investment, and financial expertise remain unaddressed.

Another administrative gap pertains to the mismatch between resource allocation and public authority responsibilities. A significant issue identified by EURAC is the lack of administrative personnel, particularly in the management of energy communities, which are only partially linked to H&C through the use of heat pumps. This shortage of personnel has led to inefficiencies in implementing renewable energy initiatives and has been assessed as a moderate barrier.

Energy integration and waste heat recovery

While South Tyrol has a good level of publicly available data (such as district heating network areas and water bodies), EURAC identified a lack

of comprehensive mapping for waste heat sources. However, the region has recently launched a waste heat survey to assess the availability and potential of unused thermal energy. This initiative aims to map waste heat sources using GIS tools, which could serve as a foundation for future incentive programs.

Spatial planning and zoning

EURAC also identified a lack of integration between urban planning and energy planning offices as a barrier to decarbonisation. Traditionally, urban and energy planning have been managed separately, leading to inefficiencies. A promising initiative has been introduced recently, which involves the appointment of a common director tasked with overseeing both urban and energy offices, thus facilitating better coordination and goal alignment.

Financial support and incentives

One financial challenge highlighted by EURAC is the limited expertise of local authorities in implementing funding and incentive programs for H&C solutions. In particular, the region lacks specialised knowledge in 5GDHC systems, a technology that offers high efficiency but requires a nuanced understanding of implementation strategies.

Interestingly, EURAC did not report any challenge related to financial support schemes or complex funding regulations; instead, it was confirmed that South Tyrol has access to both local and EU sources of funding that can support the expansion of district heating networks.

Summary

EURAC's responses indicate that South Tyrol faces moderate obstacles to H&C decarbonisation, primarily due to inconsistent policies and directives, limited personnel resources, and gaps in energy resource mapping. While spatial planning integration and waste heat surveys are promising developments, challenges related to policy harmonisation, critical infrastructure investment, and financial expertise remain unaddressed. Key areas for improvement include:

1. Policy coordination: Strengthening the alignment between energy and environmental objectives.

2. Workforce development: Expanding administrative capacity in energy communities and district heating management.
3. Mapping and resource planning: Finalising and utilising the waste heat survey to develop incentive structures.

Sout Tyrol: Gaps and Challenges	
Moderate level of disruption	Inconsistent and conflicting policies and directives Mismatch between resources and public authorities' responsibilities Policies and incentives for waste heat recovery
Low level of disruption	Access to energy resource maps Integration between spatial planning and energy planning Capacity and expertise for funding programs Policy support for research and development

Auvergne-Rhône-Alpes, France (INSA Lyon)

The Auvergne-Rhône-Alpes region in France has achieved a high level of decarbonisation in its H&C sector, reducing reliance on fossil fuels to less than 30%. Despite this progress, existing gaps and barriers continue to moderately hinder the region's full decarbonisation efforts.

Governance structures and policy frameworks

One of the main governance challenges in Auvergne-Rhône-Alpes is multi-level governance complexity, which creates coordination difficulties between local, regional, and national policies. The fragmented governance leads to inconsistent implementation of decarbonisation strategies and conflicting priorities between short-term political cycles and long-term climate objectives.

To tackle this issue, some initiatives have been introduced:

- Participation in European networks: The region is part of FEDARENE, which facilitates the exchange of experiences and policy alignment between different European regions.[4]
- Development of decision-support tools: The regional energy agency AURA-EE has implemented digital platforms that provide energy, climate, and economic data specific to each territory, helping local authorities align their actions with broader regional goals.

Another significant governance challenge relates to the mismatch between resource availability and the responsibilities of public authorities. Local governments are tasked with implementing climate and energy transition projects, yet they lack the financial and technical resources needed to execute ambitious decarbonisation strategies.

Initiatives that could help address this issue include:

- Support from energy agencies: AURA-EE assists local authorities in planning and implementing decarbonisation projects.

[4] https://fedarene.org/serge-nocodie-climate-planning-needs-to-enable-local-authorities-to-anticipate-the-challenges-of-tomorrow-2/

- Innovative financing approaches: The region is testing third-party financing models, as in the case of a citizen solar thermal project at the Préau des Colibris residency.

Auvergne-Rhône-Alpes

Level of decarbonisation: High

Despite achieving a high level of decarbonisation, Auvergne-Rhône-Alpes still faces **governance, funding, data collection, and public engagement barriers**. Key areas for improvement include: stronger policy alignment between local and national governments, introduction of policies for critical infrastructure, better integration between spatial planning and energy planning, building capacity for funding programs and data collection and management, improvement of regulations currently inhibiting access to funding, standardisation of protocols for data collection, incentives for waste heat recovery, and investment in skills training and public awareness and engagement.

Energy integration

Despite notable progress in renewable energy ad option, the region lacks explicit, binding targets for renewable energy use in H&C. The absence of mandates slows down the transition to clean energy solutions. Relevant initiatives that have been undertaken to ameliorate this situation include:

- The Regional Planning, Sustainable Development, and Territorial Equality Scheme (SRADDET), which includes an ambitious goal to increase renewable heating and cooling production by a factor of five by 2030.[5]
- The EU-funded ESCALATE project, which aims to develop local heating and cooling plans to help set clearer renewable energy targets.

Another key challenge is the lack of supportive policies for critical infrastructure, including smart grids, energy storage systems, and district heating pipelines. Despite this lack, however, the region boasts 236 heating networks, which already provide 69% renewable heat, offering a model for further expansion.

Furthermore, limited access to comprehensive energy resource maps is a recurring challenge. The lack of detailed

[5] https://www.auvergnerhonealpes.fr/contenus/les-schemas-regionaux

energy mapping tools makes it difficult to identify and optimise renewable energy sources for H&C. In this context, the TerriSTORY platform, developed through the ESCALATE project, is being positioned as a key tool for energy planning.[6]

Spatial planning and zoning

A lack of integration between spatial planning and energy planning has also led to inefficiencies in decarbonisation efforts. The absence of coordination results in missed opportunities for efficient energy distribution, conflicting land-use decisions that block renewable energy development, and difficulty in implementing comprehensive H&C strategies. In view of these issues, the SRADDET framework aims to better integrate spatial and energy planning.

Another major issue pertains to inconsistencies in zoning laws, which create barriers to H&C expansion including difficulties in securing permits for renewable energy infrastructure, land-use conflicts between energy production and other urban needs, and unequal development of H&C infrastructure across different areas. A new law on renewable energy acceleration (APER, March 10, 2023) aims to address it by defining acceleration zones for renewable energy in each municipality.

Permitting processes

INSA Lyon identified outdated and conflicting permitting requirements as a key obstacle. These bureaucratic hurdles delay the deployment of renewable H&C solutions and make it difficult to navigate the regulatory environment. This challenge is considered moderately disruptive, and France's APER bill has been introduced to streamline permitting procedures and cut lead times in half.

Additionally, limited administrative capacity and technical expertise in permitting offices create delays in processing applications. To address these issues, the French government has launched an acceleration plan that includes training for permitting officials, while the Auvergne-Rhône- Alpes region has been working with the Regional Energy and Environment Agency to increase expertise and capacity for renewable energy projects.

[6] https://www.observatoire-des-territoires.gouv.fr/partenaires/terristory

Financial support and incentives

According to INSA Lyon, financial barriers include limited funding for large-scale projects, complicated application processes for incentives, and insufficient financial schemes for specific technologies. While there are several funding schemes available, the complexity and fragmentation of funding regulations remain highly disruptive. The region is working with the French Public Investment Bank (Bpifrance) to streamline application processes.

