

REDI4HEAT

Deliverable 2.2

Local initiatives for heat decarbonization

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Date: 30/01/2024

Grant agreement No: LIFE27101077369

Project start date: 1st October 2022

Duration: 36 months

Deliverable	
Work Package	Work Package 2: Assessment of NECPs and current initiatives on RES-HC
Task	T.2.1 Assessment of NCEPs and RHC support mechanisms T.2.2 Identification of main barriers and opportunities
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Due date of deliverable	31/12/2023
Actual submission date	30/01/2024
Dissemination Level	PU
Type	Report
Number of Pages	47

Version	Date	Description	Contributors
0.1	01/12/2023	First draft circulated to partners	Selma Guyon (Energy Cities) Mélanie Bourgeois (Energy Cities) Saverio Papa (SHE), Leopoldo Mico (SHE)
0.2	22/01/2024	Final version with partners contributions	Selma Guyon (Energy Cities), Mélanie Bourgeois (Energy Cities), Malena Eder (DENA), Marek Tobiacelli (KAPE), Sílvia Remédios (ADENE), Joana Fernandes (ADENE), Rosie Christodoulaki (CRES), Saverio Papa (SHE)
1.0	30/01/2024	Submitted version	

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This project has received funding from the European Union's European Union's LIFE Clean Energy Transition LIFE-2021-CET-POLICY Programme under Grant Agreement No. LIFE27 101077369 (REDI4HEAT).

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BIO: Bioenergy Europe

CRES: Centre for Renewable Energy Sources and Saving Foundation

DENA: Deutsche Energie-Agentur GmbH

EGEC: European Geothermal Energy Council

EHP: Euroheat & Power

EHPA: European Heat Pump Association

EIHP: Energetski Institut Hrvoje Pozar

SHE: Solar Heat Europe / European Solar Thermal Industry Federation

ENC: Energy Cities

KAPE: Krajowa Agencja Poszanowania Energii Spolka Akcyjna

TRI: Trinomics BV



ABBREVIATION AND ACRONYMS

CHP: Combined Heat and Power

EED: Energy Efficiency Directive

KEA-BW: Baden Württemberg Energy and Climate Protection Agency

NECP: National Energy and Climate Plan

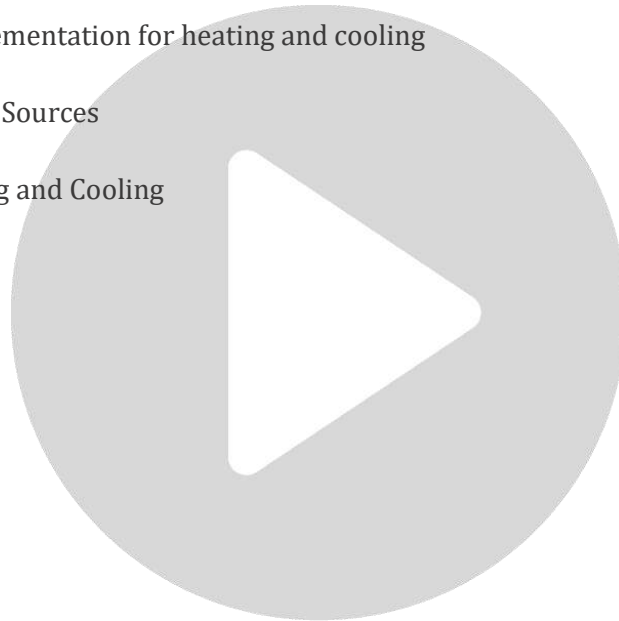
NZEB: Nearly zero-emission building

SECAP: Sustainable Energy and Climate Action Plan

REDI4HEAT: RED implementation for heating and cooling

RES: Renewable Energy Sources

RHC: Renewable Heating and Cooling



ABSTRACT

More than 70% of Europe's population lives in cities. Local authorities therefore have a key role to play in decarbonising buildings, which account for 40% of Europe's energy consumption. This report focuses on the local dimension of decarbonising heating as part of the European LIFE-REDI4HEAT project, and in particular on local planning for heating and cooling.

The analysis of 5 case studies, local plans and national frameworks shows how key this local planning is, but also that its potential is not sufficiently used in most EU countries. The report highlights some good practices in Poznan (Poland), Valencia (Spain), Baden-Württemberg (Germany), Rotterdam (The Netherlands) and Vienna (Austria) that can inspire other regions and cities; and proposes several key factors to enable the decarbonisation of heating and cooling, including: a good legal framework, technical and financial support for local authorities, key skills in local public administrations, and access to high-quality energy databases.

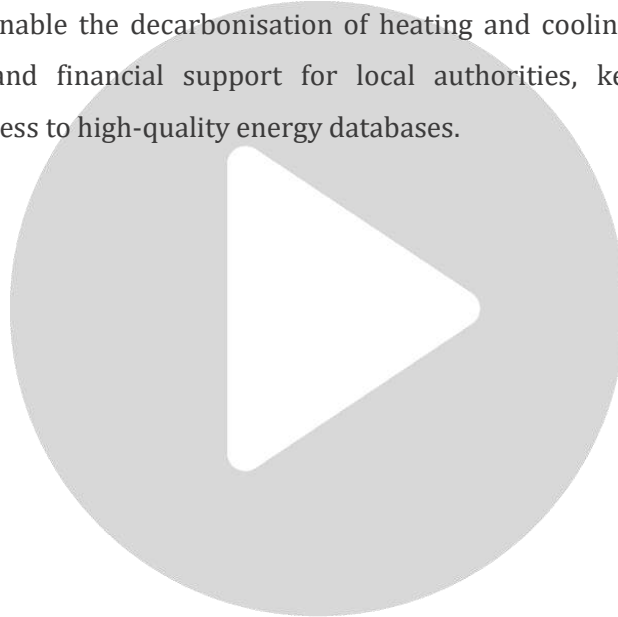


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1. Introduction

Heating and cooling planning is an essential means of decarbonising the built environment. These numbers have been shared so often that they are no longer a surprise: buildings represent around 40% of energy consumption in the European Union¹. In addition, 80% of the existing building stock will still be there in 2050. To reach our GHG emissions reduction ambitions in the building sector, heat decarbonisation must be tackled, and it must be done at the national as well as the local level. Indeed, heat planning builds a bridge between urban and energy planning, both of which are key to decarbonisation.

This deliverable focuses on local initiatives for heat decarbonisation. Local governments are key actors in the heating and cooling decarbonisation as they know best the local context and can involve various stakeholders such as energy utilities, businesses, and citizens, in the process. Renewable energy sources such as solar thermal, geothermal, bioenergy, waste heat and related technologies such as heat pumps or district heating networks can be best managed at the local level. Municipalities are in the right position to develop such alternatives when they have the appropriate skills and financial and technical support.

