

**Interreg
Europe**

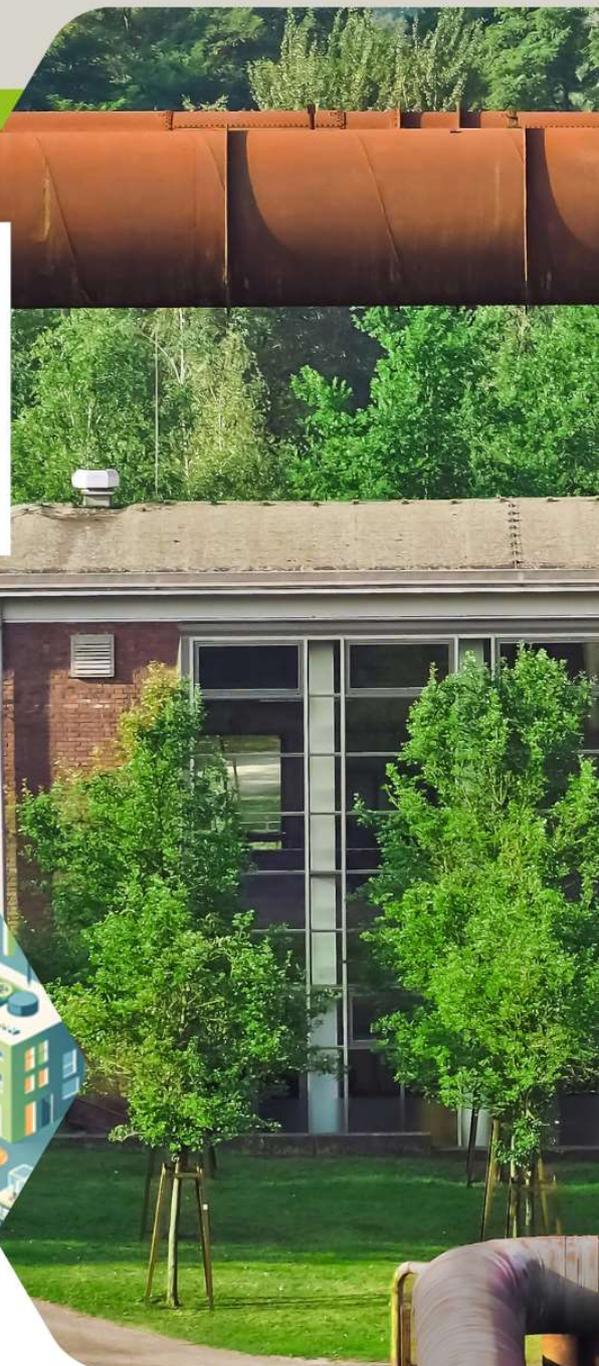


Co-funded by
the European Union

Green4HEAT



VIEŠOJI ĮSTAIGA
**NACIONALINĖ REGIONŲ
PLĒTROS AGENTŪRA**



Report

Activity A 1.1

Mapping the potential for the deployment of heat networks in Green4HEAT territories and assessing opportunities for advancing heat pump and RES integration

March 2025



The Green4HEAT project is co-funded by the European Union through the Interreg Europe 2021-2027 programme.



Table of Contents

Introduction.....	4
Overview of the data collection process.....	5
Presentation and analysis of the territorial input.....	6
Suitable Locations & Barriers to the Deployment of 4GDH.....	6
Best practices for the deployment of 4GDH.....	12
Comparative analysis of barriers and best practices.....	18
Factors that influence the feasibility of 4GDH network deployment.....	18
Factors that inhibit the development of 4GDH networks.....	18
Financial challenges.....	18
Regulatory challenges.....	19
Public opinion challenges.....	19
Best Practices.....	20
Policy recommendations and strategic proposals.....	21
Policy recommendations.....	22
Financial and investment mechanisms.....	23
Conclusion and next steps.....	25



Introduction

Within the implementation of the Green4HEAT project, Activity A1.1 aims to enhance partners' capacity to support the development of 4th Generation District Heating (4GDH) networks, including the integration of renewable energy sources (RES) and heat pumps to renovate and upgrade existing district heating (DH) systems. The National Regions Development Agency (NRDA) developed tailored research and identification tools to help partners identify areas with high potential for 4GDH networks and barriers inhibiting relevant infrastructure projects. Partners also used these tools to report effective policy practices addressing economic, regulatory, and social barriers, promoting the establishment of RES-based DH networks.

The present report summarises partners' findings along with the outcomes of the online workshop on collected policies and presents fit-for-purpose policy recommendations to enhance the territorial frameworks and financing mechanisms for 4GDH networks. Leveraging these recommendations, Green4HEAT partners can advocate for policy measures addressing social, economic, and administrative bottlenecks in planning and implementing 4GDH systems in their regions.

Overview of the data collection process

The section sets the stage for the subsequent analysis and recommendations. It summarises the data collection process, along with a comprehensive presentation of the online workshop.