Workforce skills and technical capacity

A shortage of skilled professionals and standardised training programs for green H&C technologies was another challenges that was found to limit the region's ability to implement advanced systems effectively. The Skills4DHC program is working on developing professional training programs specific to district heating and cooling.[7]

Waste heat recovery

Despite the region's significant potential for waste heat recovery, existing policies do not sufficiently incentivise its use. Many industrial facilities produce large amounts of waste heat, but regulatory and financial barriers prevent effective integration into district heating networks. France's national strategy aims to increase waste heat recovery fivefold by 2035.

Conclusion

Despite achieving a high level of decarbonisation, Auvergne-Rhône-Alpes still faces governance, funding, data collection, and public engagement barriers. Key areas for improvement include: stronger policy alignment between local and national governments, introduction of policies for critical infrastructure, better integration between spatial planning and energy planning, building capacity for funding programs and data collection and management, improvement of regulations currently inhibiting access to funding, standardisation of protocols for data collection, incentives for waste

[7] https://webgate.ec.europa.eu/life/publicWebsite/project/LIFE23-CETSkills4DHC-101167015/skillsqualification-andrecruitment-ofprofessionals-forthe-districtheating-andcooling-dhcsector

heat recovery, and investment in skills training and public awareness and engagement.

Auvergne-Rhône-Alpes: Gaps and Challenges	
High level of disruption	Mismatch between resources and public authorities' responsibilities Policies for critical infrastructure Integration between spatial planning and energy planning Regulations inhibiting access to funding Capacity and expertise for funding programs Protocols for data collection Planning and investment in skills training Data expertise and infrastructure Policies and incentives for waste heat recovery Public awareness and engagement
Moderate level of disruption	Inconsistent and conflicting policies and directives Mandates or targets for the use of renewable energy in H&C Access to energy resource maps Inconsistencies in zoning laws Building regulations Financial support schemes Proprietary data practices Resources and expertise to organise outreach programs Policy support for research and development

Provence-Alpes-Côte d'Azur, France (CCI NCA)

The heating and cooling sector in the Provence-Alpes-Côte d'Azur (PACA) region has a low level of decarbonisation, with over 60% of its energy supply still dependent on fossil fuels. According to CCI NCA, the existing gaps and challenges pose moderate barriers to decarbonisation efforts. Drawing on CCIA NCA's feedback, these gaps and challenges are presented below.

Governance structures and policy frameworks

One of the main governance challenges in PACA is the mismatch between available resources and the responsibilities of public authorities. The municipalities of department 06 (Alpes-Maritimes) face significant constraints in financial, technical, and human resources, making it difficult to identify areas suitable for renewable energy development. Although schemes such as ADEME's Heat Fund (Fonds Chaleur)[8] exist to provide financial support, their implementation is hindered by a lack of local expertise. Moreover, the transfer of competencies related to heating from municipalities to the Public Inter-Municipal Cooperation Establishments (EPCIs) has further complicated the management of these infrastructures.

Initiatives that seek to mitigate these issues include (i) the provision of technical and financial support to municipalities (particularly in securing funding from ADEME, the EU, and regional sources) on the part of Alpes-Maritimes department's engineering agencies and initiatives (such as Agence 06 and CAP'THER), and (ii) the support for small neighborhood networks provided through the "Fond Chaleur" program.

[8] ADEME is the French Agency for Ecological Transition. Regarding the Fonds Chaleur scheme: https://les-aides.fr/aide/FngP3w/ademe/fonds-chaleur.html.

Another governance-related challenge in PACA is the lack of flexibility in heating network management models. The current Public Service Delegation (DSP) model is widely used for constructing and managing large H&C networks. While effective, this model limits flexibility for local authorities that may want to explore alternative governance approaches better suited to their specific needs. The consideration of municipal management models and more flexible public-private partnerships adapted to local circumstances were addressed by CCI NCA as initiatives that could alleviate this latter issue.

A major barrier in PACA is the lack of local technical expertise, which hinders heating and cooling network development. Municipalities often lack in-house technical staff, requiring external consultancy and project management assistance. CCI NCA suggested that Fonds Chaleur can reimburse diagnostic studies, providing technical support to local authorities while reducing financial burden. Currently, Agence 06 provides smaller municipalities with access to technical expertise, bridging gaps in in-house skills.

Energy integration

A significant challenge in PACA involves the lack of supportive policies for critical infrastructure, such as smart grids, energy storage systems, and district heating pipelines. While a regulatory framework exists, it lacks enforcement mechanisms to

CCI NICE CÔTE D'AZUR

Provence-Alpes-Côte d'Azur

Level of decarbonisation: Low

CCI NCA's responses highlight that governance, funding **complexity, lack of local expertise, insufficient spatial planning and infrastructure deployment** remain major challenges in PACA. Key areas for improvement include: improving urban planning integration with energy strategies, introducing policies for the deployment of critical infrastructure, enhancing technical training programs for local authorities, and updating regulations that currently inhibit access to funding. On a moderate basis, gaps relate to existing mismatches between available resources and the responsibilities of public authorities, lack of flexible heating network governance models, inadequate financial support schemes, and public awareness and engagement.

ensure project execution. In view of this challenge, CCI NCA has suggested the creation of a municipal authority responsible for managing heating networks, inspired by the city of Grenoble's centralised network management model.

Spatial planning and zoning and waste heat recovery

A lack of integration between spatial planning and energy policies has led to inefficiencies in the deployment of waste heat recovery solutions. Heat waste from incinerators, industrial sites, and data centers requires proximity between producers and consumers, yet the low density of industries in PACA limits this potential. Additionally, while the region's coastal urban concentration (90% of the department's population) makes heating network development seem viable, limited land availability for heating and cooling production units complicates infrastructure deployment.

Another challenge is inconsistencies in building regulations. France mandates that new buildings connect to existing heating networks, but this requires buildings to be designed with district heating compatibility from the outset. For existing buildings, the absence of such infrastructure necessitates costly renovations, which raises concerns about technical feasibility, financial viability, and public acceptance.

Financial support and incentives

The current financial support schemes for H&C networks in PACA are considered to be insufficient, particularly concerning the long-term sustainability of the Fonds Chaleur program and the need for greater medium-term visibility of available financial aid — both being critical for projects that span several years. Another issue posed by CCI NCA pertains to current restrictions on departmental-level funding due to the General Code of Local Authorities, which prevent departments from directly financing projects under concession agreements.

A major challenge arises from the complex and fragmented funding processes, which lengthen project approval timelines and make financing inaccessible to SMEs. Multiple public actors (DREAL, departmental agencies, local authorities) are involved in funding approval, increasing administrative complexity.

Public awareness and engagement

A lack of public awareness and engagement weakens support for decarbonisation initiatives. Strong political backing is essential, but it is not adequate in the face of the construction disruptions (noise, traffic, dust) associated with renovation projects. Hence. social acceptability remains a challenge, as the general public does not have access to information.

To ameliorate this situation, Nice Côte d'Azur Metropolis participates in the European Heat&Cool Life project,[9] which aims to increase renewable heating and cooling networks across PACA while engaging with local communities. Moreover, the France Chaleur Urbaine website provides a tool[10] for citizens to estimate H&C network connection feasibility.

Conclusion

CCI NCA's responses highlight that governance, funding complexity, lack of local expertise, insufficient spatial planning and infrastructure deployment, and public engagement remain major challenges in PACA. Key areas for improvement include: improving urban planning integration with energy strategies, introducing policies for the deployment of critical infrastructure, enhancing technical training programs for local authorities, and updating regulations that currently inhibit access to funding.

