DECARB CITY PIPES 2050

Report on peer-to-peer learning activities

Deliverable 3.4

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Published: June 2023

PROJECT INFORMATION
Project name: Decarb City Pipes 2050
Grant agreement number: 893509
Project duration: 2020-2023

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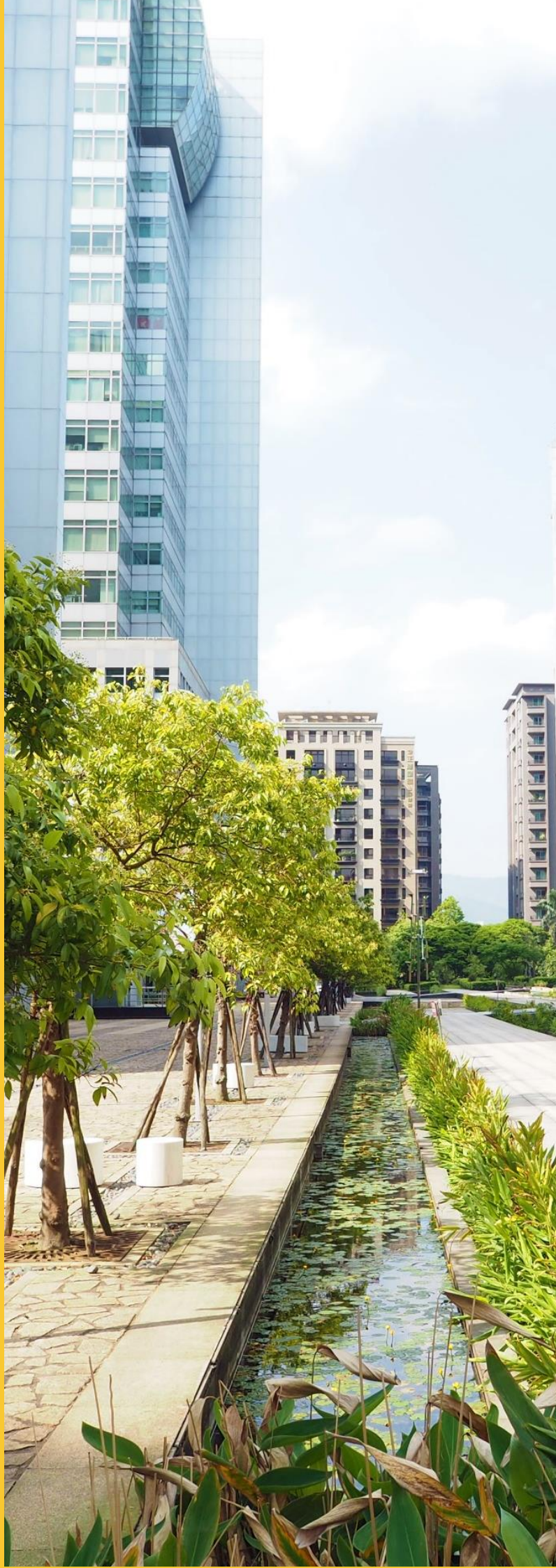

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 893509

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Executive Summary

Peer-to-peer learning

When it comes to heat decarbonisation, there is no one-fits-all solution. Facing the plurality of situations and possible actions to take, local authorities are keen on hearing from each other's experiences. Seeking answers to questions like:

- How to connect multi-owner buildings to district heating?
- Can connection to district heating be mandatory, and if yes, what are the different frameworks?
- And if I want to decarbonise a whole neighbourhood, what can I do?

Experts, frontrunner cities and innovators shared their knowledge of energy modelling for building and spatial planning, while sharing concrete examples of obstacles often met by cities and potential solutions to overcome them.

For the heat transition it is important to have a long-term vision, to engage utilities and share all the knowledge that is needed. For example, understanding what making use of deep geothermal potential can mean, how to technically replace individual gas boilers in condominiums or how essential district resources are to accelerate a decarbonisation strategy.

Despite the different points of views and experiences, essential points stand out for most cases:

- Data are essential for everyone, and the more accurate they are the better. Data on infrastructure, data on energy demand and data on potentials are strong allies for both cities and utilities looking at designing or updating heating and cooling plans. At the same time "perfect is the enemy of good", meaning that we should also have to learn to deal with not perfect data and do sensitivity and risk analyses.
- Often, technicalities are not the main obstacle to move forward in decarbonisation, even when it comes to condominiums. The real impetus is given by the legal framework, financing structures and an adequate strategy. This last one also includes the involvement of all the stakeholders, building on trust.
- In general, heat planning and heat decarbonisation are not isolated initiatives. They come within a general frame and include a variety of parameters (social, economic, etc..) which must be integrated to make the plan sustainable, fair, and viable on the long-term.

The peer-to-peer sessions held in the context of this project were a first step in the constitution of a community dedicated to decarbonising its heating and cooling systems. Adopted solutions in some cities were a way to nurture the plans of the partner cities in the project and launch exchanges to be continued outside the frame of peer-to-peer learnings.

Introduction

Context and overall objectives of the project

Responsible for roughly half of the EU's final energy consumption, transitioning heating and cooling to energy efficient, renewable solutions will be critical to bring EU countries in line with their pledged climate and energy targets. Given the long-life cycles of the grid infrastructures involved and more so given the impact transition has on both, homes as well as on energy infrastructures, there is an urgency to start the planning of this transition today. But how? What first? Which systems? What heat sources are there? How to govern this process? Increasing complexity of the energy system together with technological uncertainties require a high level of knowledge and skills to act wisely. Cities are not yet fully equipped for this. They lack capacity and skills as well as financial & legal empowerment to act.

Decarb City Pipes 2050 showcases how local authorities can build capacity to succeed in this challenge. Seven cities - from frontrunners to beginners - join forces to learn from each other and elaborate innovative responses together. They explore pathways suitable for their local challenges and build up skills in the use of data, planning tools and instruments, techno-economic as well as process and transition management knowhow (see Figure 1). In a participatory process with stakeholders, each city developed tangible transition roadmaps, building up trust and commitment for its implementation along the way. In deep peer-to-peer exchanges, cities and utilities share knowledge to benefit from other perspectives, stages of advancement and planning traditions.

Climate urgency calls on all political levels to act more stringent and faster. In this EU-project seven cities - Bilbao, Bratislava, Dublin, Munich, Rotterdam, Vienna and Winterthur - team up to work out actionable roadmaps to decarbonize heating and cooling for buildings in 2050, taking up the challenge of phasing out natural gas in heating. And the seven Decarb City Pipes 2050 cities are getting real about showing the door to fossil fuels for heating:

- In **Heating and Cooling Outlooks** they showed what is technologically and economically possible and needed on a bigger scale (**WHAT**).
- **Heating and Cooling Plans** then gave a technical–economical spatial plan of what solution makes most sense where (**WHERE**).
- Finally **Transition Roadmaps** to energy efficient, zero-carbon urban heating and cooling show how the transition can take place (**WHEN & HOW**).

Together, they will advocate for the needed changes to framework conditions.

Guided by two scientific partners and a distinguished advisory board, the project aims to empower more than 220 public officers and improve more than 50 policies. Ultimately, it strives to motivate and support more than 80 cities to start the same roadmap process.

FIGURE 1: TRANSITION MANAGEMENT KNOWHOW

Objective and purpose of this Deliverable

This report on *Peer-to-Peer learning* (*D.3.4.)* is based on the various peer-to-peer activities organised under *tasks 3.3 Peer-to-peer for cities* and *3.4 Peer-to-peer for utilities*. The aim of these two tasks was to provide cities and utilities with expertise from other cities, other utilities, and external experts so as to given them good examples and tips to move forward in the design and implementation of heat decarbonisation strategies. The focus was put on topics linked to different techno-economic choices possible for cities and utilities when planning to decarbonise their heating systems. Topics were chosen based on interest expressed by consortium partners and most common obstacles met by local authorities according to feedback from those same cities and Energy Cities' network.

This deliverable builds upon other deliverables developed under *Work Package 2 (Heating & Cooling Outlook 2050)* and *Work Package 3 (Exploring different techno economic pathways).* Examples featured in the different sessions should help cities designing and updating their heating plans, but also preparing their Transition Roadmaps.

The objective of this report is to give an overview of the main points which were discussed during the different sessions. It underlines the most meaningful experiences and provides good practices in topics which partner cities identified as recurring obstacles. The deliverable is thus mostly a collection of articles published on the Decarb City Pipes 2050 website, following peer-to-peer online sessions, workshops, or study visits organised or co-organised in the frame of the project. In this report links are added to the different articles and online sessions.

The report starts with articles related to the technicalities of energy modelling, spatial planning, and mapping and use of deep geothermal sources. These are followed by focussing on the issue of condominiums and finishes by focussing on specific measures implemented in different cities that affect entire neighbourhoods.