To streamline the overall process of territorial data collection, NRDA prepared an online form and comprehensive guidelines, ensuring consistent, comparable, and well-structured documentation of all results. The online form was divided into three parts, each focusing on a key objective of the activity:

- ▶ Part1 - Identification of location for the establishment of 4th generation RES-based heat networks: Partners provided information on suitable areas in their territories for low-temperature heat networks, along with evidence-based justification on their suitability.
- ▶ Part 2 – Barriers' identification: Partners identified key economic, regulatory, and social barriers in their territories that hinder the establishment and expansion of 4GDH networks.
- ▶ Part 3 - Best practices identification: Partners described and assessed the impact and transferability potential of policy practices that have tackled the barriers identified in Part 2.

Before completing the online forms, partners were advised to conduct desk research as well as collect direct feedback from relevant regional stakeholders, such as local authorities and industry actors.

For the third part of the online form, in line with the activity's objectives, the identified good practices should concern policy measures or actions embedded within a policy instrument that have demonstrably succeeded in overcoming barriers to heat network deployment within a particular territory.

Moreover, minimum targets were set regarding partners' input. Each partner was requested to identify:

- at least one location that is suitable for the establishment 4GDH networks within its area of responsibility,
- at least two barriers, regardless of the barrier nature (economic, regulatory or social), and
- at least one best practice.

Once the phase of the territorial evidence gathering was completed, NRDA organised an online workshop for partners to discuss the main findings and collected good practices. The aim was to jointly develop and propose tangible policy measures to facilitate the establishment of heat networks in their territories.

Each partner delivered a concise, purpose-driven presentation of the identified suitable location for the development of low-temperature RES-based DH networks and the best practice(s) they had submitted during the online data collection process. The focus was on outlining effective measure(s) that advanced low-temperature district heating (DH) deployment, and emphasising the replicable element(s) that, if transferred and implemented in other project territories, could support public authorities in advancing DH deployment there as well. Following each presentation, the rest of the partners were invited to complete an online evaluation form to assess each best practice's effectiveness in accelerating the expansion of DH networks and the level of its transferability and replicability in other territories.

Presentation and analysis of the territorial input

This section presents the territorial input collected per Green4HEAT country via the online tool. The first part presents the locations identified as suitable for the establishment of 4th generation RES-based heat networks, along with a summary of the main barriers that inhibit the construction or expansion of such an infrastructure project. The second part provides summaries of the collected best practices, including the evaluation provided by the partner that submitted each practice.

Suitable Locations & Barriers to the Deployment of 4GDH

GR1 Anthia – Aristino, Alexandroupoli, Greece

Population density: Low (suburb area)

Land use patterns: Residential zone

Available RES: Geothermal

Brief description: The area of Anthia-Aristino, located near Alexandroupolis in Northern Greece, covers a region with significant potential for geothermal energy exploitation due to it's a) abundant low enthalpy geothermal resources, b) high local demand for heating in agricultural greenhouses and public buildings, c) proximity to end users minimising transmission losses. The existing heat network spans approximately 13 km, primarily supplying greenhouses and municipal buildings. Plans for an expansion of 7–10 km, would enable the heating of additional residential, municipal, and agricultural facilities.

Key barriers:

- Limited availability of funding sources
- Complex permitting processes

GR2 Thessaloniki, Greece

Population density: High (highly urbanised area)

Land use patterns: Residential zone Commercial zone Industrial zone

Available RES: Geothermal Solar Waste heat

Brief description: Thessaloniki spans approximately 1,455 square km, with the urban area covering around 111 square km. It is particularly suitable because of it's a) urban density, b) renewable energy potential (low-enthalpy

geothermal fields, solar thermal energy and potential waste heat resources in the industrial zone of Sindos).

Key barriers:

- Difficulty in securing long-term financing
- Complex permitting processes, lacking coordination between different departments, agencies, and government bodies
- Lack of communication by local authorities of the environmental advantages of low temperature heat networks compared to individual heating solutions

BE1 Klina (Klinieken Noord Antwerpen) hospital in Brasschaat, Belgium

Population density: High (highly urbanised area)

Land use patterns: Residential zone Commercial zone

Available RES: Geothermal

Brief description: The hospital in Brasschaat, Belgium, utilises an Aquifer Thermal Energy Storage (ATES)¹ system combined with reversible water/water heat pumps for its heating and cooling needs. In line with the planned expansion of the hospital’s facilities, the introduction of second ATES to the existing DH network is planned.

Key barriers:

- Lack of financial incentives or subsidies
- Inadequate regulatory support for renewable integration in existing DH
- Restrictive zoning laws

BE2 Municipality of Schoten, Belgium

Population density: High (highly urbanised area)

Land use patterns: Industrial zone

Available RES: Aquathermal

¹ In an aquifer thermal energy storage (ATES), excess heat is stored in subsurface aquifers in order to recover the heat at a later stage. The thermal energy is stored as warm groundwater. The groundwater is also used as a carrier to transport the heat to and from the subsurface. Hence, the thermal energy is stored and recovered via the production and injection of groundwater from an aquifer through wells. The capacities of ATES systems range from 0.33 MW to 20 MW. ([nextGen, 2020](#))

Brief description: The aquathermal energy, which is low-grade heat source, from the canal of Dessel Schoten Turnhout to integrate to the Municipality's existing DH network.