On a moderate basis, gaps relate to existing mismatches between available resources and the responsibilities of public authorities, lack of flexible heating network governance models, inadequate financial support schemes, and public awareness and stakeholder engagement

Provence-Alpes-Côte d'Azur: Gaps and Challenges	
High level of disruption	Policies for critical infrastructure Integration between spatial planning and energy planning Incompatible building regulations Regulations inhibiting access to funding Planning and investment in skills training
Moderate level of disruption	Mismatch between resources and public authorities' responsibilities Lack of flexibility in heating network management models Financial support schemes Public awareness and engagement

[9] https://www.maregionsud.fr/votre-region/competences/environnement/heat-cool-life
[10] https://france-chaleur-urbaine.beta.gouv.fr/carte

Bavaria, Germany (TUM)

Bavaria's H&C sector has only narrowly been decarbonised, with more than 60% of its energy still coming from fossil fuels. According to TUM's assessment, the existing gaps and barriers significantly impact decarbonisation efforts.

Governance structures and policy frameworks

TUM has identified a mismatch between resources and public authorities' responsibilities, as many municipalities and communities, particularly in smaller towns and villages, lack in-house expertise to assess whether a DHC network would be a viable option. Instead, they rely entirely on external consultants for investment decisions, planning, and operations. On top of this, municipalities struggle to evaluate the quality of these external reports, which creates further risks of inefficient planning.

Energy integration

In terms of energy resource maps, the Energy Atlas Bayern[11] is a public database that provides renewable energy potential maps, including information on biomass and geothermal resources, as well as existing DH networks. This is expected to be further elaborated, as all municipalities are required to publish a local "heat transformation plan" by June 30, 2028, which will indicate which areas are suitable for DHC networks decentralised systems.

Spatial planning and zoning

A major gap identified by TUM is the lack of integration between spatial planning and energy policies. Until now, nearly all municipalities in Bavaria have operated spatial and energy planning separately, leading to inefficiencies and missed opportunities for renewable energy integration. Moreover, many municipalities have no energy planning at all. This issue is moderately disruptive, but legal requirements in the coming years will mandate municipalities to adopt integrated energy planning frameworks.

Financial support and incentives

While Bavaria has several funding programs for constructing and operating DHC networks, the complexity of the funding structures presents a significant barrier,

[11] https://www.karten.energieatlas.bayern.de/start/?c=677751,5422939&z=8&l=atkis&t=energie

particularly for smaller municipalities. Many lack the internal expertise needed to understand and access funding programs, leading them to hire external consultants. The additional financial burden of hiring consultants makes decarbonisation projects less attractive to municipalities.

Another financial challenge is the complexity of public procurement laws, which municipalities must comply with when investing in DHC networks. These laws impose strict requirements on purchasing equipment and services, making the process long and bureaucratic. As a result, municipalities often need to hire external consultants to navigate these regulations, increasing project costs.

Workforce skills and technical capacity

A lack of standardisation in certification and training programs for energy planning and district heating was identified as a major issue. The official requirements for certification to conduct municipal energy planning or design a DHC network are very low. Because of the growing demand for energy planning, many engineering offices have rushed into the field, leading to low-quality feasibility studies that misguide municipalities in their decarbonisation strategies.

Data collection and sharing

Bavaria faces significant restrictions on access to building and energy data, which makes it difficult to assess heat demand and energy efficiency opportunities. Due to strict data protection laws, planners do not have access to essential information such as building age and insulation quality or actual energy consumption patterns.

Another problem is the reliance on just one or two municipal employees to handle data collection in smaller municipalities. Since there is no dedicated office or department for energy data management, data collection is often unstructured and inconsistent.

Waste heat recovery

Bavaria lacks a centralised database for assessing waste heat potential from industrial facilities. While there has been some progress in identifying large-scale industrial

Bavaria

Level of decarbonisation: Low

TUM's responses highlight **misallocation of resources, energy planning and energy resource mapping, workforce skills, data collection and management, and public engagement** as the main challenges in Bavaria's decarbonisation efforts. In this context key areas for improvement include: more optimal governance structures and resource allocation; simplified funding structures and procurement laws; better integration between spatial planning and energy planning; standardised certification and training for energy planners; improved access to energy and heat demand data; and public education campaigns to promote network-based heating solutions.

waste heat sources, information about smaller low- and medium-temperature sources remains unavailable. This poses a challenge for developing 5GDHC networks, which rely on lower-temperature waste heat recovery.

A related concern pertains to the uncertainty about the long-term availability of industrial waste heat. Companies are hesitant to commit their waste heat resources to district heating projects because economic conditions and industrial processes may change over time.

Public awareness and engagement

A significant barrier to public engagement is the lack of knowledge about modern 5GDHC networks. These systems are more complex than traditional district heating, making them harder to communicate to the public. This reduces public trust and slows down adoption rates.

Another cultural challenge relates to the fact that in smaller towns and rural areas, many buildings have individual oil boilers. As a result, residents tend to prefer decentralised heating solutions because they are used to managing their own heating systems. The concept of a network-based heat supply is unfamiliar, which makes it harder to convince communities to adopt district heating.

Research and innovation

A lack of political support for research and development in green H&C technologies was identified as an additional issue. Some funding has been directed towards

alternative solutions like green hydrogen boilers, despite uncertainties about their long-term viability. This has diverted investment away from practical and scalable renewable heating solutions.

Conclusion

TUM's responses highlight misallocation of resources, energy planning and energy resource mapping, workforce skills, data collection and management, and public engagement as the main challenges in Bavaria's decarbonisation efforts. In this context key areas for improvement include:

- More optimal governance structures and resource allocation.
- Simplified funding structures and procurement laws.
- Better integration between spatial planning and energy planning
- Standardised certification and training for energy planners.
- Improved access to energy and heat demand data.
- Public education campaigns to promote network-based heating solutions.

Bavaria: Gaps and Challenges	
High level of disruption	Capacity and expertise for funding programs
Moderate level of disruption	Access to energy resource maps Integration between spatial planning and energy planning Standardised certification and training programs Proprietary data practices Data expertise and infrastructure Public awareness and engagement Research and innovation
Low level of disruption	Policies and incentives for waste heat recovery

Austria (ÖGUT)

The Austrian H&C sector has a low level of decarbonisation, as fossil fuels represent more than 60% of the energy used for heating and cooling. According to ÖGUT, decarbonisation efforts are moderately impeded by existing regulatory and administrative gaps.

Governance structures and policy frameworks

One of the most significant governance challenges in Austria is the inconsistency between national and local policies. The City of Vienna has committed to phasing out fossil gas from heating systems by 2040, yet the Austrian national government has refused to adopt similar legislation at the federal level. This regulatory misalignment creates uncertainty for investors and policymakers and hinders large-scale planning efforts.

The disruption level of this gap is high, but a recent development aims to address it. The Austrian Renewable Heat Law (in effect since February 2024)[12] mandates that new buildings can no longer install fossil heating systems. The fact that this law does not apply to existing buildings, however, limits its overall positive impact on decarbonisation.

Another challenge concerns the mismatch between resources and public authorities' responsibilities. In several regional provinces, municipalities must now consider energy aspects in their spatial planning processes. However, most planning authorities

[12] https://www.ris.bka.gv.at/eli/bgbl/I/2024/8/20240228

lack the resources and expertise to properly integrate energy considerations into spatial planning.

This issue has been assessed as moderately disruptive, and some initiatives aimed at addressing it have been launched or are underway:

- Energy Information Systems have been introduced in Styria and Salzburg, and partially in Vorarlberg, to support planners.
- Styria has created a funding scheme for spatial energy planning.
- A national platform for spatial energy planning is expected to be established in 2025.

Energy integration

ÖGUT reported a lack of supportive policies for critical infrastructure like smart grids, energy storage systems, and district heating pipelines. For example, large urban infrastructure projects in Vienna present an enormous untapped potential for the utilisation of geothermal energy. Despite repeated recommendations from scientists and industry experts, geothermal potential is not yet considered in subway construction, road redesigns, or large-scale housing developments.