Part 1 - Technicalities

Potential of geothermal energy for heat transformation in cities

Geothermal energy is a key technology for realizing the urban heat transformation. As regards deep geothermal energy, it can feed existing or newly built district heating systems with renewable heat and thus replace existing systems based on fossil sources (e.g. used in CHP's).

Check out the strategies of three cities from the Decarb City Pipes 2050 project to learn more about the potential of geothermal energy for cities, and find answers to questions, like

- In what way and to what extent can geothermal energy contribute to implementing local heat transformation strategies?
- What are existing best practice examples?
- Which obstacles can local authorities face concerning the regulatory framework and city planning and how can they overcome them?

Shallow geothermal energy potential in urban areas: The example of Vienna

Vienna has a good potential of shallow geothermal in urban areas. To map it as precisely as possible and allow the municipality to make enlightened choices in its heat mapping, the Federal Agency for Geology of Austria explores existing resources for shallow geothermal energy and possible limitations. Cornelia Steiner, an expert in hydrogeology and geothermal energy working for the Federal Agency, gave an overview of the integrative management of shallow geothermal energy use, the Agency put in place. It created a web portal for shallow geothermal energy and gives a clear overview of existing installations in Vienna. Based on thermal groundwater use for heating and/or cooling or installed as borehole heat exchange, those installations rely on different hydro-geological conditions, based on the aquifer's groundwater characteristics.

A key source for information on integrating shallow energy sources in Vienna's heat supply is the project Spatial Energy Planning (SEP), which is part of the Green Energy Lab (http://www.waermeplanung.at/). It includes a traffic light map disclosing information on potential limitations for shallow geothermal projects. Challenges for mapping resources identified in Vienna are changing input parameters (which could be overcome by interactive maps), the quality of input data as well as limitations due to resources with competing usages.

Apart from shallow geothermal energy, Vienna is also looking into deep geothermal energy potential and installations as a solution for decarbonizing the city's district heat system. Deep geothermal energy can deliver higher temperature heat than shallow geothermal heat.

Estimating the potential of deep geothermal energy: Following the Dublin region's example

District heating has been identified as the key solution to decarbonizing the Irish heat sector in densely populated areas, and geothermal energy is going to play a fundamental role here. However, while shallow resources are relatively well characterized and accessible across the whole country, it is more complicated when it comes to deeper resources. To significantly increase the installed capacity, Ireland can build on a strong support for climate friendly technologies, strong local and internal geological networks, a dynamic geoscience SME sector and District Heating demonstrator projects underway.

In the course of building up a regulatory framework for district heating in Ireland, the government, together with Geological Survey Ireland (GSI) is examining the potential of geothermal energy to contribute to district heating and the development of a dedicated district heating roadmap. To tackle the lack of subsurface knowledge, GSI is looking into a deep geothermal pilot project in Dublin and has initiated the mapping of key data at national level. As research shows, potentials for geothermal heat in the city of Dublin, particularly in the South County Dublin, are significant. A demonstrator project would apply knowledge transfer in the EU-funded Hotlime project and could serve as best-practice example for other European cities.

To enrich this mapping, CODEMA and local authorities have shared their latest heat demand maps and studies as well as planners for urban subsurface management and district heating. For the heat transition it is important that heat supply and demand are matched.

Geothermal strategy and projects in Munich

The City of Munich, together with its publicly owned utility Stadtwerke München (SWM), is aiming for fully decarbonizing its (existing) district heat system by 2040. Based on new and even more ambitious climate goals of the city, the transition of Munich's heat sector, initially planned for 2040, will even have to be completed by 2035. Today, roughly about one third of Munich's households are connected to the district heating grid. Deep geothermal energy is already a reality in the city – and it will be the backbone of Munich's renewable heat supply of the future.

The area benefits from favourable geological conditions: thermal water in limestone layers ("Malm") in the subsurface of Munich's and its southern region, high temperatures of ~100°C and depths of ~3000 km under the city). Thanks to this, Munich is a true frontrunner in developing urban geothermal energy solutions. The city area already counts two installations in operation, and a third one will be connected to the grid in the winter season of 2021. This new plant, which will be built on the grounds of an existing CHP plant in the south of Munich, will have an installed thermal capacity of more than 60 MW, serve more than 80,000 people with renewable heat and will be Germany's biggest geothermal energy plant. It will largely contribute to SWM's plans of providing the major share of district heating with deep geothermal energy until 2040 (2035). More installations are already in the planning phase – including new installations in the city area as well as the connection of existing plants in the southern region to the city's district heating grid by new transmission lines.

Of course, there are key challenges to further realise the geothermal potential in Munich. The main one is linked to the specific requirements for building geothermal plants in dense urban areas, particularly regarding a lack of suitable areas and competition of usage (spatial planning). The question of high investment costs and risks comes second, followed by the need of high-quality data on the subsurface. To continue developing geothermal capacity, the next step will

be exploring the potential and feasibility of geothermal seasonal storage (aquifer storage), this makes it possible to use the geothermal source more efficient throughout the year. The Decarb City Pipes 2050 project allows the city to gather valuable information and provides an excellent network for proceeding both on the structural (city planning) as well the research side of geothermal energy.

Key takeaways

Looking at geothermal energy to feed your heat transformation strategies means involving different actors, with different roles and responsibilities. The city government, local (publicly owned) utilities and federal geological institutes have to work hand in hand to unlock the potential of geothermal energy for urban energy transitions in heating. It is also key to develop pilot projects to work on investment problems and a better mapping of data. When available, geothermal energy can be one of the fast lanes towards decarbonised heating systems.

To sum up:

- Geothermal can be an important heat source for decarbonizing district heating.
- Geological data gives insight on the potential of geothermal heat. Additional research (boreholes) is needed.
- Spatial planning is important, the borehole needs to be integrated in the cities' spatial planning.
- Seasonal storage can improve the efficiency of the geothermal source. This is, however, not possible everywhere.
- For a business case, it is necessary to have enough heat demand. This makes the process more complex: Not only does the source need to be developed but also at the same time heat demand (building district heating). Having an existing network and using geothermal heat to replace fossil based heat is, in turn, oftentimes easier.

The original article was published on the website of Decarb City Pipes 2050 on 6 May 2021. Presentations are gathered in the Library section of the website.

Spatial heat planning: A backbone for buildings' transition in our cities

Heating and cooling plans aim at providing guidance to citizens, local businesses and stakeholders on cost-effective solutions to switch from fossil-fuel boilers to low-carbon and renewable heating systems. They are a key piece to guide the actions and provide the direction for urban and energy planning. Because energy consumption, renewable and waste heat sources are different district-by-district, solutions should be analysed per area using spatialised data.

Making heat plans:
A number of parameters to consider

Rita Gnehm, an experienced energy and urban planner at PLANAR AG für Raumentwicklung, supports the heat planning of the city of Winterthur among others. She published the Guide for cities developing heating and cooling plans, explaining procedures and parameters to take into account.

Three main maps are necessary before drawing up a heat plan:

- The infrastructure map, showing heat networks and other energy infrastructures
- The heat density map, displaying existing and future heat demand of buildings
- Potential maps, providing the potential of energy supply from renewable and waste heat.

Furthermore, data on the buildings and local circumstances are also important (see Figure 2 below). Based on the spatial distribution of these data, it is possible to define which heating solutions are the most cost-effective for each city district.

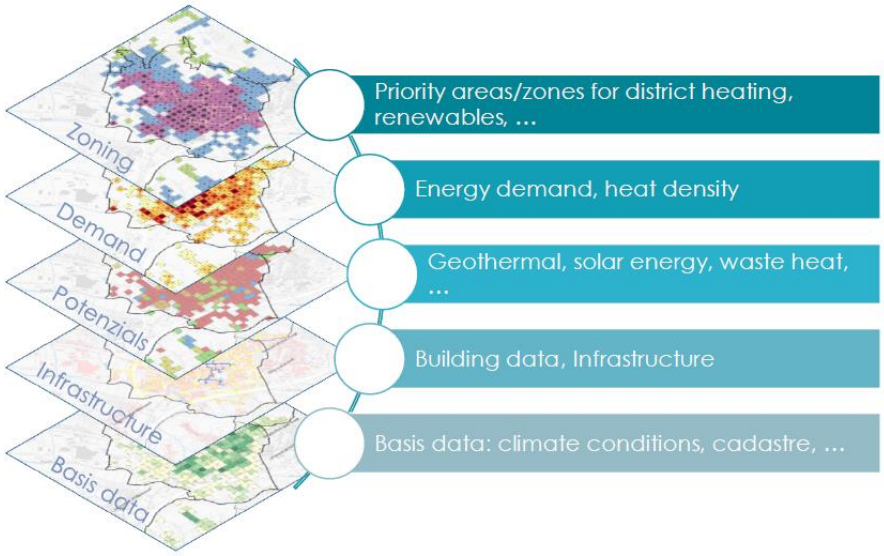
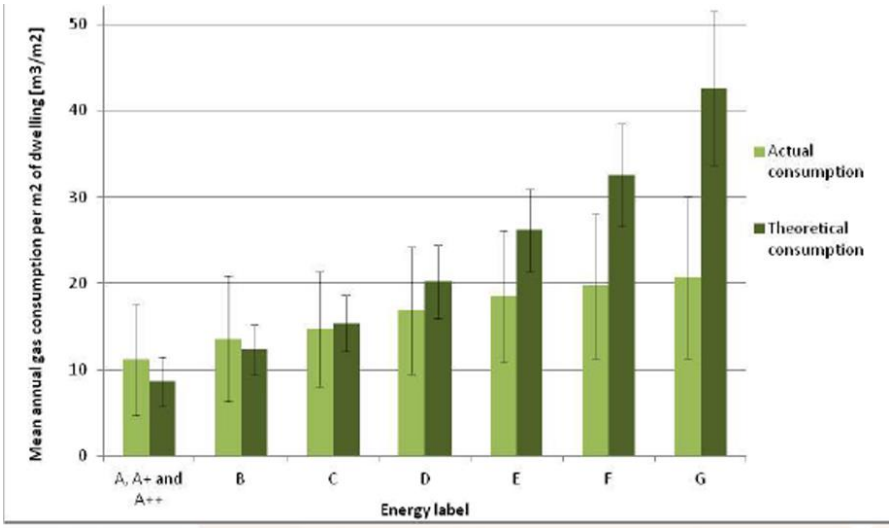