- Key barriers:**
- Limited financing sources for aquathermal projects
 - Lack of standardised permitting processes for aquathermal energy
 - Lack of understanding of modern district heating technologies and their requirements

LV1 Ape Town, Smiltene Municipality, Latvia

Population density: Moderate (mix of residential area, commercial districts, and greenspaces)

Land use patterns: Commercial zone

Available RES: Biomass

Brief description: In the town of Ape a small-scale centralised heating system using biomass for heat supply has been established, which provides heat to some municipal buildings and individual apartment buildings.

- Key barriers:**
- Incompatible buildings (i.e., non-energy efficient) for connecting to a low temperature heating system.
 - Lack of funding for the construction of new DH systems.
 - Lack of coordination between different government bodies

LV2 The Nākotnes Street apartment building district in Gulbene Municipality, Latvia

Population density: Moderate (mix of residential area, commercial districts, and greenspaces)

Land use patterns: Residential zone

Available RES: Solar Woodchips

Brief description: In Gulbene city a residential complex of 9 multi-apartment buildings and preschool educational institution comprise a small-scale DH system. The system utilises a solar collector system constructed within the premises of the educational institution to heat the water that circulated in the DH pipelines. Currently 3 residential buildings have been

renovated, including wall insulation, and renovation work is planned for another 2 buildings to enhance the DH system's efficiency.

- Key barriers:**
- Limited funding for building renovations to become energy efficient as needed for being connected to low temperature DH systems.

PL1 City of Szczecin, West Pomeranian Voivodeship, Poland

Population density: Moderate (mix of residential area, commercial districts, and greenspaces)

Land use patterns: Residential zone Commercial zone Industrial zone

Available RES: Biomass Geothermal Solar Waste heat

Brief description: The existing 3GDH system in Szczecin utilises a combination of traditional and renewable energy sources (biomass, waste heat). Upgrading the existing infrastructure along with the integration of solar and geothermal energy sources make Szczecin a promising location for 4GDH deployment.

- Key barriers:**
- Uncertain return on investment of private DH operators and managers to proceed with the DH network modernisation
 - Lack of standardised regulations
 - Citizens' concerns about higher installation and operational costs

ES1 Valladolid heat network, Spain

Population density: Moderate (mix of residential area, commercial districts, and greenspaces)

Land use patterns: Residential zone Commercial zone

Available RES: Biomass Solar

Brief description: Valladolid's current heat network covers three out of its six districts. The Junta de Castilla y León plans to build a 49 MW biomass heat network 25 km long that will supply 30.000 residents of Villa de Prado, Parquesol and Huerta del Rey. A self-consumption photovoltaic solar installation and a 6.000 cubic meter sensible heat storage system will also be built to accumulate renewable thermal energy at night.

- Key barriers:
- High initial capital investment
 - NIMBY² effect regarding the siting of the biomass plant

HU1 Lenti town, Hungary

Population density: Moderate (mix of residential area, commercial districts, and greenspaces)

Land use patterns: Residential zone

Available RES: Biomass Geothermal Solar

Brief description: A geothermal cascading system has been built in 2023, covering 100% of the heating demand of the town's public institutions. The network is 3km's long, and there is one production and one reinjection well. The production temperature is 70 celsius degrees. The network has been designed in a way as to be able to expand later and connect residential and commercial consumers also. So, there is an excellent potential and possibility to establish a low temperature heat network.

- Key barriers:
- The existing geothermal DH network is not allowed to be expanded to residential consumers for 10 years due to earlier project funding conditions.

LT1 Residential area in western part of Rokiskis city, Lithuania

Population density: Moderate (mix of residential area, commercial districts, and greenspaces)

Land use patterns: Residential zone

Available RES: Biomass Solar Waste heat

Brief description: The residential area in western part of the city is a large-scale construction project, making it suitable for 4GDH network deployment: a) new energy efficient buildings, b) employment of heat zoning

² NIMBY: a person who objects to the siting of something perceived as unpleasant or hazardous in the area where they live, especially while raising no such objections to similar developments elsewhere.

systems³ in new buildings, and c) wastewater treatment plant in the vicinity to provide waste heat to the network.

Key barriers:

- Lack of financial incentives or subsidies
- Lack of regulatory framework for implementing low temperature DH networks
- Lack of trust to utility providers

LT2 Launagai neighbourhood, Vilnius, Lithuania

Population density: Moderate (mix of residential area, commercial districts, and greenspaces)

Land use patterns: Residential zone Commercial zone

Available RES: Biomass Solar Waste heat

Brief description: Launagai is a large real estate project in the city of Vilnius, designed and implemented (2026-2036) by Darnu Group. The project's comprehensive urban vision includes the construction of approximately 302,000 square meters of residential space (approximately 5,500 dwellings) and 80,700 square meters of commercial and public facilities over the course of 10 years. Vilnius DH operator "Vilniaus šilumos tinklai" has piloted low-temperature DH network segments, positioning this site as a promising candidate for advanced DH systems.