ÖGUT

Austria

Level of decarbonisation: Low

ÖGUT's responses highlight **regulatory misalignment, inadequate infrastructure policies, funding complexity, and lack of spatial planning requirements** as key obstacles to decarbonisation of the H&C in Austria. Key areas, the improvement of which would promote and accelerate decarbonisation efforts, include: stronger national mandates for heat planning and district heating integration, legal reforms to resolve the owner-tenant conflict of interest, binding requirements to incorporate geothermal energy and waste heat into urban infrastructure projects, better integration between spatial and energy planning, policies for the deployment of critical infrastructure, more streamlined and fair funding mechanisms for 5GDHC and geothermal heating systems, investment in data collection and workforce development, and policies for waste heat recovery.

Another, data-related, issue is the limited access to energy resource maps or planning tools. Depending on the province, some regions have better access to renewable energy data than others. For instance, shallow geothermal and waste heat potential maps are incomplete in many provinces.

This gap has been assessed as moderately disruptive, and Vienna and Salzburg are currently the only provinces with comprehensive GIS-based energy maps.

Spatial planning and zoning

A major gap in Austria is the lack of a national heat planning law. Unlike Germany, where large cities are required to develop municipal heat plans, Austria has no such national regulation. Instead, spatial planning is managed at the regional level, and some provinces (e.g., Styria) have implemented energy planning requirements, but these remain non-binding.

Some relevant initiatives have been undertaken in certain areas: for example, Styria has introduced a funding scheme for municipal heat planning and integrating energy in spatial planning , while Vienna has voluntarily developed a heat plan.

A related challenge pertains to inconsistencies in zoning laws. The Vienna Heating Plan 2040, which is mentioned above, designates areas for future district heating expansion, but it does not guarantee grid connections. Additionally, there is no standardised process for designing municipal heat plans.

Solutions to this issue involve (i) the designation of four "pioneer areas" for full district heating coverage in Vienna, (ii) the development of easily implementable zoning concepts in Salzburg and Styria, and (iii) the launch of a standardised planning process for creating binding heat plans by Klimaaktiv, a national climate protection initiative.

A major regulatory issue in this policy area is connected to the Austrian tenancy law, according to which building owners must provide heating systems, while tenants cover the energy costs. As a result, landlords have little financial incentive to invest in energy-efficient systems, as they do not benefit from reduced energy bills. Additionally, the so-called “owner-tenant conflict of interest” discourages energy efficiency investments, especially in the case of older houses which have a limited rent rate,

inhibiting their owners from recuperating their investments through higher rents. Finally, the Austrian Condominium Act requires that 100% of owners to agree on major energy efficiency investments, making retrofitting large buildings almost impossible.

These issues are deemed highly disruptive. ÖGUT has suggested several solutions that could tackle them, including:

- Legal reforms inspired by the Swedish model, where building owners benefit from energy efficiency investments.
- Allowing partial surcharges or discounts on rents based on building energy efficiency.
- Commissioning a heat supply contractor to construct and maintain the 5GDHC network, instead of the owner of the tenancy houses.
- Reforming Austrian Condominium laws to lower the approval threshold for decarbonisation investments from 100% to 50%.

A final building regulatory issue involves building insulation restrictions. In Austria, if a building's outer wall touches a neighboring property, insulation improvements require the neighbor's consent. In many cases, neighbors refuse or demand unreasonably high payments, preventing energy efficiency improvements. This challenge has been assessed as moderately disruptive, and a recent Supreme Court ruling has limited neighbors' ability to block insulation improvements. However, individual court cases are still required to resolve disputes, discouraging many building owners from pursuing insulation projects.

Permitting processes

The historical restriction on private drilling for geothermal probes on public land has been recently lifted in Vienna (2023), allowing property owners to install deep geothermal probes (up to 299 meters). However, a one-time fee per meter still applies, which limits uptake.

Financial support and incentives

ÖGUT reported that funding for geothermal energy and heat pumps is inadequate. Currently, funding for air-based heat pumps is more accessible than for geothermal systems, even though geothermal is more efficient in the long term.

This issue has been assessed as highly disruptive, and some initiatives have been introduced:

- The roll-out of a national funding program from 2023 to 2024, which adjusted the cost difference between air and geothermal heat pumps.
- Research funding has been made available for demo projects.

Another regulatory issue is that building owners can only receive funding for heat pumps if a district heating provider confirms that connection to the 3GDHC grid is not possible. This discriminates against 5GDHC networks, as it limits their adoption in areas zoned for 3GDHC. Vienna has already removed this funding requirement, while national funding agencies are expected to adjust regulations in early 2025 to allow more flexibility.

A particularly challenging issue in Austria is the highly complex and fragmented funding structure for renewable heating technologies. For heat pump projects, two or sometimes three separate funding applications are required, each with different eligibility criteria and distinct accounting requirements. This administrative burden discourages potential applicants, particularly small businesses and municipalities, from pursuing available funding opportunities

Workforce Training and technical expertise

There is a shortage of trained professionals in Austria's H&C sector, partly due to frequent policy changes. Companies hesitate to invest in long-term training programs due to the uncertainty surrounding future government incentives. To mitigate this issue, the national funding agency has implemented a two-year funding period instead of a one-year that was previously in place.

Waste heat recovery

Although the introduction of regulations that will make waste heat recovery binding has been considered, this is not still the case. In Vienna, and several other cities, part of the heat is currently generated by municipal waste incineration plants.

Legal Barriers for Tenant-Based Retrofits

The Austrian Housing Law allows tenants to refuse heating system upgrades, even when costs are fully covered. This creates parallel fossil fuel and renewable heating

systems in multi-family buildings, driving up maintenance costs. A legislative reform is under discussion to require tenants to accept energy-efficient upgrades.

Conclusion

ÖGUT's responses highlight regulatory misalignment, inadequate infrastructure policies, funding complexity, and lack of spatial planning requirements as key obstacles to decarbonisation of the H&C in Austria. Key areas, the improvement of which would promote and accelerate decarbonisation efforts, include: stronger national mandates for heat planning and district heating integration, legal reforms to resolve the owner-tenant conflict of interest, binding requirements to incorporate geothermal energy and waste heat into urban infrastructure projects, better integration between spatial and energy planning, policies for the deployment of critical infrastructure, more streamlined and fair funding mechanisms for 5GDHC and geothermal heating systems, investment in data collection and workforce development, and policies for waste heat recovery

Austria: Gaps and Challenges	
High level of disruption	Inconsistent and conflicting policies and directives Mismatch between resources and public authorities' responsibilities Incompatible building regulations Policies for critical infrastructure Integration between spatial planning and energy planning Financial support schemes Lack of skilled workforce Proprietary data practices Policies and incentives for waste heat recovery
Moderate level of disruption	Access to energy resource maps Inconsistencies in zoning laws Permitting requirements Regulations inhibiting access to funding Protocols for data collection
Low level of disruption	Capacity and expertise for funding and incentives programs

EcoEnergyLand, Austria (EEE)

The EcoEnergyLand (EEL) region[13] in Austria has achieved a moderate level of decarbonisation, with 30–60% of energy still reliant on fossil fuels. According to the European Center for Renewable Energy Güssing (EEE), existing regulatory and administrative gaps across different policy areas moderately impinge on efforts for the decarbonisation of the sector.

Governance structures and policy frameworks

One of the primary governance challenges in the EEL region relates to inconsistent and conflicting policies and directives at different levels of government. In recent years, federal efforts have strongly promoted decarbonisation by incentivising the transition to renewable heating systems for private, municipal, and commercial sectors. Similarly, the state government has also supported decarbonisation, particularly for building heating. However, these policies have not been uniformly supportive of district heating networks and decentralised bioenergy systems.