This has been acknowledged by the recently adopted Energy Efficiency Directive (EED); article 25.6 requires Member States to ensure that local authorities above 45,000 inhabitants draft local heating and cooling planning, and to support financially and technically the municipalities to do so. Such planning enables municipalities to assess the existing energy demands, and the potential Renewable Energy Sources (RES) supply to plan a scenario for the decarbonisation of heating and cooling in the municipal area. It also eases the implementation of their decarbonisation strategy, keeping track of energy facilities, utilities, and sources. Local heat and cooling planning can also be used in a very efficient way to share the costs of the energy transition among stakeholders, and thus tackle energy poverty issues. These local strategies should be guided by a national or regional framework and supported by national programs for their implementation. It is therefore essential to study the alignment between the local and national levels on these issues.

¹ <https://www.localstaff4climate.eu/the-study/>

Therefore, this deliverable looks at the link between local and national planning and showcases 5 case studies that illustrate the potential of local heat planning. The case studies can inspire cities to design their strategy for the implementation of the EED. The deliverable also highlights levers and barriers that local governments face to decarbonise the heating and cooling sector, based in particular on these 5 cases. Levers are identified to emphasize what we can do to support local governments in better planning and implementing the decarbonisation of heating and cooling.



2. Methodology

For this deliverable, a three-step process was used. Initially, two Sustainable Energy and Climate Action Plans (SECAPs) per focus country of the project (Croatia, Germany, Greece, Poland, and Portugal) were selected in the project countries where it was feasible. These SECAPs were analyzed according to the information available on the website of the Covenant of Mayors in the section “key actions”. This information was cross-referenced with the analyses of the National Energy and Climate Plan (NECPs) of each country in question developed in deliverables D5.1. “Report on RHC regulatory frame towards 2030” and D2.1. “Renewable heating and cooling in the NECPs” of the REDI4HEAT LIFE project. For the choice of the SECAPs, it has to be noted that:

- In some countries, the Covenant of Mayors does not have a lot of signatories or SECAPs submitted, while in some others the Covenant of Mayors is the main initiative for local governments regarding climate and energy policies. Among the five focus countries of the REDI4HEAT project, the Covenant of Mayors is a key instrument in Portugal and Croatia where many municipalities submit their SECAPs; whereas the Covenant of Mayors is little used by German towns and is only being used to a limited extent in Poland and Greece.
- In some cases, other strategic documents are more important than SECAPs in terms of decarbonisation strategy for heating and cooling. This is the case in Germany, where cities are developing different energy and climate plans and even specific heating decarbonisation plans. Therefore, it was feasible to analyse SECAPs only for the following countries: Croatia, Portugal, and Poland.

In addition, the selection of SECAPs in the relevant countries (Croatia, Portugal Poland) was made according to the following criteria: 1. Recent SECAPs from the period 2019 to 2023 which corresponds to the period when NECPs have been for the first time published (2019) or are updated (draft update in 2023) 2. Cities of different sizes and geographies within the country 3. In each country, one city was selected because the authors knew that it had taken actions on the decarbonisation of the building and heating sector, and one city was chosen without expectations of the activities undertaken.

Moreover, Energy Cities proposed a list of case studies based on its knowledge of existing best practices with the following criteria in mind: diversity of geography, approaches and aspects of heat

planning, diverse size of cities or regions, and potential replicability. This list was presented and discussed within Work Package 2 of the REDI4HEAT consortium, and these five case studies were approved. With these case studies, cities are given examples of what heating and cooling planning can look like. The choice of regional and local examples reflects different strategies. Two examples, Baden Württemberg and Rotterdam, showcase a multi-level approach to local planning, as legal frameworks are set up at the national and regional levels. They are to some extent illustrations of what the implementation of Article 25.6 of the Energy Efficiency Directive could look like for some regions and countries. The choice of the cities of Valencia and Vienna reflects interesting strategies that emphasize the active participation of different players and the implementation of diverse solutions - from energy communities to district heating - while Poznań enhances a holistic approach.

Insights from other EU-funded projects on heating and cooling, like Decarb City Pipes 2050, have helped to draft these case studies. Previous work, from Energy Cities, analyzing municipalities' support needs for mandatory heating and cooling planning has also contributed to the selection and development of the examples. Relevant articles and research studies were another source to help complete this chapter.

The case studies are structured in five different parts. In the short introduction, we set the frame of the case study first, by looking at the different ambitions and goals that motivate the development of heating and cooling decarbonisation. Then, we also analyze if the heat planning is mentioned in structural plans or laws, where it can be binding. In the third part, we see which and how stakeholders are involved in the development and implementation of heat planning. We also look at the different tools that the region or city implements to support the transition: one-stop-shops, funding and subsidies, communication campaigns etc. Finally, we conclude and underline some key elements that cities should take away from these case studies.

Finally, in the last chapter, the barriers and levers to heat planning are discussed. To write both parts, the same sources were used for the case studies. A few research papers may have clarified certain points, as in the case of the Netherlands, but the literature about heat and cooling planning is still limited. The section on barriers clearly identifies four major areas where progress is needed, as difficulties are expressed in several of the cases cited. In terms of levers, there are three major elements to be replicated and reinforced.

The case studies and the section on barriers and levers were specially reviewed by projects partners.

3. Local and national plans to decarbonise heating and cooling: complementary, alignment, or discrepancy

This section aims to analyse the consistency and complementarity between the elements proposed by cities in the SECAPs and the national programs proposed in the NECPs to decarbonise heating and cooling.

Sustainable Energy and Climate Action Plans (SECAPs), previously SEAPS, are submitted by the cities joining the Covenant of Mayors. These action plans define mitigation target(s) and adaptation goal(s) and are based on a Baseline Emission Inventory and a Risk and Vulnerability Assessment. It provides the EU initiative with an overview of all actions that signatories plan to take to reach their targets, as well as to alleviate energy poverty.

The decarbonisation of buildings and in particular heating and cooling sectors falls under the scope of the SECAPs even though the methodology does not require actions to be defined in this area. Therefore, it is an interesting tool for analysing what cities are doing in this sector.

On the other hand, National Energy and Climate Plans (NECPs) are 10-year strategies developed by Member States to detail how countries plan to meet the energy and climate targets defined at the EU level. It was introduced by the energy union and Climate Action Governance regulation in 2018. The first NECPs submitted in 2019 aim at developing the strategies for the decade 2020-2030.

As explained in the methodology section, the submission rate and quality of SECAPs vary greatly from one country to another. Of the five project countries, only the SECAPs from Croatia, Portugal, and

Poland were considered relevant for comparison with national planning. We will therefore analyse below, firstly in a top-down manner, what the NECPs say about SECAPs, and then in a bottom-up manner, what certain SECAPs selected in the project's focus countries are doing to decarbonise heating and cooling, and whether this is being taken up in national programs.

3.1. Top-down analysis: local strategies in national energy and climate plans

Deliverable D2.1. of the LIFE REDI4HEAT project entitled “Renewable heating and cooling in the NECPs” provides an analysis of the local dimensions of the NECPs. It concludes that the importance of the local level in the NECP is very uneven depending on the countries analysed. Moreover, if the role of local authorities is well appreciated for climate adaptation and transport issues, it is much less for decarbonisation of the heating and cooling sector.