Key barriers:

- Difficulty in securing long-term financing
- Complex permitting processes for the installation of DH pipes in private owned plots
- Residents' concerns about cost, transparency, and flexibility of 4GDH

³ Zoning divides the house into areas with similar heating and cooling requirements. Homeowners can achieve improved comfort by controlling each zone with its own thermostat.

SI1 Ovčje staje district, Postojna, Slovenia

Population density: High (highly urbanised area)

Land use patterns: Residential zone

Available RES: Biomass

Brief description: The Ovčje Staje district (24,000 m²) in Postojna, Slovenia, is part of the municipality's efforts to develop sustainable and efficient district heating systems.

Key barriers:

- Lack of financial incentives or subsidies
- Complex permitting processes
- Inadequate zoning⁴ flexibility limits the placement of heating plants and pipeline networks
- Concerns about higher installation and operational costs

Best practices for the deployment of 4GDH

GR1 Municipality of Alexandroupolis

Location: Alexandroupolis – Antheia - Trianoupolis

Implementing entity: Municipality of Alexandroupolis

Scope level: City

Link: <https://celsiuscity.eu/a-pioneering-project-for-sustainableenergy-in-greece/>

Brief description: The project, co-financed by the ERDF and municipal resources, includes the development of a geothermal district heating network that will provide heat for municipal buildings, social housing and greenhouses with a total thermal power estimated at 10 MW. The project will harness the Antheia-Aristino low-enthalpy geothermal field near the city of Alexandroupolis.

Evaluation: Effectiveness 4 Cost-efficiency 4

⁴ Heat network zoning: designating geographic zones where heat networks are expected to be the lowest cost solution for decarbonising heat, it will give local communities the tools to accelerate the development of heat networks and ensure that more homes and businesses can have access to greener, cheaper heat.

Feasibility - Administrative	5	Replicability	4
Feasibility - Financial	3		

BE1 Heat zoning maps

Location:	Province of Antwerp		
Implementing entity:	Regional and local governments		
Scope level:	Regional		
Link:	-		
Brief description:	Together with the distribution system operator Fluvius, the Province of Antwerp prepared new heat zoning maps for the province, determining which DH technology works best in different land-use combinations. The maps are blueprints for future heating policies, making it possible to zoom in on certain parts of the city, and develop sustainable heating alternatives tailored to each area.		
Evaluation:	Effectiveness	3	Cost-efficiency -
	Feasibility - Administrative	-	Replicability 4
	Feasibility - Financial	-	

LV1 Kindergarten “Pienenīte” low-temperature district heating

Location:	Alūksne city, Latvia		
Implementing entity:	Municipality, district heating company, and Vidzeme Planning Region		
Scope level:	City		
Link:	https://www.lowtemp.eu/examples/kindergarten-pienenite-exploring-low-temperature-district-heating-possibilities/		
Brief description:	Within the LowTEMP Interreg Baltic Sea project, the kindergarten pilot project involves installing sensors to monitor temperature, humidity, and CO2 levels in classrooms and the sports hall, providing valuable data for optimising the building's energy use.		

Evaluation:	Effectiveness	3	Cost-efficiency	4
	Feasibility - Administrative	4	Replicability	5
	Feasibility - Financial	4		

LV2 Belava village low temperature district heating

Location: Beļava village, Gulbene Municipality, Latvia

Implementing entity: Gulbene Municipality

Scope level: National

Link: <https://www.gulbene.lv/lv/jaunums/belava-izmegina-zemas-temperaturas-centralizetas-siltumapgades-sistemas-tehnologijas>

Brief description: A smart and future-oriented 4th generation heating was tested in the village of Beļavas, Gulbene municipality, nominating the Gulbene municipality as one of the low-temperature heating supply pioneer projects within the framework of the "LowTEMP" project.

Evaluation:	Effectiveness	2	Cost-efficiency	3
	Feasibility - Administrative	4	Replicability	5
	Feasibility - Financial	4		

PL1 City of Szczecin district heating system

Location: City of Szczecin, Poland

Implementing entity: Szczecińska Energetyka Ciepła sp. z o.o.

Scope level: City

Link: <https://sec.com.pl/projekt-sec/lasztownia/>

Brief description: An innovative 5GDH system based on the Swedish Medicon Village model is operated by Szczecińska Energetyka Ciepła in the city of Szczecin. The Jerzy Stelmach Marine Science Centre is being heated using waste heat.

Evaluation:	Effectiveness	4	Cost-efficiency	2
	Feasibility - Administrative	4	Replicability	
	Feasibility - Financial	5		

ES1 Valladolid heat network

Location: Valladolid, Spain

Implementing entity: Somacyl

Scope level: City

Link: <https://somacyl.es/wp-content/uploads/2023/09/Informacion-General-Red-de-Calor-Valladolid-Oeste-20220720-120539.pdf>

Brief description: This network uses biomass as its primary energy source and currently provides heat to 3 out of the six districts of Valladolid. SOMACYL (the Public Society of Infrastructures and Environment of Castilla y León) worked closely with the Valladolid municipality to streamline administrative processes and secure necessary permits.