FIGURE 2: WINTERTHUR'S PROCEDURE FOR THE PREPARATION OF ITS HEATING AND COOLING PLAN (SOURCE: AEE INTEC)

Quality of the outputs is highly dependent on the quality and availability of data. To support cities, the above-mentioned guide proposes solutions for three different cases:

- Hardly any data is available, a complete estimation is necessary.
- Partial consumption data and/or combustion data is available.
- A digital twin is available (each building is mapped, if possible, with measured data).

Future heat demand density is derived from current heat demand, based on the building's age (construction period), the retrofitting rate and retrofitting depth. **It is key to consider a rebound factor when choosing the retrofitting success rate since theoretical savings are almost never realised**. In a Dutch study, a rebound factor of 25 or 30% was determined (depending on whether the building was owned or rented). Figure 3 shows that the actual consumption – especially in badly insulated buildings – is much lower than the theoretical consumption, mainly due to behaviour.



Bron: D. Majcen, L.C.M. Itard, H.J. Visscher, 2013, Energielabels en werkelijk energiegebruik

FIGURE 3: THEORETIC VS. ACTUAL GAS CONSUMPTION IN FLATS

Renovation rates also need to be sped up: In Switzerland, the energy-related renovation rate is currently 1% per year, but the national climate strategy aims at an annual retrofitting rate of 1.2% until 2040.

Heat demand density allows to estimate the potential of district heating development based on economic factors. **Experience has shown that the limit density for an economic operation of district heating in urban Western Europe is between 300 – 500 MWh/ha/year.** But it clearly depends on the types of district heating networks, on the types, prices and location of energy sources available, and on structural framework conditions (such as ownership structure and types of buildings, or typographical conditions).

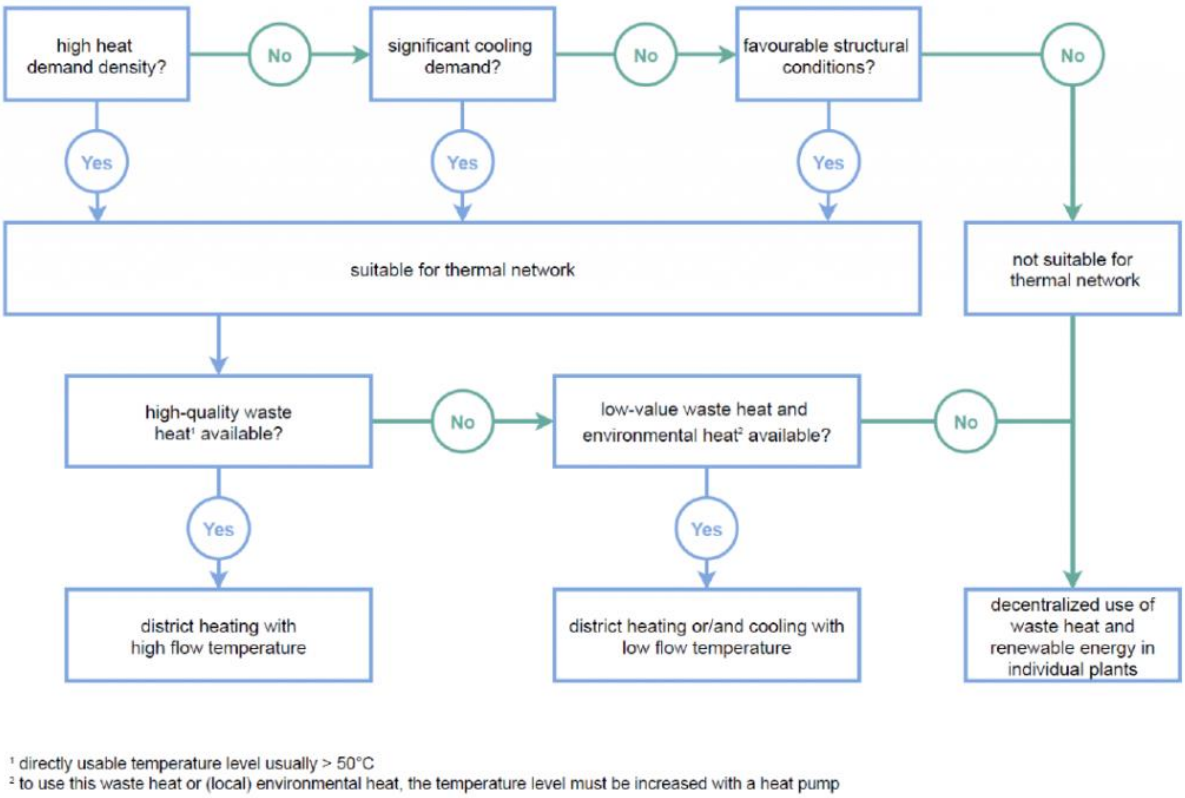


FIGURE 4: DECISION SCHEME FOR DEFINING A SUPPLY TYPE REGARDING HEAT DEMAND DENSITY, DEPENDING ON ENERGY DEMAND AND ENERGY SUPPLY.

Heat plans need continuous improvement to include latest developments

A first heating and cooling map doesn't need to plan all details. Further feasibility studies and pilot projects will help to sharpen data and adjust hypotheses for the next version. The City of Rotterdam is the perfect example that **heat planning is an iterative process.**

The first What-map, presenting the most cost-effective solutions to replace fossil gas boilers, was set up in 2018. In 2021, the city developed a more accurate version, presented by Lydia Hameeteman. This one is still based on the same methodology taking into account costs of investment for building insulation, of connection to networks and their expansion and reinforcement, of energies. However, it includes more detailed data regarding energy consumption, types of buildings, and costs based on on-going projects and new studies.

This is key for the city to show that Rotterdam always strives for the most accessible and affordable systems for citizens. The heat map provides transparent information to citizens about what would be possible in their neighbourhoods. Of course, local factors at building-level can always play a role in the eventual outcome, thus the map is a guide, not the final answer to how the transition will take place.

Stronger together in Rotterdam – The Hague: Heat planning at regional level

The same steps have been applied by the Region of Rotterdam – The Hague when defining its heat plan: analysis of heat demand, heat supply and heat infrastructure, without forgetting the conditions to implement the plans.

One of the main results of the Regional Energy Strategy 1.0 regarding heat is that cities of the Region will do better together: the development of a heat transportation network for several cities will reduce the costs by 25% compared to the scenario in which each city develops its own heating district network using limited local heat sources. The collective option also allows to cover more heat demand via district heating (from 67% to 80%), since it enables to use the waste heat from the port of Rotterdam.

However, techno-economic elements are not good enough: the right framework conditions are needed. According to Astrid Madsen, independent energy expert who supports the Region, the heat transition can be successfully designed if all parties are willing to participate. This can only be achieved by designing a supported approach for and by the parties throughout the value-chain of the transition, whereby:

- public interests are safeguarded,
- there is sufficient value for everyone, and
- the risks can be controlled during realisation and use.

This requires a proactive approach from the Region and the different cities to foster the regional cooperation, design effective laws, regulations and financial instruments, build and share knowledge among the parties involved. To safeguard public interest, debates are currently raging in the Netherlands concerning heat networks' ownerships. The government proposes that they should come mainly into public hands.

The original article was published on the website of Decarb City Pipes 2050 on 30 June 2021. Presentations are gathered in the "Library" section of the website.

The data-driven future of heat planning

Energy modelling is key for cities to get a good understanding of their energy demand and greenhouse gas emissions. Urban and energy planning decisions should be data-driven. But how can cities have access to good data on their building stock?