The analysis of the mentions of SECAPs and other local strategies in existing NECPs shows the following results in the table. We note that SECAPs as a planning tool are rarely used in NECPs as a reference for local action. The Portuguese and Croatian draft updated NECPs encourage the municipalities in their country to become signatories of the Covenant of Mayors and/or draft SECAPs. In addition, Portugal mentions the 100 climate-neutral and Smart Cities initiative as a mark of ambition for certain cities.

Also, some countries (Croatia, Poland, and Portugal) mention the action of several cities within the country on specific issues as good practice, but these best practices are not covering heating and cooling decarbonisation.

TABLE 1: ANALYSIS OF THE MENTIONS OF SECAPS AND OTHER LOCAL STRATEGIES IN EXISTING NECPS

Country	The number of times the terms “SECAP” or “SEAP” or equivalent are mentioned in the 2019 NECP	Number of times the terms “SECAP” or “SEAP” or equivalent are mentioned in the draft update of the NECP (2023)	Is there a mention of local heating and cooling plans in the 2023 document?
Croatia	8	9	No
Germany	0	0	Yes
Greece	0	2	No
Poland	0	No data	No data
Portugal	0	1	No

Sources: Authors



3.2. Bottom-up analysis: the potential of local Strategies (SECAPs) as an added value for national ones (NECPs)

For this section, we have chosen to analyse the SECAPs for the municipalities of Almeida (Portugal), Matosinhos (Portugal), Karlovac (Croatia), Zadar (Croatia), Bydgoszcz (Poland), and Wroclaw (Poland). As explained in the methodology, these were chosen with criteria such as recent SECAPs, different sizes, and geographies, known for their action on the decarbonisation of buildings or not.

3.2.1. SECAPs of Almeida and Matosinhos (Portugal)

The SECAP of Almeida was submitted and approved in 2022. The key actions list highlights one action related to energy efficiency in public buildings which lists potential measures that could be applied to public buildings such as “increasing thermal comfort through the adoption of construction solutions with better thermal performance and resilience to climate change, namely through the application of thermal insulation, glazing with thermally cut frames and the creation of shading - energy efficiency in buildings through the installation of highly energy efficient equipment for lighting, air conditioning and ventilation, including equipment to use solar thermal energy - water efficiency in buildings”. Thus, only solar thermal is proposed as a measure for integrating renewables into the energy mix for heating and cooling utilities.

The SECAP of Matosinhos was submitted and approved in 2021. The key actions list details one action related to the decarbonisation of the building sector which is the target of reducing by 15% the heating needs in the residential sector. This implies the rehabilitation of 30% of the residential buildings, including social housing. The summary of key actions does not include actions on the integration of renewables in building heating or cooling.

Going back to the analysis of the Portuguese NECP carried out in deliverables D2.1. and D5.1. In both the NECPs and these two SECAPS, the focus is primarily on building efficiency and less on integrating renewables into heating or cooling sector. In terms of technologies, solar thermal energy is

highlighted at both levels, but the other technologies mentioned in the new NECP, such as heat pumps, are not included.

In sum, both the analysed SECAPs and the NECP are aligned in this regard. Nevertheless, the Portuguese NECP could adopt a more ambitious approach towards the decarbonisation of the heating and cooling sector and to accelerate the integration of renewable energy technologies/solutions. Setting up specific programs, financing schemes and effective policies, aimed at municipalities, to promote the decarbonisation of the heating/cooling sector could lever the achievement of the targets identified for 2030.

3.2.2. SECAPs of Karlovac and Zadar (Croatia)

The city of Karlovac submitted its SECAP for the first time in 2010 and the latest was approved in 2020. Three key actions are focused on buildings:

- Implementation of integrated energy recovery programs for the buildings owned by the city of Karlovac up to Nearly Zero Emissions Building (NZEB) category.
- Implementation of integrated energy recovery programs for the residential buildings up to NZEB category.
- Modernization of the district heating distribution network of the city of Karlovac. This will include “1. replacement of existing pipes with energy-efficient ones; 2. integration of temperature, flow, and monitoring systems heat losses as well as pipe rupture sensors so they could be responded to as quickly as possible; 3. modernization of all pop-up pump accessories substation owned by the city and the City Heating Plant.”

The three measures concern buildings, but the last one concerns the heating system itself and mentions the municipal heating plan. Karlovac has a major project to supply this modernized heating network with geothermal energy that is undergoing but as indicated in the SECAP would require further financial support.

The city of Zadar submitted its plan in 2021 which was approved in 2023. The key measures related to buildings and heating decarbonisation are:

- Replacement of waste energy system with natural gas in 439 apartments.
- Subsidizing the renovation of energy-inefficient external envelopes and roofs for family houses.
- Installation of solar thermal systems for domestic hot water preparation and heating supplement on residential buildings. 70 family houses are already equipped with solar heating systems.

Referring to the analysis of deliverables D2.1. and D5.1., the Croatian NECP is on the right track in terms of heating transition but lacks a long-term vision. The two SECAPs studied propose measures focusing on the renovation of buildings, solar thermal energy, and heat networks. These last two technologies are at the heart of the national strategy outlined in the NECP to decarbonise heating and cooling. Furthermore, the natural gas mentioned in the plan for the city of Zadar is still very present in the Croatian NECP, which contains no measures to ban fossil fuel boilers at any date.

We also note that in its SECAP, Karlovac in particular mentions the need for financial and technical support to implement its projects. However, the NECP does not propose any dedicated funding measures for actions by towns and cities to decarbonise heating, nor any obligation to plan for local heat and therefore any accompanying support mechanism.

Therefore, in Croatia there are local initiatives that could help to better define the measures needed in the NECP to decarbonise the heating and cooling sector in towns and cities and inspire other cities. The NECP could therefore be enriched by showcasing such examples.

3.2.3. SECAPs of Bydgoszcz and Wroclaw (Poland)

The city of Bydgoszcz submitted its SECAP in 2021 that was approved in 2023. Key actions identified in the SECAP that concern the decarbonisation of buildings are:

- Comprehensive renovation of public utility buildings within the Bydgoszcz area. The program includes comprehensive thermo-modernization works, connecting buildings to the municipal heating network, constructing heat substations, and implementing heat and electricity management systems. It mentions that if appropriate, Renewable Energy Sources will also be used.

- Complex thermal modernization of residential buildings together with the construction of new heat connections, heat substations or gas-fired heating energy sources belonging to the housing stock of the city of Bydgoszcz.
- Decommissioning of coal-fired boilers and their connection to the municipal heating network. Replacement of old coal-fired boilers with low-emission ones, using renewable energy sources.
- Comprehensive refurbishment of public utility buildings.
- Promotion of the use of high-efficiency cogeneration systems, fueled by natural gas, at Osowa Góra Heat Plant in Bydgoszcz.
- Increasing energy efficiency through the reconstruction and thermal modernization of the heating network in the Bydgoszcz area.
- Construction, and reconstruction of heating networks within the territory of the city of Bydgoszcz, enabling the use of thermal energy generated in high-efficiency co-generation conditions.
- Spatial planning and green areas.