Evaluation:	Effectiveness	5	Cost-efficiency	5
	Feasibility - Administrative	5	Replicability	4
	Feasibility - Financial	5		

HU1 Expansion DH network in Lenti, Hungary

Location: Town of Lenti

Implementing entity: Municipality of Lenti

Scope level: City

Link: <http://www.geoterm.lenti.hu/projektadatok/oldal/1>

Brief description: The DH system employs a cascading use approach, where geothermal energy is used at different temperature levels for various applications, maximizing efficiency.

Evaluation:	Effectiveness	3	Cost-efficiency	3
	Feasibility - Administrative	-	Replicability	-
	Feasibility - Financial	-		

LT1 National Energy Independence Strategy

Location:	Lithuania			
Implementing entity:	Ministry of Energy			
Scope level:	National			
Link:	https://www.ena.lt/nn2-nens/			
Brief description:	The Strategy supports the concept of prosumers for biomass and wind energy, integrating the energy produced in district heating and household heating.			
Evaluation:	Effectiveness	1	Cost-efficiency	1
	Feasibility - Administrative	1	Replicability	1
	Feasibility - Financial	1		

LT2 Pilots of low temperature DH extension in Vilnius

Location:	Vilnius, Lithuania			
Implementing entity:	AB Vilniaus šilumos tinklai			
Scope level:	City			
Link:	https://chc.lt/zemos-temperaturos-tinklai/			
Brief description:	Vilniaus šilumos tinklai (VŠT) tested low-temperature district heating (DH) during the 2024 heating season by reducing the supply water temperature to 65°C in part of the Žirmūnai network. For a week, a mobile boiler plant supplied 17 buildings with lower-temperature water, while the rest of the network operated normally. VŠT monitored system			

performance, evaluating heat loss reductions, equipment adaptability, and maintained thermal parameters.

Evaluation:	Effectiveness	2	Cost-efficiency	-
	Feasibility - Administrative	-	Replicability	-
	Feasibility - Financial	-		

SI1 Energy renovation in the municipality of Postojna

Location: Municipality of Postojna

Implementing entity: Municipality of Postojna

Scope level: City

Link: <https://www.postojna.si/objava/142374>

Brief description: The initiative, valued at €3.5 million, is primarily funded through a public-private partnership between the Municipality of Postojna and the company Petrol. It involves the complete energy overhaul of several public buildings to enhance their efficiency and reduce energy consumption.

Evaluation:	Effectiveness	3	Cost-efficiency	3
	Feasibility - Administrative	3	Replicability	3
	Feasibility - Financial	3		

Comparative analysis of barriers and best practices

This section identifies the most pressing challenges affecting the deployment of modern heat networks across project territories, utilising the input from partners presented in the previous section. Additionally, it examines common characteristics emerging from territories identified as suitable for DH deployment. Lastly, leveraging insights from the collected best practices, the section outlines policy approaches and measures that can be transferred, adopted, and revised in different territorial contexts to advance low-temperature DH deployment.

Factors that influence the feasibility of 4GDH network deployment

Based on the characteristics of identified suitable locations for the deployment of 4GDH networks, **urban areas with a mix of residential and commercial districts** offer the highest potential. In three-quarters (75%) of these locations, the areas are primarily residential, resulting in high demand for sustainable heating supply. Additionally, the presence of commercial buildings or districts in these areas generates additional demand for heating, while also providing sources of low-grade waste heat that can be utilised by modern low-temperature DH networks (i.e., 4GDH). **Integrating waste heat from commercial buildings** helps balance heat loads within the network, ensuring a stable and reliable heat supply. Moreover, the proximity of consumers reduces the distance heat needs to travel, minimising heat losses and infrastructure costs. However, it's worth noting that in only 25% of the identified areas, partners indicated the potential for waste heat recovery from commercial buildings or industrial sites as an additional heat source for the DH network.

Furthermore, the **availability of different renewable energy sources** (RES) is a key parameter for the viability of potential DH networks. Over half (58%) of the identified suitable locations are characterised by the local availability of various RES, with solar and biomass being the main sources. These RES when integrated into the DH network enhance its efficiency and ensure that the thermal energy provided meets the demand of connected consumers.

Factors that inhibit the development of 4GDH networks

Financial challenges

According to 83% of respondents, the **high initial capital investment** required for setting up low-temperature and RES-based DH networks is a major barrier. Over half of the project territories report limited financial incentives or subsidies for constructing new 4GDH networks or upgrading existing high and medium temperature DH systems to low-temperature ones. Even in regions with available funding, such as Flanders, **strict criteria and high competition make access to funding difficult**. The high initial investment cost, coupled with **uncertainty about the long-term return on investment**, also discourages private investors. For example, in Belgium (ANTWERP), the expansion

of the small DH network in the Municipality of Schoten, which utilises aquathermal energy from the canal of Dessel Schoten Turnhout, has not yet progressed. The application of aquathermal energy in DH networks is currently limited in the country and mostly confined to the research community, requiring innovation or research funds for further expansion of the network.