Three dimensions to consider in energy modelling

When working on heating and cooling planning, there are three key dimensions cities have to consider: the demand, the infrastructures and the supply side. Within the Decarb City Pipes

2050 project, our objective is for cities to decarbonise and find innovative heating and cooling solutions for their districts. It is therefore important to act on these three aspects, both in the long and in the short run. The demand side is the one that is more resistant to change. As most buildings are privately owned, cities face more difficulties to reduce the energy demand. In this article, we're taking stock of possible ways to obtain a spatial analysis for the demand side.

Energy modelling: A combination of top-down and bottom-up approaches

There are two main ways of mapping the building stock's energy consumption: the first one, a top-down approach, consists of collecting available aggregated real-consumption energy data, which are then split at district or building levels based on different parameters (e. g. building ages, building fabric, surface and height, heating systems etc.). This is often preferred when the data available is either not sufficient or at low granularity to estimate their individual consumptions. Another bottom-up approach consists of collecting the consumption of individual buildings or modelling them. In fact, energy modelling of buildings' consumption is often a combination of the two methods, depending on the type of data available, which can vary for the different energy carriers. This can also allow one method to help verify the accuracy of the other.

National legislations should enable access to data for cities

All too often, cities are dependent on the willingness of utility companies to share their real-consumption data at a good granularity (via non-disclosure agreement), unless the national legislation favours open data approaches. In the Netherlands for example, the legislation forces all energy utility companies to publish the effective consumption of small clusters of buildings, which are usually composed of 15-20 delivery points. More data is in theory available, but cannot be shared due to privacy legislation. This measure facilitates urban planning at district level by cities. The question of open access to data is also key regarding the energy supply side, especially for renewable energy potential. The Dutch legislation also allows cities to have access to a lot of data to estimate geothermal energy potential by binding oil and gas companies to publish the data from their exploratory studies of the underground.

Building archetypes and Building Energy Ratings as a basis for energy modelling in Dublin

CODEMA, Dublin's Energy Agency, aspires to a model based on public data and open-source development. Dublin's model employs especially-requested Small Area (80-120 dwellings) Building Energy Ratings (widely known in Europe as EPC) data for known buildings and data-driven archetypes for unknown buildings. The archetypes are developed by taking average building properties for each period of construction in each Small Area. In other words, unknown apartments built between 1970 and 1980 in an area of 80-120 dwellings are assumed to be equivalent to an archetypal, composite apartment whose properties are equal to the average of all apartments of that period in that area. An average is defined as the median for all numeric columns and the mode for all category columns (i. e. brick, stone walls etc). As the replication

of this methodology is somewhat onerous, CODEMA has built a web application to generate it automatically for any region in Ireland. This stock is being used as an input to a simple Resistance Capacitance building model (based on ISO 13790) to model retrofit scenarios. Manipulation of these scenarios will be possible via a web-based application which is being developed by the CODEMA team.

Commercial and industrial buildings are somewhat blind spots for the modelling as, unlike residential, only floor area information is available. As a result, floor area energy benchmarks are being used to estimate demand which is comparatively crude. Nonetheless, for the gas consumption, Dublin's archetypal approach is close to the real-consumption data disclosed by the gas distributor at district level, meaning that the methodology used is robust and a fair approximation of the reality.

Munich develops a 3D model of the city aggregating more than 100 data sources

To go beyond an archetypal approach, CODEMA would need better data on commercial buildings' geometry and fabric, which is currently not publicly available. From the point of view of building geometries, the OSM Ireland Buildings project is showing some promise in crowd-sourcing the mapping of building footprints. Reassuringly, the organisers of this project also verify the user-inputted footprints before deploying them to OSM. By making some assumptions about unknown building heights OSM Buildings creates a 3D web map of Dublin, however, it is missing fabric information and will be for some time without some investment in surveying.

Overcoming this data gap with assumptions, the REDAP project has opted to fill the commercial building stock with the most typical residential building properties in the immediate proximity of the commercial building.

Not content with this data gap, the Munich planners surveyed their stock to estimate periods of construction for each building, and further invested in the acquisition of a 3D city model via laser screening to know the exact volume of each building. The resulting map has been enriched with more than 100 data sources to provide a comprehensive picture of the building stock[1] by enabling estimation of each building's energy consumption (except for those owned by the city for which real-consumption data is available). It is also regularly updated with information about demolition of buildings, creation of new ones, and renewable energy production plants.

Energy modelling: A rising need for cities

The granularity of the modelling depends on the needs and data available: For overall city and district planning, aggregated estimation at the hectare level can be sufficient. On the contrary, data at building level is necessary to carry out concrete projects (such as district heating development). In any case, energy modelling is increasingly important for cities to get a deeper knowledge of energy demand, GHG emissions and their action plans' impact. These models should support data-driven decisions and the integration of urban and energy planning altogether, encompassing socio-economic aspects as well (such as energy poverty). In addition, data platforms are key tools to engage stakeholders and widely share knowledge to foster the

[1] These data sources include buildings' years of construction, city-owned buildings, underground data, companies' location, etc.

heating and cooling transition. Dublin and Munich address the matter respectively with Dublin Energy Webmaps and München Energie Portal.

The original article was published on the website of Decarb City Pipes 2050 on 22 July 2021. Presentations are gathered in the Library section of the website.

Accelerating the decarbonisation of district heating networks through mandatory connection

District heating is becoming an increasingly hot topic for municipalities. Latest revisions of EU legislations and plans to phase out (Russian) gas put it as a strategic component. Without making it a silver bullet, it is clear that district heating has a key role to play where heat supply is available and demand density is high enough to make it cost-efficient, in combination with other solutions. One option to accelerate its development can be to makeit mandatory to connect to the network for some buildings and areas. However, this may bring along as many opportunities and challenges than there are countries, and maybe even cities, in the EU!

This is what the Decarb City Pipes 2050 partners and stakeholders learnt during the capacity building session on 6 May 2022. Five speakers, from five countries, shared their own experiences and perspectives to give the best possible answer to the question: Is mandatory connection to district heating (DH) your highway towards fossil-free heat?

Starting with the obvious: Nothing happens without customers!

To quote Birger Lauersen from the Danish District Heating Association, there must be a district heating network for customers to connect to it, but there has to be customers for a district heating network to be developed. This chicken-egg problem was addressed quite early in Denmark, in the 1970s, as Lauersen presented it. Mandatory connection to district heating was early seen as the best way to reduce the Danish dependency on imported oil. Local authorities were able to define areas in which connection to district heating were mandatory for all buildings, once the network was built. This came with a comprehensive consumer protection. In the 2000's, under liberalisation' pressure, the possibility to define new areas for mandatory connection were taken away from municipalities, although within the existing defined areas, new buildings are still obliged to connect. Today, to develop district heating in new areas, cities, still in charge of DH development, need to convince 60% of customers to sign up beforehand and commit to connect once it is built, ensuring financial viability. However, the consumer protection laws are still in place, to limit the potential damages consumers could encounter.

Main highlights

- In Denmark, consumer protection is ensured through the true-cost principle (only costs incurred to deliver the service can be asked to consumers). In addition, district heating companies are mostly citizen- or municipally-owned and tend to be less profit-oriented. Thanks to this, consumers are protected against abuse of the natural DH monopoly, because there is a cost-based pricing. To help ensure efficiency, DH companies are voluntarily benchmarked against each other on an annual basis.
- The current energy crisis puts more tension on district heating networks, with an increasing number of citizens who want to be connected: 80% of DH customers haven't experienced prices' increase during winter 2021-2022. However, it requires time to make it possible to build the connection or extend the network. This is sometimes too much time for people who then opt for another, individual option, which threatens the remaining ones either to be locked-in a fossil system or to see increased costs for the district heating. To address this, regranting power to municipalities to define zones for mandatory connection to DH is under discussion.

Municipalities require the right national and regional frameworks to deliver DH at best

In **Germany**, local authorities do not have a specific legal instrument for district heating, but can use a general tool called ABZ (*Anschluss- und Benutzungszwang*, or compulsory connection and usage), which was presented by Sören Damm from AGFW, the German Energy Efficiency Association for heating, cooling, and CHP. Each ABZ varies according to municipalities, but they must all depend on a municipal entity and serve a legitimate public objective. Introducing an ABZ for mandatory connection to district heating in Germany is a long and difficult process for a municipality, with the risk of long legal procedures. However, an ABZ can also be enforced at regional level, which was done by the Baden-Württemberg region to make it easier for cities of the region to enforce it on their territories. The region recognised district heating as a key tool to reach climate protection, an evident objective of public interest. However, some conditions apply like having an efficient district heating, as defined by EU regulations.

Main highlights

- The municipal entity in charge of the district heating network defines a scope for the connection to be mandatory (which area, which buildings, what is efficient district heating etc.), the exemptions, and the enforcement conditions.
- Despite an ABZ, the timing for connection can nonetheless be very long (from 5 to 20 years according to what the city decides and can do), thus cities often use it as an incentive for building owners, but rarely enforce penalties to them.
- In addition, exemptions are often, in practice, a long and detailed catalogue which significantly limit the implementation of the ABZ, and thus the business model of the district heating system.