The plan proposed by the city of Bydgoszcz therefore has numerous measures to decarbonise the heating sector in the city to depollute the city's air. This local plan seems precise and ambitious to phase out coal in the city but does not foresee the phase-out of all fossil fuels such as natural gas.

The City of Wrocław submitted its SECAP in 2019 which was approved the same year. The following key measures of the SECAPs are linked to the decarbonisation of the building sector:

- New connection for Combined Heat and Power (CHP): connection to the network Fabryka Automatów Tokarskich in Wrocław powered by high-efficiency gas cogeneration.
- Implementation of the city Anti-Smog Programme that proposes subsidies for the replacement of stoves and boilers in Wrocław with an ecological heat source.

Both SECAPs refer to the National Air Protection Program, which aims to replace polluting heating in households and renovate their dwellings. As a result, compared with SECAPs in other countries, the actions are more focused on the residential sector and less on public buildings. There is no important funding program mentioned to support public buildings' renovation and transition to RES. At both national and local levels, there is no real mention of programs to develop RES for heating, or if so, the measures are not precise and do not detail what type of renewable source shall be used.

We note that the district heating networks have an important place, as well as gas, in this transition away from coal. This is the case both in the Polish NECP (according to Deliverable 5.1.) and in the SECAPs.

It should be noted that the local spatial planning referred to in the Bydgoszcz plan is not to be found in the 2019 Polish NECP, while it could be a good and inspiring practice.

The two Polish SECAPs are therefore relatively aligned with the NECPs, but these good local practices in Poland could be given greater prominence in the NECPs, which could then better reflect the needs of local authorities in implementing the measures and inspire other municipalities.

3.2.4. SECAP of Athens (Greece)

The City of Athens has developed a Sustainable Energy and Climate Action Plan, under the name “Athens Climate Action Plan” and along with the requirements of the C40 global cities network. In June 2022, the Climate Action Plan was approved by the Athens City Council. The Athens Climate Action Plan marks the first time a Greek city defines specific solutions for mitigating the impacts of climate change.

In parallel, as Athens belongs to the 100 Resilient Cities (100RC) of the Rockefeller Foundation, the city of Athens has also developed the “Athens Resilience Strategy for 2030” in 2021, where measures for reducing energy demand and increasing energy efficiency are foreseen. As part of the Athens Climate Action Plan, the Resilience Strategy is framed by four Pillars (Open city, Green city, Proactive city and Vibrant city) and among others, describes the strategy that will be followed to reduce greenhouse gas emissions by 61% in 2030 and to achieve climate neutrality in 2050.

Therefore, this section will summarize the most relevant measures, as described in those two binding documents.

City of Athens and Climate Change

Studies indicate that extreme heat events are expected to typify the city's future. Between 2021 and 2050, average summer temperatures in Athens are projected to increase by 2°C; between 2071 and 2100 this increase will reach 4°C. Moreover, it has been estimated that for every 1°C temperature increase in Athens, there is 5.2% increase in mortality rates, 6% increase in smog, 10% drop in sales and 4.1% increase in the use of electricity.

City of Athens and Building Stock

The City of Athens around the late 1950's witnessed an unprecedented growth of population resulting in a golden era for the building sector. The majority of the Athenian building stock, 81%, was produced between 1960 and 1980 and therefore, lacks not only anti-earthquake structures but also thermal insulation. Today, Athens is a very densely and anarchically built city with an aging building stock and high energy demands.

Energy poverty tends to become one of the biggest social problems; almost 25% of Athenian households suffer from energy poverty and are unable to cover their basic domestic needs. These households live in indoor temperatures that do not exceed 6-7°C in the winter months.

Heating & Cooling and Energy Efficiency measures

The suggested adaptation measures related to the reduction of heating and cooling loads and to the increase in energy efficiency are:

- Establish a regulatory framework for the use of cool and sustainable materials in all municipal public works.
- Urban planning that includes shading and natural cooling solutions.
- Energy retrofits in municipal buildings to improve efficiency and reduce energy costs. The buildings maintained by the City of Athens are over 1000 buildings, with most of them lacking thermal insulation. The goal is to upgrade 30% of the municipal buildings by 2030 and 100% by 2050.

- Promote national funding programs regarding energy savings, such as the program “ENERGY SAVING AT HOME”. This program can reduce up to 44% of the household’s energy demand and has already improved the energy efficiency of 40.000 houses.
- Establish a municipal fund for energy upgrading of residential buildings. If the City of Athens provides funds for energy upgrades to 24.000 households until the year 2030, energy demands can be decreased by 27% per residence. The goal of the renovation rate is 40% of residential buildings renovated by 2030, 80% by 2040 and 100% by 2050.
- Support and promote the conversion of 10% of the existing residential buildings to nearly zero-energy-buildings until 2030.
- Establish the Building Renovation Passport, in cooperation with CRES: A Building Renovation Passport (BRP) is a document outlining a long-term (up to 15 or 20 years) step-by-step renovation roadmap for a specific building, resulting from an on-site energy audit. A library with BRPs will be also created in order to record the energy demands and the measures applied in long-term for energy savings so that in future an energy roadmap could be developed.
- Promote and support the program “Building the Future,” aiming at the reduction of energy consumption in the tertiary sector. Up to 8.000 buildings have been recorded as hosting entrepreneurial activities in the City of Athens that could be benefited. The goal of the renovation rate is 40% of tertiary buildings renovated by 2030, 90% by 2040 and 100% by 2050. Support the funding mechanism for enterprises “Athens Business Green Toolkit”.
- Establishment of the Energy poverty observatory, in cooperation with CRES. The observatory is responsible for monitoring households that suffers from energy poverty and delivers solutions for energy efficiency.
- Support the Building Retirement Code that retires and demolishes old buildings (whole blocks of buildings) and creates open green spaces. Already, 500 buildings have been identified that are prioritized.
- Dedicated campaigns to raise citizens’ environmental awareness, encouraging them to reduce energy consumption.
- Educational campaigns in schools through seminars/workshops, leaflets, interactive communication focusing on children.
- Support integrated planning, data-driven policy making and strengthen municipal leadership.
- Long-term awareness raising campaign to provide information and build capacity among citizens regarding energy savings (energy inspectors, website, phone center, financial instruments consultation, etc.).

The city of Athens has been selected as one of the 100 Resilient Cities by the Rockefeller Foundation. Additionally, the City of Athens, along with five more Greek cities (Thessaloniki, Kalamata, Ioannina, Trikala, Kozani), is included in the program of the European Commission “100 Climate Neutral Cities by 2030 - by and for the citizens”.

From the above, it can be noted that due to the old buildings stock in the city of Athens, the Plan has given particular emphasis on the energy upgrade of both public and private buildings, on the alleviation of energy poverty and on the public awareness campaigns to reduce energy consumption.