Regulatory challenges

In addition to financial barriers, regulatory challenges also inhibit the establishment and expansion of 4GDH networks. Over half of the respondents highlighted the **lack of coordination among various government bodies** involved in constructing new 4GDH networks, such as planning, permitting, and monitoring, as a key barrier. For example, the University of Patras from Greece pointed out that fragmented responsibilities across municipal, regional, and national agencies lead to delays and inefficiencies. Aligning local heating demand with national renewable energy policies requires better interagency collaboration, which is currently insufficient. Moreover, **complex permit granting processes**, including geothermal resource exploitation, environmental impact assessments, land use approvals, and construction permits, involve navigating multiple administrative layers, causing delays and increasing project costs. In many Green4HEAT territories, there is not a unified framework tailored to modern, low-temperature DH systems, making it difficult to integrate renewable energy sources like solar thermal or geothermal efficiently. **Ambiguity in the rules** can lead to inconsistencies in project execution and increase risks for developers. For example, inadequate zoning flexibility limits the placement of heating plants and pipeline networks, particularly near potential energy sources like forests for biomass or industrial waste heat facilities.

Public opinion challenges

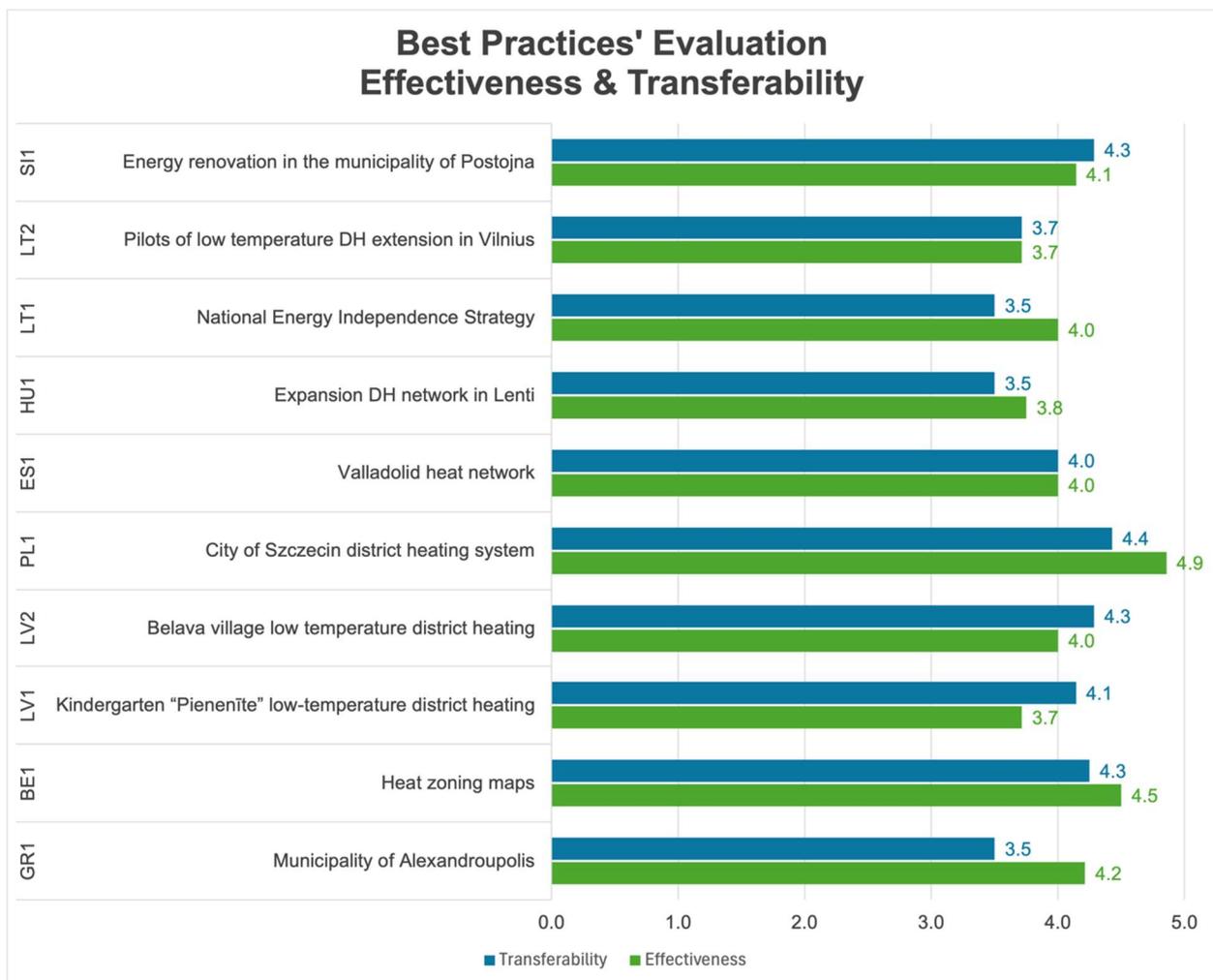
Public opinion about DH and the transition to RES-based heating systems is another crucial factor. The viability of planned DH networks depends on integrating a sufficient number of buildings into the network. Data indicates that **citizens in Green4HEAT territories are moderately supportive** of such investments. However, in 83% of territories, the public has significant **concerns about the high installation and operational costs** of 4GDH systems compared to existing individual heating solutions. Additionally, in 67% of cases, citizens are **not well aware of the environmental advantages of low-temperature DH**, resulting in scepticism and a tendency to stick to the status quo. The high upfront investment costs for 4GDH systems and the installation of low-temperature heat pumps in connected buildings further explain why homeowners and commercial property owners are reluctant to transition.