Joël Ruffy, from AMORCE, presented the new connection obligation scheme at national level in **France**. Since 2022, all French municipalities who own district heating networks have to define mandatory connection zonings to district heating if: 1) the district heating network uses at least 50% of renewable or recovered energy sources, 2) heat deliveries are metered (sub-station), and 3) there is a financial balance in the operations. 550 public networks meet these criteria and can benefit from this tool to be expanded – private networks are not eligible. However, local governments can refuse to use this instrument. Buildings located in the mandatory connection zonings will have to be connected unless they can prove there is another more environmentally friendly solution, the cost of connection and/or of heat is disproportionate, or that it is technically impossible to implement it.

Main highlights

- The mandatory connection to district heating framed at the national level will help France accelerate the deployment of its networks, which should be doubled or tripled by 2030 to meet the national targets.
- Local authorities have thus a legal mandate to make it mandatory for buildings to connect to the network. Respecting the obligation becomes a *sine qua non* condition to obtain the construction permit for new buildings.
- For existing buildings, the obligation only applies if there is a need to change the main components of the current heating system. However, as buildings' owners don't have the obligation to declare their heating system changes, cities are unable to control, and the enforcement relies on the goodwill of buildings' owners, despite cities' publicity of the measure.

Municipalities are central actors to organise the market

The question of investment is always a sensitive question when discussing district heating networks. Mai Muhammad, from the City of Aberdeen, presented the freshly designed strategy of the Scottish government to tackle this issue. **Scotland** published a Heat Networks Act aiming at fostering the development of heat networks in the country. It introduced the notion of heat network permits, which were intended to help de-risk investment by providing a degree of certainty with regards to the likely customer base. Permits would be awarded, following a competition, to a single, winning bidder providing exclusivity to develop heat networks in some districts for a specified number of years. In parallel, the Act also introduced transfer schemes, to ensure continuity of supply for consumers and enabling a smooth transition between operators if an operator would cease activity. In parallel, the Heat Networks Act tasks municipalities to assess techno-economic feasibility of buildings to be connected to district heating and to deliver licences to DH operators to guarantee their capabilities. Only licensed DH companies can join bidding competition to get DH permits.

Main highlights

- The Scottish Heat Networks Act will give a solid reference framework for investors and operators, and additional powers and tasks to municipalities.
- To cover the costs of these activities, the Sottish government will publish a Local Authority Cost Strategy before the whole regulatory system becomes operational in 2024. It will favour cooperation between local authorities and stakeholders to ensure the provision of relevant resources, for local authorities to meet their duties under the Act.

The tricky question of acceptance

Municipalities can set up all the conditions to make connection to district heating mandatory, but one challenge remains: the acceptance of this obligation. This can prove more complex when private companies are the grid owners and operators. Niels Hanskamp, from the Association of Dutch Municipalities (VNG), gave an overview of how this issue could become a major one, should mandatory connection to district heating be voted in the Netherlands.

Currently, the district heating infrastructures are mostly owned and operated by private district heating companies. It makes it very complicated to quantify the profits made by those actors, and municipalities who have no other solution but to rely on those companies to develop the network. To accelerate the gas phase-out, a new district heating law is discussed in the Netherlands, which may decide to introduce mandatory connection to district heating. However, public opinion is reluctant, and regulators are cautious not to ensure monopoly rents to private actors. Municipalities are calling for installing cost-based tariffs and for transferring grid ownerships to public actors to provide more transparency. This could be made progressively during a transition period of 20 years.

Main highlights

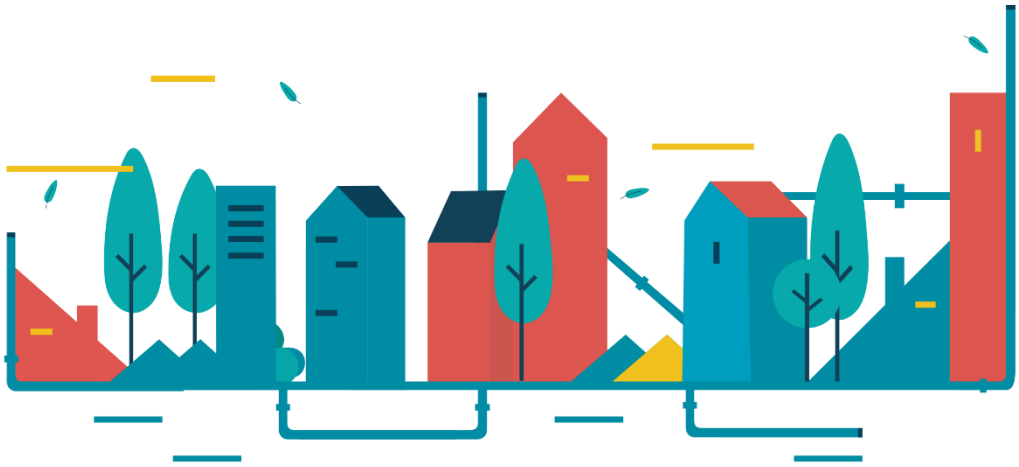
- Mandatory connection to district heating can be a way to expand the network but should be associated with transparency measure to foster public acceptance, as well as cost-based tariff.
- This increased transparency may encounter resistance amongst private companies, lead to an increased renationalisation of the network, and push district companies to focus on grid operations without being the grid owners. However, the period covering the transition may bring to delayed investments from part of the private sector and thus make the costs for the municipalities more expensive, with a decreased efficiency.

So, what's in it for municipalities?

- Mandatory connection to district heating can encourage the development of renewable heating, as seen in France, Denmark, and Germany. However, there are still barriers to be overcome. Those obstacles and opportunities especially vary from one national framework to the other.
- Despite the different exemptions which may exist, mandatory connection can really help in steering the process and rethinking supply in cities. However, this is no silver bullet. Access to data and enough human resources for cities to enforce this obligation is especially key.
- Beyond national regulation, cities must have a proactive approach to the topic to really accelerate the transition. A strong EU political framework can also help support cities in this process, such as the revision of the Energy Efficiency Directive, which gives an important role to district heating to reach higher targets of heat decarbonisation. In addition, the revision of the Energy Performance of Buildings Directive may also be a catalyser to better frame the conditions under which connection to district heating networks should be mandatory.
- This is not only about making the connection mandatory, but about a holistic approach. The system cannot be successful if it does not consider the planning, economic, business, and customer side. The question of transparency and sharing of benefits can - with the right incentives - be a game changer.

The original article was published on the website of Decarb City Pipes 2050 on 3 October 2022. Presentations are gathered in the Library section of the website.

Part 2 – Condominiums and multi-owner buildings



There is no technical barrier to remove individual gas boilers in condominiums!

A number of cities' strategies to decarbonise heating in existing buildings rely on energy efficiency measures and replacement of fossil-fuel boilers by heating systems powered by green energy, such as heat pumps and district heating (DH).

This replacement can be done relatively easy in social housing flats with collective (gas) heating, however the challenge is bigger for multi-apartment buildings in which each flat is equipped with an individual gas boiler[2]. In particular, it requires important piping work in buildings. In the following chapters, we will therefore explore the question of which smart technical approaches and solutions exist in condominiums to phase-out natural boilers.

Connection to district heating is the cheapest option to replace individual gas boilers in Vienna

In a study commissioned in 2020 by the energy planning department of the City of Vienna, Peter Holzer, working for the Institute of Building Research and Innovation, evaluated different options to replace existing gas boilers in condominiums:

- Connection to district heating,
- installation of collective pellet boiler,
- collective air-source or geothermal-source heat pump and
- installation of individual heat pumps.

Based on the examples of eight existing multi-family buildings in Vienna (plus six modelized buildings) and the prices from 2020, the average costs of the work range from € 85/m^2 to €210/m^2, *i.e.*, from € 6,000 to € 14,700 per flat.

[2] Replacing fossil boilers in individual houses (ground bound) is in most cases also quite complex. Even though one may have to deal with less owners (easier to make a decision, necessary for such building activities), you might still need to do some "re-piping" in the building.