3.2.5. Conclusion of the SECAPs analysis

In conclusion, we observe that even though there are remarkable measures and practices at the local level to decarbonise the heating sector, these are barely mentioned in the NECPs. However, we observe a relative alignment of strategies and technologies chosen for the decarbonisation of heating between the NECPs and the SECAPS. This alignment is also observed in Athens SECAP, where particular emphasis is given in the energy upgrade of buildings and energy poverty alleviation due to the old building stock. Local plans sometimes derive, as in Poland, from national programs such as the air protection program. Finally, we can note that the ambition of the local level is not fully supported at the national level and that cities do not always have access to a national financial or technical support program to implement their actions.



4. Inspirations from 5 case studies

4.1. Baden Württemberg (Germany): supportive regulation for local heat planning

Baden Württemberg is the third largest German federal state by area and population with over 11 million inhabitants. Through the amended Climate Protection Act adopted in 2021, the state is committing to a series of climate protection targets for 2030 and 2040 such as to decrease greenhouse gas emissions by at least 65% by 2030. In the sector of building stock and heat supply, Baden Württemberg has set the goal of climate neutrality by 2040. To give themselves the means to succeed, the German state also introduced, within the regulation, a mandatory heating and cooling planning requirement for municipalities.

4.1.1. The Climate Act setting the scene for heating and cooling planning

The creation of a binding heating and cooling planning regulation in this southern region of Germany in 2021, anticipated the implementation of both the revised Energy Efficiency Directive and a draft national law proposed by the Federal Ministry for Economic Affairs and Climate Action (BMWK) and the Federal Ministry for Housing, Urban Development and the Built Environment (BMWSB). This draft law, under discussion in 2023, could set up mandatory heating planning for German federal states and district heating expansion, as well as decarbonisation roadmaps for district heating operators. Since the revision of the Heating Climate Protection Act in 2021, German local authorities of the Baden Württemberg state, representing at least 20,000 inhabitants (which includes half of the state's population) have to submit heating and cooling plans. They aim to elaborate a systematic analysis of current heat demand, determine the potential of its reduction and meet the remaining demand with renewable energy and waste heat. They should involve citizens and relevant

stakeholders in the planning and include a spatial representation of the planned heating supply structures.

These plans are expected to be submitted at the end of 2023 and mandatory updates have been determined every seven years. Smaller municipalities are also supported and encouraged to commit to the same goal. Other targets are included such as mandatory photovoltaic systems installation on newly constructed buildings.

4.1.2. Energy and Climate Protection Agency: pillar to support municipalities

The main stakeholder and governmental body of this heating and cooling planning regulation is the Baden Württemberg Energy and Climate Protection Agency (KEA-BW). The agency provides the necessary instruments to support municipalities in drafting. The agency also plays the important role of a helpdesk, answering questions and providing assistance to municipalities. KEA-BW is also working closely with Danish partners to develop this model of local planning on the basis of what has been done in the last decades in Denmark.

4.1.3. A wide range of tools to support municipalities

The regional Energy and Climate Protection Agency is providing all kinds of help from financial support to creating technology catalogs and sharing best practices.

Firstly, the Climate Protection Act enables municipalities of all sizes to collect and process data and information related to their building stock and heating systems. Thus, essential data related to energy consumption, infrastructure plans, or information on existing central and decentralized heating systems are easier to get. The agency is also making sure that all plans, once submitted, will be published in a state-wide database. From this data collection and to the very concrete planning, municipalities are guided thanks to the toolbox which gives clear instructions on the core elements of the plans.

KEA-BW also provides municipalities with catalogs of technologies detailing their availability, costs, and criteria, to help local governments to choose the most relevant ones. The agency also thought of sharing examples and good practices, with case studies, to inspire municipalities.

More importantly, funding is provided to municipalities to develop capacities for their heat planning. In addition, municipalities that do not find themselves under mandatory planning can benefit from a funding program of 10.4 million EUR for the period 2021-2026 to develop their heating planning. The regional agency also came up with joint planning opportunities for small municipalities or between a small town and a larger obligated one.

Lastly, additional legal frameworks are used as tools to develop district heating and cooling facilities, like the “Anschluss- und Benutzungszwang” which regulates the accessibility and usage of services like district heating and can implement compulsory connection and use of district heating.

4.1.4. Conclusion of the case study

The success of this regional mechanism is such that it has inspired other German federal states, and federal but also European policymakers. In fact, in North Rhine-Westphalia the state agency for energy and climate protection has also developed a similar comprehensive support framework and coordinated activities to develop local heat plans.

The case of Baden Württemberg gives a good example of how to create the right framework from a legal (obligation) and support perspective. At a time when the whole of Europe needs to get to grips with the issue of mandatory local planning for municipalities with more than 45,000 inhabitants, the state of Southwest Germany has shown the way, providing an example of a legislative and support framework that can be replicated in other European countries.

4.2. The Dutch integrated approach: neighborhood heating planning in Rotterdam

The Netherlands has committed to reducing by 49% their emissions by 2030 (compared to 1990). To tackle the highly emitting sector of building stock, the country has set the goal of freeing building stock of natural gas by 2030. To reach these goals, municipalities play leading roles. Indeed, the Dutch National Climate Agreement of 2019 requires municipalities to develop a gas phase-out strategy. As one of the biggest cities in the country, Rotterdam has developed its plan to become climate-neutral by 2050, getting rid of its gas grid.

4.2.1. Rotterdam: a city taking the lead on heating transition planning

As with any other Dutch city, Rotterdam is complying with the binding requirement of developing a heat transition vision. The city itself is convinced that the municipality is a suitable leader to manage the heat transition and that it essentially needs to cooperate with all parties. The city submitted its plan at the end of 2021 and developed its vision further through the EU-funded project Decarb City Pipes 2050 to draft a transition roadmap for its heating and cooling system. On the path to achieving its transition, the city has switched already 10,000 buildings from gas to other energy solutions.

4.2.2. A multilevel planning

The Rotterdam case highlights an interesting integrated approach to the transition to heating, with active stakeholders at all levels.

Indeed, in the Netherlands, the legal framework imposes a cooperation between the national, the regional, and the local level. The Dutch National Climate Agreement voted in 2019, mandates regions to present a Regional Energy strategy compatible with the national strategy, and all municipalities to develop a “Vision of heat transition” that has to be compatible with the regional strategy. At the national level, a dedicated body “Natural Gas Free Neighbourhoods Programme (PAW)” has been created to support the development of the local vision on heat transition. The ministries from

Economic and Climate Change as well as the association representing Dutch municipalities, VNG, are part of this new body. Therefore, multilevel governance is strongly encompassed in the design of the Dutch Climate Agreement implementation.

At the municipality level, Rotterdam, with the Decarb City Pipes 2050 project, has chosen to engage various stakeholders through coordinated groups in the design of its phase-out gas strategy. Therefore, internal staff from the city, district heating companies, public and private grid operators, regional energy strategy actors, housing cooperatives, and citizens took part in the drafting of a strategic, tactical, and operational heating vision. Thanks to this collaborative approach to governance, Rotterdam managed to efficiently find the most sustainable and reliable heat alternative at the lowest possible social costs.

4.2.3. The neighbourhood approach as the foundation for mapping

Heat mapping in the Netherlands is an inspiring study case for many cities as it is based on the “neighborhood approach”. The neighborhood approach is an emerging concept in urban planning and describes an area-based approach where the natural resources and social dynamics are managed directly in relation to their local contexts. The Dutch government itself has advocated this method of analysis district by district as the most appropriate renewable heat solution.