While individual heating system conversions from fossil fuels to renewables receive significant financial support, biomass power plants lost their subsidies years ago due to the removal of feed-in tariffs, leading to their closure. Similarly, biogas plants that once contributed to renewable electricity and heat generation are also struggling due to discontinued subsidies. As a result, biomass heating plants are now the only significant district heating providers, as other decentralised energy producers have faced economic challenges.

The disruption level of this gap is assessed as moderate, and efforts to address this issue are not fully aligned between federal and state authorities. While the federal government provides more structured incentives, the state government has not provided similar levels of support for decentralised heating supply structures.

Energy integration

One of the major barriers identified is the lack of explicit mandates or targets for the use of renewable energy in the H&C sector. While Austria has promoted the “get out

[13] The EcoEnergyLand is an association of 19 municipalities as local administrative units within the Austrian region of Burgenland.

of oil and gas" strategy, there is no comprehensive national strategy outlining clear targets for integrating renewables into DHC networks.

Moreover, Austria's policies have historically focused on district heating rather than cooling, meaning that regional heating networks exist, but no cooling networks have been developed. This lack of focus on cooling remains an issue for expanding low-carbon energy solutions in the built environment.

The region has taken some independent steps to improve the situation: Under the "Climate and Energy Model Government Activities", EEL has committed to maximising renewable energy use and improving the efficiency of existing bioenergy plants.

Spatial planning and zoning

A key challenge in the region is the lack of integration between spatial planning and energy planning policies. Spatial planning authorities have not yet incorporated energy infrastructure needs into their zoning policies, but this is expected to be addressed in the future.

Financial support and incentives

Although there are funding incentives for the decarbonisation of the heating sector at both national and federal level, these are highly differentiated. While biomass heating plants for district heating still receive funding, biomass power plants and biogas plants have lost their subsidies, making them financially unviable. This issue has been assessed as highly

EUROPÄISCHES ZENTRUM FÜR ERNEUERBARE ENERGIE GÜSSING GMBH

EcoEnergyLand

Level of decarbonisation: Moderate

EEE's responses highlight **policy misalignment, insufficient renewable energy introduction and planning, and, in certain cases, limited capacity and expertise in the design and implementation of funding and incentives programs** as key challenges. While public engagement, waste heat recovery, and research and innovation are well-developed, addressing policy alignment, integration between spatial and energy planning, and long-term financial stability is essential for accelerating and completing EEL's and Austria's transition to sustainable H&C systems. One of the largest challenges faced currently by EEE is jumping on the bandwagon of more recent DH&C technologies and models.

disruptive, as it could lead to further closures of existing bioenergy plants, reducing the availability of renewable heat supply.

Additionally, Austria is facing potential changes in its renewable energy subsidies, with a new federal government considering subsidy reductions. This could create additional uncertainty for investors and operators. Despite these concerns, state and federal funding incentives for individual building-level heating conversions remain strong, even as district-level energy supply faces declining support.

Data collection and sharing

A major challenge is the absence of standardised data collection protocols for DHC networks. The level of data availability varies significantly depending on the age and technical infrastructure of different networks. On the one hand, older heating networks often rely on conventional heat meters, and some of them lack digitalised data transmission capabilities. On the other, modernised systems may transmit consumption data via digital bus systems, but this is not yet a universal practice. At the same time, there is no standardised system for aggregating and sharing data across different heating networks.

The disruption level of this challenge has been assessed as low, but improving digitalisation and data-sharing frameworks could further enhance network efficiency.

Waste heat recovery

The EEL region has already conducted a study on waste heat utilisation, especially the one coming from biomass combined heat and power (CHP) plants and biogas plants. Additionally, the study assessed the waste heat potential from commercial and industrial activities but determined that these sources were not significant due to the small scale of industries in the region.

Public awareness and engagement

Austria has implemented the "Climate and Energy Model Regions" initiative, which includes 1157 municipalities. EEL is one such model region and has been active in sensitising the public, municipalities, and businesses about the energy and heat transition. As a result, public awareness of renewable heating solutions is considered high, and outreach activities have been implemented.

Research and innovation

The region has historically been a pioneer in bioenergy research and innovation. EEL was one of the first regions in Austria to develop biomass district heating plants, and it has also created pilot projects for biomass gasification and biogas production. Due to this extensive experience, research and development in renewable heating solutions is well-established, and Güssing has been recognised as a national and international model for bioenergy-based heating solutions.

However, since the region introduced the use of biomass and district heating systems quite early, the systems have been in existence for a long time. Through its participation in the ALPHA project, EEL is interested in considering the viability and benefits of carrying out a generational change and introducing new models of local and district heating and.

Conclusion

EEE's responses highlight policy misalignment, insufficient renewable energy introduction and planning, and, in certain cases, limited capacity and expertise in the design and implementation of funding and incentives programs as key challenges. While public engagement, waste heat recovery, and research and innovation are well-developed, addressing policy alignment, integration between spatial and energy planning, and long-term financial stability is essential for accelerating and completing EEL's and Austria's transition to sustainable H&C systems. One of the largest challenges faced currently by EEE is jumping on the bandwagon of more recent DH&C technologies and models.

EcoEnergyLand: Gaps and Challenges	
Moderate level of disruption	Inconsistent and conflicting policies and directives Mandates or targets for the use of renewable energy in H&C Integration between spatial planning and energy planning Capacity and expertise for funding programs Generational change in H&C technologies
Low level of disruption	Permitting processes Standardised protocols for data collection

Slovenia (Trebnje)

Slovenia's H&C sector has achieved a moderate level of decarbonisation, with fossil fuels currently providing between 30% and 60% of energy. The Municipality of Trebnje has found existing regulatory and administrative gaps to have a crucial impact on efforts to decarbonise the sector.

Governance structures and policy frameworks

A significant policy challenge in Slovenia arises from the misalignment between national and European legislation. As an EU member state, Slovenia is required to modernise its district heating and cooling networks, increase the share of renewable energy, and integrate waste heat utilisation. However, the transposition of EU directives into Slovenian legislation is often delayed or incomplete.

One key example is the requirement for district networks to allow access to heat producers using renewable energy sources and waste heat, which has not yet been fully addressed in Slovenia. As a result, integrating new sources into existing networks faces unnecessary delays. Moreover, Slovenian energy policies often contain conflicting goals, with decarbonisation efforts, on the one hand, and the continued promotion of fossil fuels (particularly gas as a transitional technology), on the other, happening simultaneously.

Another governance challenge is the fragmentation of the country into numerous small municipalities, each with varying priorities for energy system development. While cities like Ljubljana and Velenje are actively investing in modernising their DHC networks, many smaller municipalities lack financial and technical capacity to do so. This results in uneven investment in energy infrastructure modernisation, which ultimately hinders a unified national transition to sustainable DHC systems.

This gap is assessed as moderately disruptive, and Local Energy Concepts (LEK)[14] have been introduced as an initiative to support municipalities in developing strategic energy plans to improve efficiency and increase the use of renewable energy.

Additionally, Slovenia lacks a systematic approach to transitioning to 5GDHC networks; there is no clear timeline for the transition, while support for innovation and digitalisation within these systems is currently insufficient.

Energy integration

A major challenge in this policy area is the absence of supportive policies for critical infrastructure. Most existing Slovenian legislation focuses on individual heating units rather than on integrating modern energy solutions into district heating networks. One particularly counterproductive regulation requires thermal storage systems to be classified as heat sources, meaning they require a separate building permit for a boiler house, even if they operate independently as part of a smart grid.

The lack of supportive policies for infrastructure was assessed as highly disruptive, but some initiatives have started addressing it. Municipalities have

Slovenia

Level of decarbonisation: Low

According to T Slovenia faces key regulator dministrative barriers in decarbonising its heating and cooling sector. Policy misalignment, fragmented governance, inadequate infrastructure, insufficient funding, and absence of skills training slow the transition, while permitting inefficiencies and weak spatial planning further hinder district heating expansion. Limited public awareness and inconsistent data collection add to the challenges. Addressing these gaps through stronger national coordination, streamlined regulations, and better financial support will be crucial for advancing the country's decarbonisation efforts.