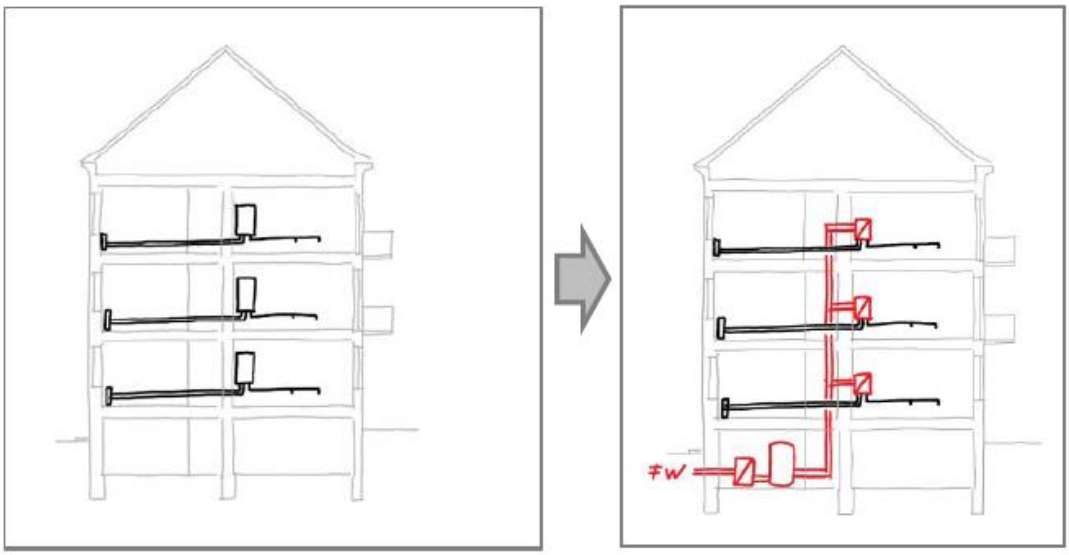


FIGURE 5: SCHEMATIC OF SWITCH FROM GAS BOILERS TO CONNECTION TO DISTRICT HEATING (IN RED: NEW EQUIPMENT NEEDED: PIPES, HOT WATER TANK, SUBSTATION).
SOURCE: IBR&I INSTITUTE OF BUILDING RESEARCH AND INNOVATION, VIENNA, AUSTRIA

The cheapest option is the connection of the building to district heating, while the most expensive is the replacement of gas boilers with individual heat pumps. Connection to district heating allows to keep using existing radiators most of the time if the district network provides water with a temperature higher than 70°C. Another learning is that there is no significant difference in cost between the installation of individual and collective heat pumps. Specific difficulties may arise for the replacement with heat pumps, such as the need to replace existing radiators with ones that can run on low-temperature, or to install heat-pump condensers on the roof because of the lack of space or noise issues. This would increase average costs by around €35/m^2.

On the other hand, switching to heat pumps can offer the opportunity to provide cooling by installing reversible heat pumps. Watch the recording of the study presentation here!

Innovative approaches can reduce costs of piping works to connect multi-family buildings to district heating

The main cost to connect condominiums equipped with individual gas boilers to district heating is the installation of water pipes between the flats and the district heating substation. To reduce this cost, Sozialbau AG, the biggest not-for-profit housing association in Austria, reuses old chimney ducts wherever possible to install water pipes while reducing impacts on tenants.

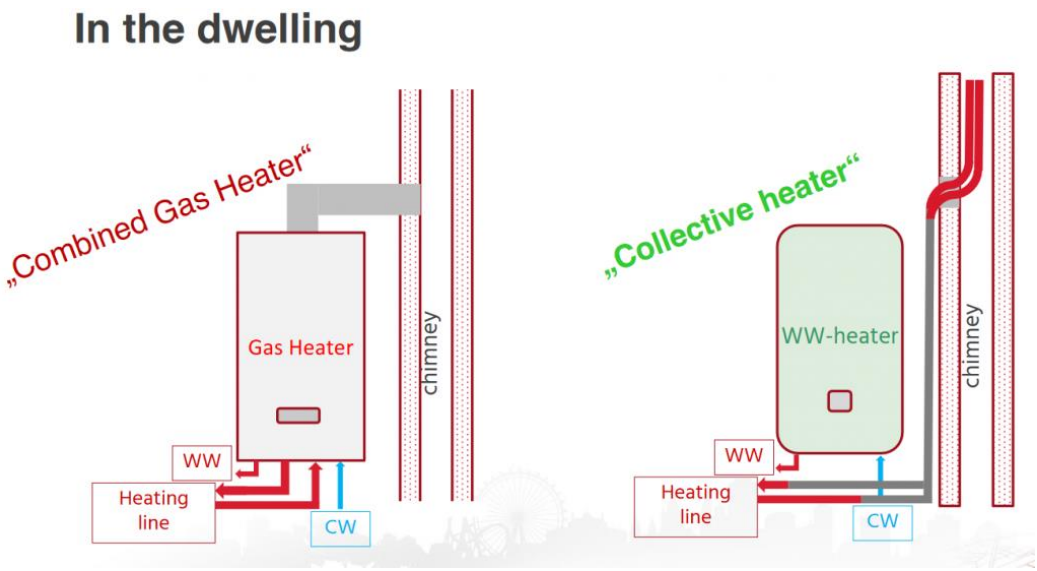


FIGURE 6: SCHEMATIC OF SWITCH FROM GAS BOILERS TO COLLECTIVE HEATER (RADIATORS ARE CONNECTED TO COLLECTIVE HEATER VIA THE HEATING LINE GOING THROUGH THE CHIMNEY DUCT, GAS HEATERS ARE REPLACED BY ELECTRIC BOILERS FOR HOT DOMESTIC WATER). SOURCE: SOZIALBAU AG.

To reduce the costs of the water pipes' installation, Mijnwater utility designed an **innovative prototype of an external column to be installed in front of each building to connect district heating networks coming from the street to each individual flat at each storey**. The Mijnwater concept is based on a very low-temperature district heating network (around 15-25°C) combined with individual heat pumps to boost water temperature to 60°C, allowing very high energy performance. While this concept of an external column has not yet been implemented, Mijnwater is confident that it can be a cost-effective solution because this is a modular approach based on industrially prefabricated elements which can be easily adapted to all types of buildings.

Key takeaways

The removal of gas boilers in condominiums is without exception technically possible! There may be challenges, but there is no technical impossibility. **While technical innovation is always needed, the main obstacles are financial and regulatory, which should be treated via political decisions and appropriate legal frameworks**. Some adaptation of building codes and urban plans might be needed to facilitate the installation of decarbonised heating systems (for instance heat pumps condensers on roofs). More difficult are the financial issues to ensure a just transition and provide the means for vulnerable households to pay for the installation of new systems. Another regulatory change is often the acceptance of reluctant tenants to switch to new fossil-free heating systems, even when the majority of them are ready to start a renovation process. However, strategies exist for cities to boost condominiums' renovations!

The original article was published on the website of Decarb City Pipes 2050 on 4 June 2021. Presentations are gathered in the Library section of the website.

Decarbonising condominiums requires dedicated strategies - and new laws!

Condominiums represent 40% of housing in the European Union. They are a key concern to achieve the decarbonisation of our cities. Because of their fragmented ownership structures, dedicated strategies for this stakeholders' group are necessary, as well as regulatory change to ease the decision-making process of owners to switch to sustainable heating appliances.

Connecting multi-family houses to district heating systems: A much-needed task but not an easy one.

Decarb City Pipes 2050's city partners plan to heavily rely on green district heating systems for their future energy supply. Munich, for instance, is envisaging to connect more than 20 000 buildings to its district heating (DH) network by 2030. Most of them will be multi-family houses, which also represent the larger part of the building energy demand. City centres with large housing buildings present a high heat-demand density, which is a key condition to develop economically viable DH networks. However, it is incredibly difficult for a group of homeowners to get the necessary approval for retrofitting works (including change of heating systems) and achieving such projects is often complicated as it involves a large number of people, with different interests (such as owners living in the buildings and the ones renting their flats).

To discuss this issue of supporting condominium retrofitting, we invited the city of Frankfurt to present the lessons-learnt from the Interreg North-West-Europe ACE-Retrofitting project. This project, implemented from 2016 to 2020 in six cities, led to the adoption of 400 retrofitting plans, the coaching of more than 80 000 co-owners and 4 000 professionals of the building sector.

How to succeed?
A holistic and tailor-made approach.

The approach developed by the ACE-Retrofitting project is a multi-pronged strategy that targets homeowners, retrofit professionals and financiers, and aims at linking them to cultivate trustful relationships. To overcome the lack of knowledge from co-owners and the uncertainties around the benefits of building renovations, coaching activities and step-by-step guidance were highly valuable. Cities can play a key role in increasing the confidence of owners by providing them with neutral and clear information, organising experience sharing opportunities, visits of successful projects and raising-awareness campaigns. They can also support co-owners throughout the tendering process and the development of masterplans which do not only include energy-related works (safety, comfort, IT, etc).

Retrofitting works in multi-family houses involve a large number of players from the private sector: construction companies, energy service providers and financers, audit service companies, etc. And these professionals are very often not used to working with this particularly complex building segment. To tackle this, cities of the ACE-Retrofitting project set up an online

professional directory, encouraged professionals to sign a charter for quality works, disseminated case studies, offered training and developed working groups. The city of Frankfurt even created Germany's first quality-controlled directory of building professionals for condominiums! Finally, Aberdeen, Antwerp, Frankfurt, Liège, Maastricht and Paris designed online matchmaking platforms to connect homeowners and professionals[3].