Effective outreach and communication efforts by municipalities are crucial for advancing public understanding of 4GDH systems and their benefits. Most respondents acknowledged that local municipalities' strategies for informing and engaging the community about the benefits of 4GDH networks are moderately to highly ineffective. Low levels of citizen involvement in the design and operation of heat networks further enhance scepticism about the planned networks.

Policy recommendations and strategic proposals

This section presents partners' evaluations of the collected best practices, focusing first on their effectiveness in accelerating the expansion of (4G)DH networks, and second, on their transferability and replicability in other territories. Combining these key points with insights from the previous section, it outlines targeted policy recommendations to enhance territorial regulatory and administrative frameworks, along with financial and investment strategies that could encourage the deployment of 4GDH networks.

Based on the partners' evaluation during the online session, the **case study of Szczecin's district heating system in Poland** stands out as both the most effective practice and the one with the highest level of transferability. The assessment highlights the importance of thorough and long-term planning to ensure the efficient operation of the DH system. It also underscores the significance of interconnected buildings, connecting commercial properties and residential buildings with varying heating and cooling needs. This DH design approach enables the circulation, sharing, and reuse of energy between buildings with different energy profiles.



The **heat zoning maps implemented by the Province of Antwerp** were also assessed as both highly effective and cost-efficient in the long term. By identifying areas with high heating demand, these maps help public authorities prioritise regions where 4GDH networks can have the most significant impact with minimal heat loss and optimised resource use, guiding infrastructure investments accordingly.

Similarly, the **initiative by the Municipality of Postojna to renovate several public buildings** to enhance their efficiency and reduce energy consumption is a moderately cost-effective measure with significant effectiveness. By lowering peak heating demands, energy-efficient buildings help balance the load on 4GDH networks. This makes it easier for DH networks to meet their needs with lower energy input, thus enhancing the overall efficiency of the 4GDH network.

Policy recommendations

Holistic modernisation initiatives: Partners should advocate for the modernisation of district energy networks and building stock to optimise performance and facilitate the transition from medium temperature to low-temperature DH systems. It is important to ensure the upgrading of both building envelopes and apartment interiors, including the installation of smart metering systems, efficient radiators, and heat pumps where necessary.

Comprehensive communication strategy: Public authorities can increase public awareness for low-temperature RES-based DH systems by developing a comprehensive communication strategy that leverages diverse media and platforms. It is important for messages to be tailored to different target audiences (e.g., building owners, renters, commercial building owners, potential waste heat suppliers, etc.), clearly outlining the short- and long-term financial, environmental, and social benefits of investing in 4GDH renovations.

Heat zone mapping: Government bodies responsible for DH planning and/or infrastructure constructions and maintenance should prioritise the development of heat zones maps. By understanding the heat demand and supply in different zones, planners can design the infrastructure more effectively. This includes determining the optimal locations for heat production units, storage facilities, and distribution networks. In addition, heat zone maps enable better financial planning by highlighting areas where investments in 4GDH systems will yield the highest returns, helping prioritise projects and allocate funds more efficiently.

Scalable infrastructure planning: Responsible government bodies for the renovation of existing medium temperature DH networks, as well as those overseeing infrastructure construction and maintenance, should prioritise the incorporation of modular designs in the planning of new and upgraded networks. A modular approach to designing DH networks allows for future expandability, ensuring that networks can be easily scaled up or modified to meet evolving social, economic, and technological demands.

Data-driven planning: Government bodies overseeing the planning of DH systems are encouraged to utilise advanced data analytics and modelling tools to enhance the accuracy and efficiency of infrastructure planning. By analysing current and projected heat demand, demographic trends, and

technological advancements, planners can make informed decisions that align with long-term objectives.

Regulatory harmonisation: Partners should push for regulatory amendments that create a unified framework tailored to 4th Generation District Heating (4GDH) systems. This framework should address pre-planning, spatial planning integration, permitting, grid connection, building renovations, and the integration of buildings with different uses (commercial, residential, industrial). Harmonisation should not only concern responsibilities of different ministries and services, but also local, regional, and national regulations to reduce administrative barriers in multiple levels.