[14] In Slovenia, a Local Energy Concept (LEK) is a strategic document that municipalities develop to plan and manage energy supply and consumption at the local level. Established under the Slovenian Energy Act of 2004, the LEK aims to align local energy policies with national objectives, promoting efficient energy use, environmental sustainability, and the integration of renewable energy sources. For more information on LEK, see: https://trebnje.si/media/uploads/2023_VSEBINSKE%20STRANI/OOPI/LEK%20TREBNJE%202023_2030.pdf

begun developing regional energy strategies to improve infrastructure for district heating, while changes to the building code, which are currently discussed, may enable a more flexible approach to advanced energy systems, such as heat storage units.

As a more general comment on energy integration, Trebnje explained that Slovenia tends to prioritise meeting formal EU energy efficiency criteria over ensuring effective practical implementation. As a result, while legislation mandates specific renewable energy usage percentages, the actual transition to renewables is slower than expected, and fossil fuels remain dominant in practice.

Spatial planning and zoning

A lack of integration between spatial planning and energy strategies poses a significant barrier to DHC expansion. Municipal spatial plans do not systematically consider the needs of energy infrastructure, meaning there are no designated spaces for district heating expansion. As a result, district heating facilities often face land-use conflicts that delay or prevent their development.

As far as building regulations are concerned, Slovenian legislation emphasises insulation requirements as a primary tool for improving energy efficiency. While this aligns with EU energy efficiency guidelines, it can negatively impact DHC expansion. Highly insulated buildings consume less heat, making district heating less financially viable. Furthermore, Slovenian energy policy encourages individual heat pump installations, reducing incentives to connect to DHC systems.

Permitting processes

The limited administrative capacity and technical expertise in permitting offices was identified as a major issue. Due to low wages, staff shortages, and an overloaded workforce, permit applications take longer to process, and errors occur during the review phase. Moreover, site assessments are often incomplete, leading to uncertainties in permit evaluations.

Financial support and incentives

Slovenia’s financial support schemes for DHC systems are inadequate, as funding primarily focuses on individual household solutions rather than large-scale network

investments. Available financing is mostly aimed at traditional technologies (high-temperature networks); it also prioritises new DHC networks over modernising existing ones, thereby limiting opportunities to reduce heat losses in aging infrastructure. Additionally, DHC systems require high upfront investments, but funding schemes rarely cover these costs.

Another financial challenge is the complex and fragmented funding application process. DHC projects require approvals from multiple institutions (ministries, local governments, the Energy Agency, Eko Fund), yet there is no efficient coordination between them, resulting in long waiting periods and unclear responsibilities. Each funding program has unique eligibility requirements, making the application process complicated and time-consuming.

Workforce skills and technical capacity

There is a lack of standardised certification and training programs for green H&C technologies in Slovenia. Municipalities struggle to develop long-term workforce training strategies, as staff shortages limit the time available for additional education.

Data collection and sharing

Slovenia lacks standardised protocols for energy data collection, leading to inconsistent reporting practices among district heating operators. Some companies that report to the Energy Agency collect only data pertaining to energy production and prices, while others do not report at all. This creates gaps in national statistics and prevents the development of comprehensive energy planning tools. A suggestion made by Trebnje involves the creation of a shared platform, where every stakeholder could provide their data.

Additionally, there is no publicly accessible national database on DHC system performance. Network operators often restrict access to key data, limiting research and policy planning efforts. Related to this is the lack of appropriate infrastructure, which stems from the fact that there is no regulation mandating the implementation of modern digital solutions, such as smart meters and data management systems.

Waste heat recovery

Slovenia lacks explicit policies and incentives for waste heat recovery. Waste heat is only indirectly mentioned in the Environmental Protection Act and the Regulation on Emissions of Substances and Heat from Wastewater Discharge into Water and Public Sewers, its utilisation not being addressed in these two or any other regulation.

Public awareness and engagement

Slovenia does not have sufficient public awareness campaigns about district heating benefits. Instead, most outreach focuses on energy efficiency in buildings, leading to low awareness and acceptance of district heating expansion. Recent changes in grid fees, which have significantly increased electricity costs for households with their own solar power or heat pumps, have further exacerbated this issue and undermined the level of public trust.

Conclusion

Slovenia faces key regulatory and administrative barriers in decarbonising its heating and cooling sector. Policy misalignment, fragmented governance, inadequate infrastructure, insufficient funding, and absence of skills training slow the transition, while permitting inefficiencies and weak spatial planning further hinder district heating expansion. Limited public awareness and inconsistent data collection add to the challenges. Addressing these gaps through stronger national coordination, streamlined regulations, and better financial support will be crucial for advancing the country’s decarbonisation efforts.

Slovenia: Gaps and Challenges	
High level of disruption	Inconsistent and conflicting policies and directives Policies for critical infrastructure Slow transition to renewables Integration between spatial planning and energy planning Administrative capacity and technical expertise in permitting offices Financial support schemes Planning and investment in skills training
Moderate level of disruption	Mismatch between resources and public authorities' responsibilities Lack of a systematic approach to transitioning to 5GDHC Incompatible building regulations Regulations inhibiting access to funding Protocols for data collection Proprietary data practices Data expertise and infrastructure Policies and incentives for waste heat recovery Public awareness and engagement

Comparative Assessment of Survey Results

The input provided by ALPHA project partners regarding their territories reveal significant regulatory and administrative barriers in planning and implementing decarbonised heating and cooling systems across the Alpine space. While each region and/or country faces unique challenges, several common transalpine gaps have emerged, hindering the transition to sustainable H&C networks. These gaps span governance structures, energy integration, spatial planning, permitting, financial support, workforce capacity, data sharing, and public engagement.

Common gaps and challenges

The following comparative assessment identifies shared obstacles and discusses trends across these policy areas. Before embarking on the presentation of common gaps and challenges on the basis of their potential impact, the following table offers an aggregate image of the existing regulatory and administrative issues across all regions. It does so by ranking these issues according to the levels of disruption that was ascribed to them in partners' territorial input.

Fragmented governance structures and policy frameworks		Inadequate energy integration		Spatial planning and zoning					Financial support and incentives		
Gaps											
Inconsistent and conflicting policies and directives	Mismatch between resources and public authorities' responsibilities	Limited access to energy resource maps or tools	Lack of mandates or target for RES integration	Lack of supportive policies for critical infrastructure	Conflicting or outdated regulations	Incompatible building regulations	Integration between spatial and energy planning	Zoning laws	Inadequate financial support schemes	Complex and fragmented regulations	Limited administrative capacity and expertise
Potential impact											
MODERATE	MODERATE	MODERATE	HIGH	HIGH	HIGH	HIGH	MODERATE	MODERATE	HIGH	MODERATE	MODERATE

Waste heat potential	Workforce skill and technical capacity		Data collection and sharing			Public awareness and engagement		Permitting processes		Research and Innovation
Gaps										
Absence of policies and incentives for wase heat recovery	Absence of standardised certification and training programs	Insufficient planning and investment in skills training	Absence of standardised protocols for data collection	Proprietary data practices	Limited technical expertise and infrastructure	Lack of provisions for public education and involvement	Limited resources for outreach programs	Limited capacity and expertise in permitting offices	Conflicting or outdated requirements	Lack of policy support for R&D
Potential impact										
MODERATE	MODERATE	HIGH	MODERATE	MODERATE	MODERATE	HIGH	HIGH	MODERATE	MODERATE	LOW

Energy integration: Lack of binding targets and supportive infrastructure policies

Lack of explicit mandates or targets for the use of renewable energy in H&C

Many of the participating Alpine regions report a lack of binding mandates for renewable energy integration in H&C networks. It appears that the transition to renewable energy in the heating and cooling sector has not been prioritised compared to other sectors like electricity generation. This absence of clear legislative requirements, which stems from a combination of policy gaps, economic concerns, technological challenges, and market fragmentation, weakens incentives for transitioning to decarbonised solutions.