Change of regulatory framework for the homeowners' decision: The example of Germany

Retrofitting decisions, including the switch to district heating and cooling (DHC) systems, often require by law very high approval rates (in many countries up to unanimity), which most often prevents the adoption of retrofitting plans. In Germany, before December 2020, any "structural change" of condominiums (including retrofitting projects and renewable energy production) required a "double qualified majority", i.e. two-third of all ownership shares and of all owners. Since then, a new federal law states that a simple majority of the owners attending the homeowners' assembly can take such a decision[4].

It is too soon to know the impact of this new law, but this is a step in the right direction. Yet, the entire regulatory framework still presents barriers to the roll-out of fossil-free and efficient DH systems in cities. In Germany, DH operators have to present to homeowners a comparison of the costs of DH systems and the current heating systems of buildings before establishing any connection. This often leads to comparing greener DHC systems with gas boilers, which doesn't make sense as such calculation does not integrate any carbon taxes on gas boilers.

We should instead compare decarbonised heating solutions between themselves, and consider the financial aspect for the society as a whole and not only for the end-users!

The original article was published on the website of Decarb City Pipes 2050 on 17 May 2021. Presentations are gathered in the Library section of the website.

From individual gas boilers to a centralised renewable heating system? Challenge accepted!

The question of decarbonising condominiums, especially when each flat has its own boiler, is coming back over and over, because it is a sensitive one. With the ambition of being climate-neutral by 2040 and a big history of social housing, the City of Vienna has a lot to share and teach us!

[3] Find out more in the Guidebook for local authorities that illustrates common success factors and practical experiences from the cities (available in English, Dutch, French and German).

[4] However, the costs of the measures are only distributed among the owners who agree on them, with two exceptions: if the measure is amortised within 10 years or if the owners' meeting resolves the measure at a cost that is not disproportionately high with a majority of 2/3 of the votes, then costs are distributed among all owners.

More than a century of experience with social housing.

In the early 1920s, Vienna has been developing its social housing programme. A century later, almost half of the Viennese people live in one of the 420,000 subsidised dwellings, and Vienna is considered one of the most liveable cities in Europe. The municipality owns slightly more than half of the dwellings, while the rest are co-operative flats built with municipal subsidies. However, this great model dating back to a time when fossil gas did not sound like a bad idea is now facing the issue of urgent decarbonisation. Even though the city has put forward a plan, the issue of decarbonising condominiums, especially when inhabited by citizens from lower income groups, is not an easy task. And yet, some actors of the social housing market are not afraid to face the challenge.

Sozialbau AG is a not-for-profit Austrian housing associations. Its activities cover around 53,000 dwellings, representing 120,00 inhabitants (7% of Vienna's population!). Around 11% of the properties for which they are responsible are heated by individual gas systems. In 2018, Sozialbau AG started reflecting on how to propose decarbonised centralised heating systems to their customers, seeing the necessity to embrace the energy transition**.** Replacing 6,000 gas boilers is, however, not easy, especially when you have to convince every single tenant. So starting early was part of the strategy.

The attic, the chimney, and the heat pump: The perfect combination.

After a careful study of possibilities, Sozialbau AG first started its strategy to phase out individual gas boilers in 2019 with dwellings in Miesbachgasse in Viennas second district. The reason for starting here was simple: every flat had a chimney flue, which would make the whole process easier. In every flat, the individual gas boiler was replaced by an electric boiler, connected to the central one in the attic through the chimney flue.

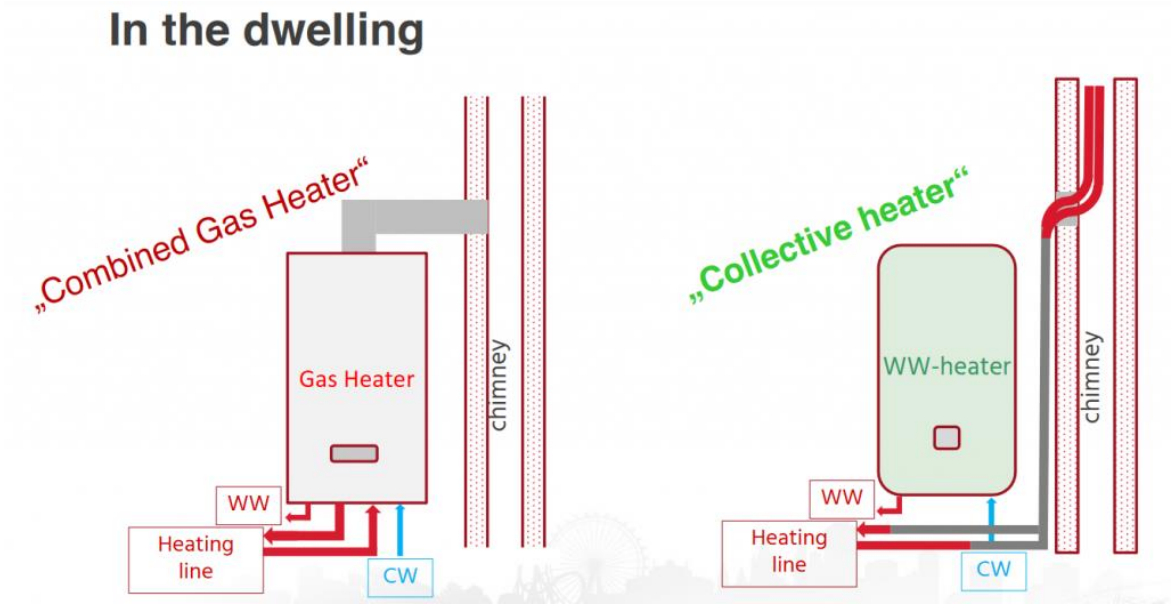


FIGURE 7: FROM INDIVIDUAL GAS BOILERS TO CENTRALISED ELECTRIC ONES ©SOZIALBAU AG

A gas heater would remain in case the heat pump would fail (which only happened once out of three winters, because of extraordinarily freezing days). The most challenging was not the technical part, but actually finding qualified workers. Often, standardised, fossil fuelled systems are pushed because they are thought to be easier to install and maintain – and mostly because workers are used to working with gas boilers. Vienna has some training centres which can now be used to familiarize everyone with the different technologies and accelerate the replacement of gas boilers.

In terms of installation costs, it could vary between €3,300 and €5,200 per flat, with a support of €5,000 maximum brought to residents thanks to the savings from the property. As regards the heating costs, they depend on a heating cost metering system and they are billed to each tenant independently.

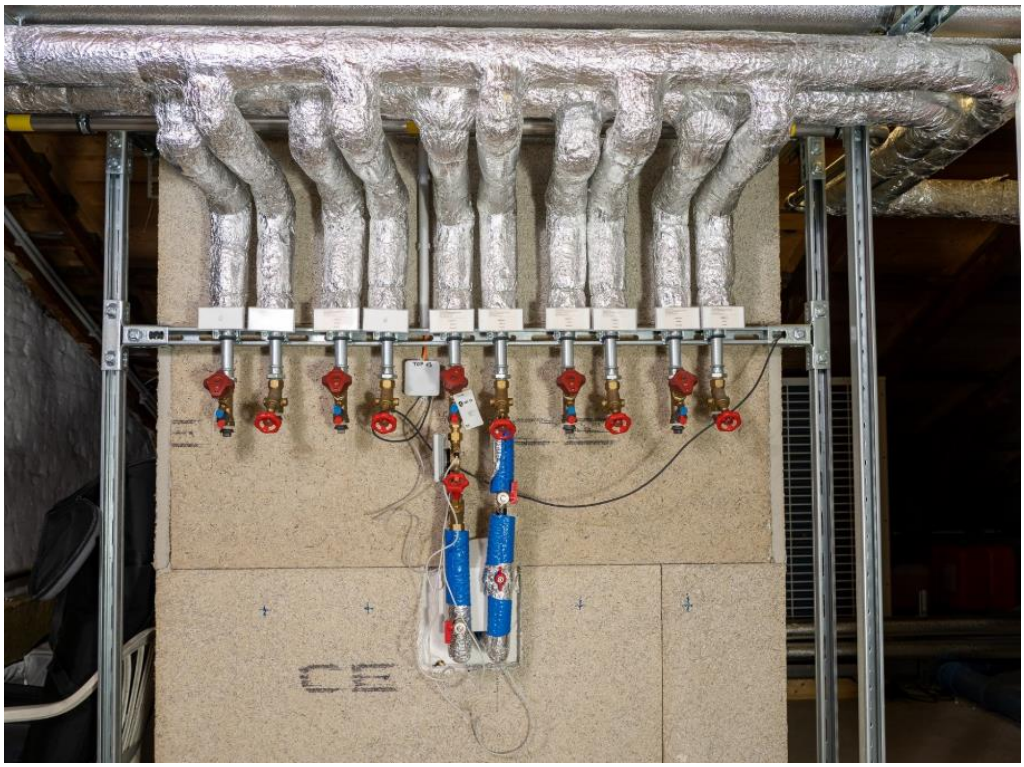


FIGURE 8: PIPES FROM EACH FLATS CENTRALISED IN THE ATTIC ©SOZIALBAU AG

Working together with tenants: The key to success.