Streamlined permitting processes: Partners should advocate for simplification of the permit granting processes for geothermal resource exploitation, environmental impact assessments, and land use approvals. One-stop-shop services to centralise and expedite permits can be effective in the first phase of 4GDH deployment and the renovation/upgrade of existing medium temperature DH networks and the renovation of connected buildings.

Tariffs based on long-term marginal costs: The tariff system needs to also be adapted to the specificities of 4GDH. Implementing tariff policies based on the long-term costs of future renewable energy systems, ensure provision of price signals that support the synchronisation of supply and demand systems and the transition to RES-based DH systems.

Innovative business models: Partners should support the adoption of innovative business models in the DH sector to facilitate its modernisation. Embracing approaches like Heat-as-a-Service (HaaS), performance-based contracts, and dynamic pricing can optimise operations and cost-effectiveness while ensuring customer comfort. Flexible subscription plans and energy savings sharing models can provide predictable heating costs and incentivise energy efficiency. Expanding offerings to include integrated energy services simplifies customer management and creates cross-service efficiencies. Community-based heating models enhance engagement, collaboration, and cost reduction, promoting sustainable energy use and a customer-centric approach to district heating.

Demonstration projects: Regional and national authorities can benefit from implementing pilot projects and demonstration sites to showcase the practical benefits of 4GDH networks. Highlighting successful case studies and sharing lessons learned with the broader public can help build support and confidence in the technology.

Financial and investment mechanisms

Public-Private Partnerships: Government bodies and regional authorities should encourage the formation of public-private partnerships (PPPs) to share financial risks and leverage expertise from both sectors. PPAs can facilitate the successful deployment of 4GDH projects, which have a high initial investment cost, by pooling resources and knowledge.

Subsidy Schemes: Government bodies and regional authorities should implement subsidy schemes to incentivise the adoption of renewable energy technologies in district heating systems. For example, prioritise funding for feasibility studies, planning, and initial investments to lower entry barriers for new



projects. Subsidies can also help bridge the gap between traditional heating methods and sustainable alternatives, making the transition more financially viable for stakeholders.

Empowering Local Authorities: National governments are advised to provide financial support (e.g., dedicated funds or grants) to sub-national governments (regional and local), enabling them to implement and manage district heating projects effectively. Local authorities play a crucial role in the successful deployment of 4GDH systems, as they are closest to the communities they serve. Empowering them with the necessary resources and autonomy can lead to more tailored and impactful solutions which are also widely accepted by the local communities.

Conclusion and next steps

The last section summarises the key takeaways from the policy study and reflects on how these funding's will contribute to the broader policymaking efforts within the Green4HEAT project.

Activity A1.1 of the Green4HEAT project has pointed out the critical financial, regulatory, and social challenges that inhibit the deployment of low-temperature RES-based DH networks in the partnership territories. The significant initial capital investment required for 4GDH systems poses a major barrier, while limited financial incentives and subsidies further exacerbate the problem, discouraging private investment due to uncertainties about long-term returns. Additionally, although public funding is available in some regions, strict criteria and high competition make access difficult.

Regulatory challenges further impede 4GDH network development. More than half of the respondents highlighted the lack of coordination among government bodies as a significant barrier, leading to delays and inefficiencies. Complex permitting processes and the absence of a unified framework tailored to low-temperature DH systems further complicate project execution. Moreover, ambiguity in regulations can lead to inconsistencies and increased risks for developers, hindering the integration of RES such as solar and geothermal.

Public opinion also emerged as another critical factor affecting the viability of 4GDH networks. While citizens in Green4HEAT territories show moderate support to RES-based DH systems, concerns about high installation and operational costs persist. Additionally, a lack of awareness about the environmental benefits of low-temperature DH contributes to scepticism.

To address these challenges, a coordinated policy approach is essential for the deployment of 4GDH systems. Government bodies overseeing planning, construction, upgrading, and maintenance of DH networks (and broader infrastructure projects) should focus on planning and securing funding. The activity's survey highlighted key factors influencing the feasibility of 4GDH network deployment and the identification of suitable locations for DH construction. Urban areas combining residential and commercial districts offer the highest potential. Integrating waste heat from commercial buildings balances heat loads, ensuring a stable supply while minimising heat loss and infrastructure costs. The availability of RES, like solar and biomass, is vital, with 58% of identified locations featuring local RES, enhancing efficiency and meeting consumer demand. Regulatory improvements, state financing initiatives, simplified planning processes, and pilot projects can also provide valuable insights for large-scale deployment.

Overall, the findings from Activity A1.1 of the Green4HEAT project play a crucial role in shaping broader policymaking efforts. By identifying the financial, regulatory, and social challenges inhibiting the deployment of low-temperature RES-based DH networks, this activity provides a clear roadmap for targeted policy interventions. These insights highlight the need for coordinated policy approaches, financial incentives, regulatory improvements, and public awareness campaigns. Addressing these barriers can accelerate the deployment of 4GDH systems, improve territorial heat planning, establish thermal energy communities, and attract investments in green heating and cooling technologies.



In essence, these findings inform and drive the strategic actions necessary to achieve the Green4HEAT project's objectives.