- **Lombardy** highlighted that Italy is not required to meet the EU's 48% renewable energy target for district heating and cooling under the RED III Directive, leading to weak policy incentives for increasing renewable energy in DHC.
- **Austria** faces similar issues, with no national strategy explicitly mandating renewable integration in DHC networks, although Vienna has taken independent steps.
- **France** has made progress in decarbonising district heating, yet **Auvergne-Rhône-Alpes** reports that explicit binding targets for renewable H&C adoption remain insufficient.

Lack of supportive policies for critical infrastructures

Additionally, the lack of supportive policies for critical infrastructure (e.g., smart grids, energy storage systems, and low-temperature networks) is a widespread issue. Municipalities and local governments often prioritise individual solutions (such as heat pumps) over network-based systems due to regulatory limitations and financial incentives that favor private over collective investments. Again, a combination of high upfront investment costs, technological uncertainty, and fragmented market needs

deters the introduction of supportive policies and the deployment of infrastructure that is crucial to the development of H&C networks.

The lack of integrated energy resource maps and associated tools was also raised as a challenge related to RES integration by several partners, albeit with a moderate potential impact. In many cases, there are already initiatives that have been undertaken or are underway to address this issue.

Relevant initiative

Bavaria (Germany)

All municipalities are expected to publish a local "heat transformation plan" by 30/06/2028, which will indicate the areas that are favorable for the development of DHC networks.

Spatial planning and zoning: Lack of integrated energy and land-use planning and

Conflicting or outdated requirements

Rigid land-use regulations, mismatched urban development plans, and unclear guidelines for integrating renewable energy sources can create barriers to investment and innovation, while inconsistencies between national and local policies lead to delays in project approvals and increased costs for developers. Across the Alpine space, spatial planning authorities rarely designate reserved areas for H&C infrastructure, resulting in inefficient network expansion and underutilisation of renewable heat sources.

Relevant initiative

Auvergne-Rhône-Alpes (France)

The Regional Planning, Sustainable Development and Territorial Equality Scheme (SRADDET) aims to integrate various territorial issues, including energy planning, into a cohesive framework.

In **Austria**, the absence of a national heat planning law results in inconsistent approaches across provinces, with some (e.g. Vienna and Syria) voluntarily integrating energy planning while others do not. **Bavaria** and the Alpine regions in **Italy and France** face similar problems, where zoning regulations often do not account for future DH expansions. The case is similar in **Slovenia**, where urban planning and energy planning have

traditionally been managed separately, leading to inefficiencies.

Incompatible building regulations

Outdated or conflicting building regulations were also raised as significant impediments. For example, both in **Lombardy** and **Slovenia** building regulations and associated incentives prioritise building insulation over the deployment of DHC solutions. Many existing codes fail to account for modern technologies like dynamic insulation, phase-change materials, or integrated renewable energy solutions, limiting innovation and system efficiency.

Financial support and incentives: Fragmented and inaccessible funding schemes

Inadequate and/or complex financial support schemes

Many partners reported fragmented and complex financial support structures, making it difficult to access funding for DHC projects. Multiple applications, differing eligibility criteria, and lack of harmonisation between national and EU funding mechanisms discourage investments.

- **Lombardy** reported that funding schemes are insufficient, while smaller municipalities across all three Italian regions (**Lombardy**, **Liguria, and South Tyrol)** lack the expertise to apply for funding, forcing reliance on external consultants.
- **France and Bavaria** have multiple funding schemes, but their complexity makes it difficult for local governments to navigate them effectively.
- **Slovenia's** financial support largely favors individual heating solutions rather than district-wide infrastructure investments.
- In **Austria**, securing funding for renewable heating projects requires multiple separate applications, each with distinct administrative requirements, while the shifting landscape of incentives and subsidies deters investment.

Overall, funding structures favor short-term, small-scale projects over long-term, network-based solutions, slowing the transition to sustainable H&C systems.

Workforce skills and technical capacity

Insufficient planning and investment in skills training by local authorities

A widespread issue is the lack of specialised training programs for district heating operators, engineers, and policymakers in H&C technologies. Bavaria, Liguria, Auvergne-Rhône-Alpes, and Slovenia all report that certification and training programs for the H&C sector are insufficient.

Limited funding for workforce development prevents upskill initiatives and certification programs. Related to this is the weak collaboration with industry and academia, which reduces opportunities for knowledge transfer and innovation.

Public awareness and engagement

Relevant initiative

EcoEnergyLand (Austria)

The region is part of the "Climate and Energy Model Regions" initiative, which currently includes 1157 municipalities. This initiative has engaged with public awareness activites to sensitise the civil society about the benefits of energy and heating transition.

A major gap in the decarbonisation of H&C systems across Alpine regions is the low level of public awareness and engagement. Citizens, businesses, and local policymakers often lack information on the benefits of DHC networks, leading to limited support for infrastructure expansion and low adoption of renewable energy-based systems. **Lombardy, Liguria, PACA, Bavaria, and Slovenia** highlight that public engagement strategies remain underdeveloped, with little communication on the economic and environmental advantages of district heating. As a result, residents in several participating regions tend to prefer individual heating solutions (e.g., heat pumps or gas boilers) due to a lack of trust in centralised systems.

MODERATE-IMPACT COMMON REGULATORY AND ADMINISTRATIVE GAPS

Fragmented Governance structures and policy frameworks

Inconsistent and conflicting policies and directives

A recurring issue across Alpine regions is the fragmentation of responsibilities between national, regional, and municipal authorities. Inconsistent policies create regulatory uncertainty, delaying the implementation of H&C solutions. Several partners noted that decentralisation of energy planning responsibilities without adequate resources results in inefficiencies and a lack of coordination.

- In **Austria**, national and regional or municipal policies are misaligned, with Vienna committing to a fossil fuel phase-out by 2040, while federal policies remain less ambitious. Additionally, energy planning responsibilities have been delegated to municipalities without sufficient technical capacity or financial resources.
- In **Italy**, particularly **Lombardy**, **Liguria, and South Tyrol**, the absence of a coherent national policy on district DHC exacerbates disparities in regional implementation. Regulatory bodies such as ARERA oversee tariffs and regulations, but local authorities lack decision-making power, leading to inefficiencies.
- In **Auvergne-Rhône-Alpes and PACA** in France, the governance structure is further complicated by multi-level administrative frameworks. PACA regional authority struggles with unclear jurisdictional overlaps, making it difficult to coordinate energy transition efforts effectively.
- In **Slovenia**, the delayed transposition of EU directives into national law has slowed the integration of green H&C solutions. Additionally, the fragmentation of governance into numerous small municipalities results in uneven investment and planning.

Relevant initiative

Vienna (Austria)

The City of Vienna has independently committed to phasing out fossil fuel heating by 2040, setting ambitious local targets despite misalignment with national policies. This proactive approach serves as a model for municipal-level climate action.

Across the board, regions struggle with conflicting national and regional policies, a lack of clearly defined responsibilities, and insufficient coordination mechanisms. This array of governance and policy challenges ends up preventing effective long-term energy planning and investment security.

Mismatch between resources and public authorities' responsibilities:

Many local and regional authorities are tasked with overseeing H&C projects but lack the necessary financial support, technical expertise, or regulatory power to drive meaningful change.