In Rotterdam, the neighborhood analysis has been translated into the construction of a “WHAT MAP” to define the best alternatives with the lowest social costs for existing buildings in each district and a “WHEN MAP” to share when alternatives to gas, and especially district heating, will be available in different neighborhoods. Rotterdam's approach also focuses on energy savings through energy efficiency and improved housing standards and insulation in existing buildings. Information and communication about the Heat Transition Strategy are publicly shared through the “Duurzaam010.nl” website. National funds, mentioned above, are helping the city to deliver on the transition in the first neighborhoods.

4.2.4. Conclusion of the case study

The Rotterdam example is interesting for its ambition to phase out gas and gas grids by 2050, and for the governance and methodology chosen. Framed by the Dutch National Climate Agreement requirements and fostered especially by the Decarb City Pipes 2050 EU-funded project, Rotterdam has taken the lead in neighborhood heat planning. The city is now an example in the country and Europe and inspires other cities with such an integrated approach. The cooperative approach adopted by Rotterdam, involving a wide range of stakeholders, clearly demonstrates the importance of designing plans at the local level, as only cities can rally these diverse stakeholders around a project.

4.3. Integrated spatial and energy planning to foster district heating in Vienna

The Austrian National Energy and Climate Plan (NECP) set the scene for the transition: climate neutrality economy and society by 2040, phasing out oil heating systems by 2035, and heating strategy co-designed with local stakeholders (among other goals). At the local level, the city of Vienna committed to similar goals with the Smart Climate City Strategy Vienna 2040 adopted in 2022 by the City Council. Within the strategy, decarbonising the heating and cooling system is one of the priorities, as for buildings, heating and cooling demand has the highest share of total energy consumption in the city.

4.3.1. Integrated planning as the path to meet Austrian climate goals

The heating and cooling Vienna 2040 strategy results in a clear vision: take early action, plan and give long-term perspectives for the future of the city. The capital city of Austria has engaged with integrated planning, a sustainable approach that gives a complete view of resources and commitments to support strategic decision-making. The concrete plan for Vienna 2040 implementation lies in the Vienna Climate Guide which precisely lists the measures and tools used to reach the goals set and outlines the phase-out of fossil fuels.

4.3.2. The co-design of the strategy

In Vienna, relevant energy stakeholders from the city administration, municipal departments, utility and grid operators of the building and housing sector have engaged with energy experts to design this integrated strategy. This shared governance was at the baseline of drafting the picture for heating and cooling supply and demand in 2040 but also of exploring energy supply options for new buildings and spatial energy planning. Stakeholders also engaged with spatial requirements of energy infrastructures to complete the integrated planning.

4.3.3. A 100% renewable energy mix plan for heating and cooling

The spatial and energy planning of Vienna is driven by the development of central district heating and renewable energy to phase out gas. Indeed, the comprehensive and detailed analysis of Vienna's needs and spatial features has led to the following conclusions. For dense built-up areas, district heating and electricity grid infrastructure will be extended as well as storage facilities. For less dense areas renewable low-temperature heat networks and other diverse renewable solutions like heat pumps and biomass will be used. Energy efficiency is also part of the plan with thermal and energetic refurbishment of the building stock and improvements of heating systems.

To anticipate further concerns on the implementation, Vienna is creating two new entities: a central advice center for building matters and a Renewable Energy Competence Center for energy communities-related ones. Training for workers, monitoring, and public communication are also part of the strategy. The implementation of the Smart Climate City Strategy Vienna 2040 and its decarbonisation component is also supported by various tools implemented at the national level. Indeed, the Austrian Climate and Energy Fund is one of the main mechanisms to provide financial support to municipalities, like Vienna, voluntarily participating in climate change mitigation programs. Thousands of projects are funded in the Land of Vienna covering a large scope from renewable energy to retrofitting. The Spatial Energy Planning initiative is providing provinces like Vienna with guidelines on how to develop assessment reports for energy needs in different municipalities. Efforts are also made to improve energy and building-related geodata for heat planning, notably through the Spatial Energy Planning platform. And progress is noticed in data

harmonization for spatial planning through the Spatial Energy Planning Platform, which enhances the integration and coordination of data related to energy planning across the regions.

4.3.4. Conclusion of the case study

Vienna can inspire other big cities in Europe to voluntarily take the lead in decarbonisation through integrated spatial and energy planning. Despite the absence of a national binding regulation, the city has taken the lead to ensure that it will meet its 2040 target of phasing out gas. Given the size and means of the city, it has been able to implement an ambitious and comprehensive decarbonisation plan, while benefiting from several nationwide tools.



4.4. Poznań's holistic approach to decarbonisation

Poznań is the fifth largest city in Poland. As everywhere in Poland, finding alternatives for coal is a priority of the city. The transition towards clean energy sources is making a difference in many extends, providing safe and cheap energy to the Polish population, guaranteeing sufficient air quality, and meeting European goals set with the Green New Deal. Poznań is one of the cities that went the furthest on this path in Poland. Looking at the way the city is decarbonising its heating and cooling system can be very insightful for other Polish or European cities.

4.4.1. Decarbonisation to mirror national goals and improve air quality

On one hand, in the Polish National Energy and Climate Plan (NECP) the increase of renewable energy sources shares in gross final energy consumption as well as energy efficiency targets will be big challenges in the heating sector that is today extremely reliant on fossil fuels and in particular coal. On the other hand, Poland's Energy Law defines a regulatory framework and mandates all Polish municipalities to prepare municipal heat, electricity, and gas supply plans of 15 years once every three years, as stated in articles 19 and 20.

For many years, Poznań's strategy has focused on improving the efficiency of renewable energy sources, investing in the renovation of building stocks and improving the connection to district heating and the existing network itself. District heating covers the needs of over 360,000 end users for heat and is in the process of further digitalization and decarbonization, with the integration of waste heat from industries and soon geothermal energy. In total, 300 TJ of external waste to heat recovery is helping the energy transition and the improvement of the air quality, as smog used to be a common issue in the city.

4.4.2. A leading partnership between the city as leading stakeholders of the transition

In Poznań, the district heating network is managed by Veolia Energia Poznań. The decarbonization strategy has been thought of in close cooperation between the utility and the city, but also with city planners and environmental experts. National utility Veolia Polska also takes part in some new projects, connected with district heating and heating systems. The stakeholders built a long-term project team together: “Green Poznań Project”.

4.4.3. District heating is the main focus of heating decarbonisation

Decarbonization in Poznań is led by different projects, tackling a wide range of issues for big results. First, the “Keep Warmth” project allows the city and Veolia to increase energy efficiency in residential buildings. Heat losses, which lead to emissions of pollutants into the environment and increase the bill for residents, are the main targets of the project. Thermal imaging tests of 455 single-family houses and 35 tenement houses were carried out free of charge for the inhabitants.