Data collection and sharing

In many regions, there is no standardised database for energy demand, waste heat potential, or district heating networks, making informed decision-making difficult. The absence of a coordinated framework for data sharing hampers effective energy planning, monitoring, and benchmarking. Many municipalities and regional authorities struggle to gather reliable data on heat demand, energy efficiency, and renewable energy integration, leading to gaps in policy implementation and network optimisation. **Bavaria** faces strict data protection laws, making it difficult for local governments and researchers to access building energy data and district heating performance metrics. In **Liguria** and **EcoEnergyLand**, lack of metering infrastructure and limited access to information from distributors and energy managers reduce transparency and impede network development and management. **Slovenia** lacks centralised platforms for energy data, preventing integration of renewable sources into existing networks.

Waste heat recovery

Waste heat recovery remains largely underutilised across Alpine regions due to regulatory gaps, technical barriers, and limited financial incentives.

- **Bavaria** struggles with lack of information, uncertainty, and fragmented ownership, making agreements between industries and district heating operators difficult. Likewise**, South Tyrol** has not yet systematically mapped waste heat sources
- **Auvergne-Rhône-Alpe, Austria, and Slovenia** currently provide few financial incentives for waste heat utilization.

Additionally, many existing DH systems are designed for high-temperature operations, making it costly to integrate low-temperature waste heat without network modifications.

Permitting processes: Complex and lengthy administrative procedures

A persistent barrier across several regions is the complexity of permitting procedures for new DHC infrastructure. Lengthy approval times and unclear responsibilities hinder project implementation, while many local authorities lack the specialised knowledge required to assess innovative technologies, leading to prolonged approval processes, inconsistent regulations, and uncertainty for investors.

- **Italy** faces bureaucratic delays due to overlapping administrative responsibilities. In **Liguria**, the permitting process is particularly challenging due to the landscape protection constraints in many areas.
- **Slovenia** struggles with **low staff capacity in permitting offices**, causing delays and missed funding opportunities; the situation is similar in the case of the **Auvergne-Rhône-Alpes region** in France.

Relevant initiative

Vienna (Austria)

In 2023, Vienna's regulations were updated, permitting building owners to drill geothermal probes as deep as 299m.

Key takeaways

Despite obvious regional variations, this survey has revealed important common transalpine challenges to H&C decarbonisation. As discussed in more detail above, these include governance fragmentation and policy misalignment, lack of binding renewable targets, complex financial incentives, slow permitting, and weak spatial-energy planning integration. Additional shared gaps relate to data collection and sharing practices and infrastructure, underutilisation of waste heat potential, and lack of dedicated outreach programs and campaigns.

While these challenges vary in severity and context, addressing them effectively requires targeted policy reforms, improved coordination, and dedicated financial and

technical support. The survey has also revealed that several initiatives have also emerged, including the expansion of district heating support programs, streamlined permitting laws, enhanced training programs, and improved data-sharing frameworks.

The identification of shared regulatory and administrative challenges, as well as the emergence of good practices that can inspire the implementation of similar measures across Alpine region, has shown that a coordinated transalpine approach is essential to accelerating ALPHA regions' decarbonisation efforts.

Following the classification in high-impact and moderate-impact gaps that was developed and elaborated above, this last section will recapitulate the main common challenges that were identified as part of the survey, providing some initial recommendations on possible actions and initiatives that could address or mitigate these gaps.

High-impact gaps and proposed actions

One of the most pressing challenges is the **absence of binding mandates for renewable energy integration in H&C networks**. Without clear legislative requirements, investment in decarbonisation remains uncertain, slowing the transition to cleaner energy sources. This issue can be addressed through the introduction of national and regional targets for renewable H&C, where these are not already in place, backed by financial incentives and regulatory frameworks that prioritise network-based solutions over individual systems.

The **lack of supportive policies for critical infrastructure**, including smart grids, energy storage systems, and low-temperature networks, further undermines efforts to modernise H&C systems. Governments should prioritise infrastructure investments through targeted subsidy programs and regulatory adjustments that encourage the deployment of district heating pipelines, advanced thermal storage, and integrated digital management systems.

Spatial planning and zoning policies remain disconnected from energy strategies, leading to inefficiencies and delays in H&C development. To bridge this gap, spatial

planning authorities should be mandated to incorporate energy infrastructure needs into zoning regulations, ensuring that district heating networks can expand without facing land-use conflicts or excessive bureaucratic hurdles.

In addition to this, **incompatible building regulations** often create obstacles to H&C network expansion by imposing conflicting or outdated requirements on new and existing buildings. Future regulations should be harmonised at national and regional levels to align with energy transition goals, ensuring that new constructions and renovations are compatible with district heating networks rather than prioritising individual heating solutions. Additionally, legal frameworks should be updated to facilitate easier retrofitting of existing buildings to connect to H&C systems.

Inadequate and/or complex financial support schemes constitute another barrier that causes a high level of disruption. The introduction of dedicated grants, tax incentives, and low-interest financing options can accelerate the deployment of advanced H&C infrastructure and drive long-term energy efficiency. Moreover, financial and administrative complexities in funding mechanisms create significant barriers for local governments and smaller municipalities. Simplifying application processes, standardising eligibility criteria, and increasing technical support for funding applications would improve accessibility and encourage broader participation in decarbonisation projects. Additionally, long-term financial stability for renewable heating incentives should be ensured to prevent market uncertainty.

The **shortage of skilled professionals and training programs** in the H&C sector remains a major obstacle to widespread adoption. Strengthening workforce development through **vocational training, certification programs, and partnerships with technical institutions** would ensure that municipalities and utilities have access to the expertise needed to manage modern district heating systems. Governments should also provide financial incentives for upskilling programs and facilitate knowledge exchange between regions with successful workforce development initiatives.

Finally, **public awareness and engagement** in H&C decarbonisation remain insufficient, reducing social acceptance of network-based solutions. Expanding **outreach campaigns, providing clear and accessible information** on the benefits

of district heating, and actively involving local communities in planning decisions would strengthen public support and accelerate adoption. Local and national authorities should allocate dedicated resources to awareness-raising programs and work with community organisations to improve communication and transparency.

Moderate-impact gaps and proposed actions

Fragmented governance structures and policy frameworks create inefficiencies in decision-making, slow project approvals, and lead to regulatory inconsistencies between national, regional, and local levels. To improve governance alignment, intergovernmental coordination mechanisms should be established, such as regional energy councils or working groups that bring together policymakers from different levels of government.

Related to this is the **mismatch between resources and the responsibilities of public authorities** that was identified by many partners. Despite being tasked with overseeing H&C projects, many local and regional authorities lack the necessary financial support, technical expertise, or regulatory power to drive meaningful change. Again, strengthening coordination between different government levels as well as ensuring adequate funding and technical assistance can enhance the effectiveness of public authorities in managing the transition to advanced H&C systems.

Data collection and sharing practices are often inconsistent, limiting the ability to develop effective energy planning strategies. Establishing standardised protocols for data reporting, improving transparency in energy usage statistics, and investing in digital platforms for real-time energy monitoring would enhance planning capabilities and facilitate better-informed policy decisions.

Despite its significant potential, **waste heat recovery** remains underutilised due to regulatory gaps and limited incentives. Introducing mandatory waste heat recovery targets, financial support mechanisms for heat recovery infrastructure, and streamlined regulations for integrating industrial waste heat into district heating networks would unlock new energy efficiency opportunities.

Finally, **permitting processes** often cause project delays due to complex, outdated, or fragmented approval requirements or limited administrative capacity. Smaller municipalities, in particular, struggle with bureaucratic inefficiencies, further prolonging implementation timelines. A simplified and standardised permitting framework should be introduced, ensuring that approvals for H&C projects are processed more quickly, with reduced administrative redundancies and clearer procedural guidelines.