Then, the Kawka project is another instrument of the city to plan solutions for energy efficiency and air pollution. Since 2015, connections to district heating have been carried out in different neighborhoods of Poznań, as well as the replacement of individual boilers by district energy. The project continues with “Kawka Bis 2023” which funds up to 100% of the heating source replacement for coal or wood boilers for homeowners but also tenants. The amount of the subsidy depends on the alternative energy used: electric heating (including PV panels), gas heating, heat pump, or district heating. Assistance is provided by the city to calculate the future heating costs and the potential grant to select a heating device. Funding decarbonization of heating systems goes with the enforcement of a local law in Poznań to foster the transition. Indeed, the Anti-smog resolution indicates that from 2024, all owners of old classless central heating furnaces will be fined. The act also plans that all non-class boilers should be replaced by the end of 2025.

Finally, the decarbonization strategy is tapping into the potential of waste heat. Since 2014, waste heat from Volkswagen’s foundry in Poznań has been exchanged for thermal energy and supplies 30

buildings. This example illustrates the potential benefits of strong cooperation between a large industrial plant and a district heating company, reducing CO2 emissions and water consumption.

4.4.4. Conclusion of the case study

Poznań's comprehensive efforts to decarbonize the heating and cooling system are commendable. The success of the implemented measures inspired further projects to explore potential geothermal district heating in Poznań with local utilities and the Danish geothermal heating developer Innargi.

We can highlight here the holistic approach that allows the city to answer health and environmental problems with a comprehensive strategy. Decarbonisation of the building sector would benefit from being considered as intrinsically linked to other public health and environmental issues.

4.5. Heat planning based on energy communities in the pioneering city of Valencia

An energy community is a way to generate, use, and manage energy at a local level through the cooperation of different agents, and especially citizens. The latter become an active part of the energy sector. They can produce and share renewable and local energy, offer energy efficiency services, or promote ways of sustainable mobility, among others, according to Valencia Roadmap for 2030, from the EU-funded Tomorrow project. In Valencia, heat planning is focusing on electrification and a large development of energy communities, which is quite an exception in Europe. To reach climate neutrality the city wants to take the lead in energy transition, implementing a new energy model: one that is both democratic, local, and decarbonized.

4.4.1. The right-to-energy approach

Valencia has a strong and long-lasting engagement toward climate neutrality and decarbonization. It is no surprise that the city is part of the 100 climate-neutral and smart cities in 2030, a project from the European Commission. The city signed the Covenant of Mayors declaration in 2009, which led to the establishment of the Valencia Climate and Energy Foundation by the City Council, to deliver

strategies, actions, and tools to reach climate targets. The city's strategy has always focused on “right to energy” and fuel poverty prevention. The fair and inclusive energy transition strategy, integrated into the Valencia 2030 urban strategy, has taken this approach further. Valencia's vision is holistic and integrates citizen participation in many domains.

What is even more important for the city, is that the solutions are concrete in action. Energy communities can be quicker and more concrete for citizens than other decarbonization solutions. Thus, they have been at the heart of the latest heating strategy in the city.

4.5.2. 100 energy communities for 2030

Behind this number lies a whole decarbonization vision of the city of Valencia. In May 2021, the Valencia Climate and Energy Foundation announced a new policy goal: to establish one hundred Energy Communities within the city by 2030. At an upper level, this goal resonates with the objective of Spanish semi-autonomous regions to develop energy communities, along with support frameworks that provide finance for community initiatives. The goal is also aligned with the National Strategy Against Energy Poverty 2019 which associates thermal and electrical self-consumption to fight against energy poverty. It will also contribute to the national goal of 76GW of solar PV energy by 2030, set by the National Energy and Climate Plan.

4.5.3. A co-creation approach at the local level

Thanks to a collaboration with the university, the city has been able to implement a new systemic innovative approach. Valencia's Urban strategy has benefited from such an approach for the energy transition strategy for 2030 and 2050. Decision-makers were supported by a group of 20 representatives from 18 different entities (civil society, academia, private businesses, public entities, and the media...). This process went beyond participation with citizens as the key word was co-creation. These participants coordinated and led the development of the strategy. The successful approach has inspired the political leadership to embed citizens' collaboration in the long term. In this sense, energy communities are a great opportunity, as they involve citizens in the development and ownership of energy-related projects, which contribute to larger goals.

In addition, the city also implemented a co-created approach for energy efficiency plans in schools, the project EURONET 50/50, where parents and students define the strategy to save energy. None of

these projects would have been possible without the great communication campaigns made to reach out to citizens and increase their involvement in the energy transition.

4.5.4. Direct support for energy self-consumption

To implement the new vision and to reach its goal for energy communities, Valencia has focused on providing direct support. An Energy Office has been created and assists directly citizens within a neighborhood setting, targeting areas where energy poverty is higher. The office organizes workshops on renewable energy technologies and creates opportunities for citizens to get organized and start their projects. They facilitate the exchange of best practices and lessons between energy communities. Such an office works as a one-stop shop working between public and private institutions, for the energy transition that aims at empowering citizens. It also follows citizens for renovation and energy savings projects, among others.

The energy office is meant to be replicated in another district of the city, thanks to the financial support from the Spanish Recovery and Resilience Plan. Another support is provided by the Valencian Institute for Business Competitiveness (IVACE-ENERGIA) in the form of subsidies that cover around half of the costs for the creation of an energy community.

4.5.5. Conclusion of the case study

The decarbonisation strategy of buildings in Valencia is, according to its SECAP, based on the reduction of consumption, the energy efficiency of buildings, and electrification with PV panels and heat pumps. To do this and in general, for its entire strategy, the city has chosen shared governance by developing energy communities. The success of the Energy Office and the first energy communities are a promise for successful decarbonisation in Valencia. This example is particularly interesting for cities dealing with energy poverty but also for those who have a high potential for renewable energy development.

5. Obstacles and levers identified at local level

5.1. Obstacles to cities' heat planning for energy transition

5.1.1. An unappropriated legal framework

Cities are underlining the gaps to be made up for fostering the energy transition. In Germany, although progress has been made in some regions, several shortcomings in national legislation are listed to generalize energy zoning planning and energy efficiency, and to allow hybrid heating systems. Moreover, cities like Munich are asking for a “Geothermal Energy Development Act” to tap into the potential of such energy. Central to political debates nowadays, the issue of prohibiting oil and coal for heating would also highly support the process of decarbonisation at the local level. It is one of the requirements of Rotterdam. The Dutch city also emphasizes that more direct government investment instead of current subsidies in heat infrastructures would help the development of district heating ensure a more public-owned approach and cost-based tariffs and increase public support for the transition. Appropriate funding is highly connected to an appropriate legal framework. The investment required to plan and implement heating and cooling decarbonisation is not on the agenda for most cities and local authorities. This will remain the case as long as they do not receive adequate support, both financial and legislative.

The city of Vienna really needs the abolishment of the connection obligation to the gas grid mentioned in the Gas Act, to guarantee the implementation of their phase-out gas strategy. Other pieces of legislation need to be adapted in the housing sector like the Tenants Act or the Condominium Act, to facilitate the switch to renewable energy systems and ensure a just repartition of costs. On the side of Poland, the amendment of the obligation to execute planning documents for the supply of heat, electricity, and gas fuels, planned at the national level, is key to activating regions' leadership for the transition.

5.1.2. An absence of visibility

Planning is key to giving visibility to the private sector. It is even more the case in the energy sector as investments in facilities are substantial. Furthermore, data are central when it comes to visibility. Too often, there is a lack of access to certain data, like in Spain. Datasets on buildings, energy demand, potential of waste heat, renewable thermal energy, and energy infrastructure are often incomplete or inaccessible. Then, except for two federal States in Germany, no long-term funding programs are found for citizens affected by the heating transition. In Vienna, there is also a lack of visibility around the distribution of costs for decommissioning the gas network and for the future network. Often, funding is provided through projects, as in the example of Poland with the stop-smog program. However, the project approach does not give sufficient visibility for investments. A more mission-based approach to local planning for decarbonisation would foster the transition.

5.1.3. Lack of capacities

Funding is also lacking when it comes to specialized staff and more generally capacities at the local level. In Rotterdam, despite being a big municipality, the city struggles with limited capacities against data unavailability. In general, many cities reported the lack of local positions fully dedicated to the management of the energy transition. According to a study published by Energy Cities in 2022, 214,000 new local employment positions across the European Union are needed to decarbonize the built environment between 2022 and 2030. For a city like Delft in the Netherlands, that means getting 25 full-time extra positions in 2030 compared to 2019. In the case of Spain, the staffing shortage in municipalities is one of the highest in Europe with a need for more than 38 500 additional Full-Time Equivalent (FTE) needed in 8 years. These figures point out the need for subsequent funding and training to provide local authorities with capacities in order to draft and implement a decarbonization roadmap. Today, this planning is too often externalized due to a lack of means in municipal administrations or local energy agencies.

5.1.4. Technical obstacles for frontrunners

Finally, technical obstacles are common for cities that lead the way for heat planning like Valencia. When the national framework is not set up, technical matters can be tricky for municipalities. For Valencia, the connection to the power grid and the interoperability is the first problem. Exchanging information between DSOs and energy suppliers is a second obstacle, especially as utilities are two

mixed grids in the neighbourhood of Castellar. Cities lack of technical guidance to overcoming this obstacle.

5.2. Key aspects to foster heat planning for a decarbonised Europe

Cities are learning significant lessons from the heat planning they develop, whether it is required or not at the national level and produce substantial policy recommendations that the EU and national policymakers should pay attention to.

5.2.1. Building an articulated legislative and support framework

Progress is still awaited in the heat planning framework. Indeed, in most countries, there is not yet an obligation or strong incentive to develop local heating and cooling plans. Only a few countries, according to the EU tracker “state of play of local heating and cooling national framework” developed by Energy Cities, have the appropriate legal framework; these include Denmark, The Netherlands, Lithuania, Finland (and potentially Germany soon).

However, from the case studies, we can identify that:

- Technical and Financial support frameworks are key to enabling municipalities to develop ambitious local heating and cooling plans. This is clearly stated in the case study of Baden Württemberg where the regional agency supports extensively municipalities in developing their local plans.
- Centrally established supportive mechanisms and coordination across levels of government are key enablers. The Netherlands is the country that is the closest to ticking these boxes. As mentioned above, there is a coordinated effort at the national, regional, and local levels. The national level defines and creates the dynamic for the local level through the 2019 Climate Agreement. The regional level comes as a supporter in between, with a regional energy strategy that gathers stakeholders and can work as a one-stop-shop, like for instance the KWW in Germany. Municipalities are accountable for defining their vision of heat transition according to their context and means. Such coordination should foster knowledge exchange

between the different stakeholders involved at the different levels, from institutions to agencies.

Also, the implementation of Local planning is dependent on legislation at the national level that can give appropriate mandates to municipalities. Indeed, restricting or binding legal obligations for gas boilers and gas grid connections are among the most needed legislations to facilitate the heating and cooling decarbonisation and implementation of local strategies. Their efficiency is remarkable, but they are still rare in Europe. An inspirational case is the one of the Canton of Zurich, in Switzerland, which bans the replacement of an oil or gas boiler for existing buildings. The ban is conditioned to the life cycle costs of the decarbonised heating alternatives being not more than 5% higher. This ban has allowed the city of Winterthur, located in the same Canton, to announce the decommissioning of its gas grid 10 years in advance.

These aspects of the legislative framework and support for local authorities should be greatly improved with the transposition of the new European energy efficiency directive, which requires Member States to ensure that towns and cities with more than 45,000 inhabitants draw up local heating and cooling plans (article 25.6), obliges Member States to offer technical and financial support to towns and cities for this purpose (article 25.6) and requires funding measures (article 30) for energy efficiency. The European Commission will be publishing recommendations to this end and has published in December 2023 a set of recommendations relating to the transposition of Article 30 that suggests best ways to use national energy efficiency funds, and financial and technical support to facilitate investments in energy efficiency.

5.2.2. Available and relevant data

Data is at the core of any heat planning. It is a precondition to be able to access and process data for the cities, to make the right choices of heating sources according to the territory. In Germany to improve the standardization of energy data, open-access data platforms for spatial data are being developed. They are especially tailored for localized energy planning purposes. Poland has also understood that data is essential. The country is developing a nationwide system to be able to produce a heat map, as part of the Polish energy policy until 2040.

5.2.3. Train the workforce to the new skills

Funding mechanisms are part of the already developed heating planning support schemes. However, the need to fund local positions to support, monitor, and implement the heating planning is overlooked. In the Netherlands, a special national fund was created in 2019 that allowed the municipality to get additional expertise and hire several full-time employees working on buildings' decarbonisation, heat strategy, and neighborhood heating plans, even if it is not nearly enough.



6. Conclusion

Planning for the decarbonisation of heating and cooling must be carried out at the national level, to give broad directions, and at the local level, to adapt to the reality of the local context and involve a wide range of stakeholders. In this deliverable, we can see that the link between national and local planning needs to be improved to ensure that national programs are adapted to the reality and needs of local authorities and to better highlight what is already being done at local level to inspire other local and national decision-makers.

The case studies selected showed different facets of local planning to decarbonise heating and cooling, notably governance, with a neighbourhood approach, involvement of local stakeholders, a community or multi-level approach, and also the technical and financial support needed to draw up and implement such plans. These case studies could inspire other cities and member states to replicate the identified good practices. While there are still many limits to action by cities today, these case studies have also highlighted success factors such as a good legislative framework, good technical and financial support, a clear mandate for cities, availability of data, and human and training resources.

Finally, the deliverable underlines the need for integrated frameworks for heat decarbonization in each country. It is, therefore, necessary to closely monitor the development of national legislative frameworks and the support mechanisms that accompany action by cities to ensure that the means are in place to achieve the objectives of reducing greenhouse gas emissions in the building sector.

7. List of Tables and Infographics

Table 1: *Analysis of the mention of SECAPs and other local strategies in existing NECPs ...16*

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