Although discussions with tenants took place before the work began, particularly about Sozialbau AG's corporate values in the fight against climate change and the associated philosophy, most of the dissemination and exchange took place after the heat pump was installed in the attic. That helped make it visual and real. A brochure was then designed and distributed to each tenant, and a customer help desk was set up to make it easy for tenants to make appointments and ask any questions they might have.

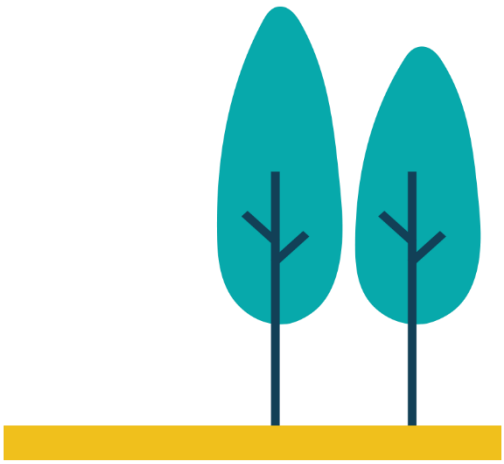
The major game changer was when they released a short video of two minutes, shot as an action film, which showed how quick the intervention of the workers in each flat would be. Since the interruption of residents' private space was the main concern for tenants, they were all relieved to see that the average time per flat would obly be between 3 to 5 hours. In one apartment after another, the gas boilers are now being removed.

Main takeaways

The initiative taken by Sozialbau AG has proven to be fair and inclusive, and a huge part of this is due to good communication with tenants, using different channels and formats. The decision to start planning early and going one flat after the other also contributed to streamlining the work and avoiding too many bottlenecks. This solution can be easily replicable for any building with a chimney flue – but it means finding ad hoc solutions for the others. Sozialbau AG is nonetheless showing the way towards decarbonised heating systems in social housing.

This article has been written following the first in-person project meeting in Vienna in 2022 and the Decarb Cities Conference, which Energy Cities co-organised.

Part 3 – Examples in neighbourhoods



Positive Energy Districts – a good motivation to decarbonise heating systems

Positive Energy Districts (PEDs) are urban neighbourhoods that generate more renewable energy than they consume. At a time when European cities are trying to get rid of fossil fuels, implementing PEDs sounds attractive. But how? The City of Vienna, member of the Decarb City Pipes 2050 project – and also involved in an EU project linked to PEDs (Cities4PEDs) - shared its experience, together with other cities like Brussels, Delft, Lille, Lyon, Stockholm, and Valencia, during a workshop organised in the frame of Energy Cities' Annual Conference in Brussels in April 2022.

The need for urban planning and a transformation of the construction sector.

Although they often require an important mapping work of existing buildings and resources, urban planning instruments such as renewable energy production or heating systems regulation can boost PEDs' development. In fact, defining different zones in urban plans allows proposing different solutions or setting requirements adapted to the specifics of each district. Nonetheless, pushing for diverse obligations, such as connecting to district heating systems or switching to renewable-based heating appliances, needs to be accompanied by strong communication towards urban developers and citizens to guide them in this pivotal shift. In this vein, the City of Vienna developed a service platform to guide citizens, listing (among other things) trusted companies to potentially collaborate with.

Furthermore, to achieve PEDs, a transformation of the construction sector is needed. The Municipality of Lille understood this and initiated a process of co-creation with local developers and designers, to constitute together the collective basis for the Low Carbon Pact. Another issue is that, all too often, building developers miss the targets they were required to achieve: the results of buildings' energy consumption can be assessed at the earliest, one or two years after the new owners live in the building. The problem? The developers are then not legally liable anymore. To overcome this, Stockholm developed an ambitious and compulsory capacity programme for developers, to push them towards higher achievements. All developers to whom land has been sold in the Royal Seaport District are required to share their approaches and monitor their results. The city also publishes the results of the building performances to incentivise developers: monitoring the results and analysing the reasons for failures are key for improving results!

The city of Delft, on the other hand, developed a series of measures ranging from a continuous communication campaign to investing in its own real estate, subsidising businesses and setting clear deliverables for social housing companies. For newly built districts, it is possible to recognise many strategies to transfer high ambition to developers. When it comes to existing districts, experimentations still need to be implemented to better understand which levers need to be pushed to accelerate and constitute different types of supportive systems for the renovation of our built environment.

Dedicated and skilled human resources as a precondition

Decarbonising buildings, setting up strategies for district transformation, and multiplying PEDs in cities is a marathon. It will only be achieved through a multi-pronged strategy covering citizen engagement, collective renovation, urban planning instruments, activation of building developers and specific organisation of local governments. But mostly, it requires skilled and numerous human resources in city administrations in the long term to drive strategies, trigger projects, motivate stakeholders and support citizens.

As Etienne Vignali from Lyon Confluence puts it, “the most important is not the legal status and the governance model chosen, but the dedicated people who are working to decarbonise our districts”.

This article is based on a workshop organised during Energy Cities Annual Conference in Brussels on 20 April 2022.

Playing with local resources for an efficient heat decarbonisation

In May 2022, Decarb City Pipes 2050 organised a consortium meeting in Vienna the same week as the Decarb Cities Conference, which was co-organised by Energy Cities. It was an opportunity for partners to take part in a side visit, organised by Wien Energie, Vienna’s utility, and have a look at Therme Wien – not only to enjoy some relaxing moments, but to check the impressive heat pump in the depth of the building!

Heating a neighbourhood with… bathwater!

Residents of the Oberlaa neighbourhood could already benefit for decades from the nice thermal baths to enjoy some relaxing moments. But what was unknown to them, is that a lot of thermal wastewater represented a real potential for additional use! That is why Wien Energie, Vienna´s energy utility, decided to take a closer look at the site and take advantage of this resource to move further in the decarbonisation of the territory.

In light of such potential, Wien Energie decided to dig further into a possible use of this local resource and came up with an idea: to use the residual heat of the thermal wastewater to supply a newly built district heating through a heat pump.

Since 2022, a heat pump is recovering the waste heat and around 1,900 houses in the Oberlaa area are now benefitting from the heat provided by Therme Wien.

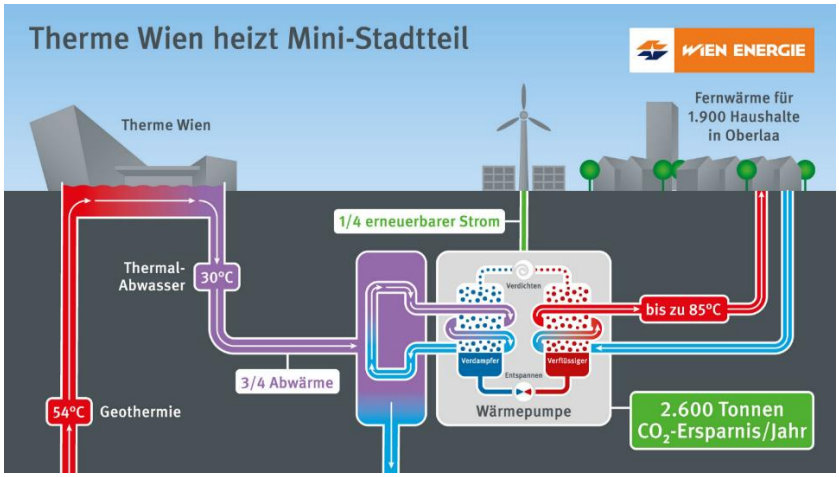


FIGURE 9: FIGURE 9: HEATING SYSTEM FROM THERME WIEN (SOURCE: WIEN ENERGIE)

The warm wastewater enters the heat pump at a temperature of around 30 °C and is then delivered to households at a temperature of up to 85 °C. Thanks to this infrastructure, 2,600 tons of CO_2 are saved every year.

The role of district heating in Vienna's decarbonisation strategy

To be climate neutral by 2040, Vienna will have to transform itself in an integrated way, redirecting 2 to 3% of its GDP to this objective (estimate and numbers from 2021). A Green New Deal for the City is being put together, looking at system integration for a global decarbonisation of Vienna. Huge investments will thus be needed. By 2027, they are foreseen to be of €1.29 billion, amongst which €625 million just for the heat transition and €334 million for renewable energies. The sole solar sector should be boosted by 16 times by 2030. Decarbonising the whole energy system, as underlined by the city of Vienna, implies "learning to think post fossil": substituting sources and reducing energy consumption will be key.

Despite the foreseen population growth, the renovation rate should lead to a decrease of heat demand by 18% between 2019 and 2040, with a total phase out of gas by 2040. Decarbonisation should mainly happen through the increase of the role of electricity (multiplied by 2.5 between 2019 and 2040, from 1,900 GWh up to 4,800 GWh). The role of biomass will remain limited and even slightly decrease, while district heating will keep its prominent position, increasing over the period from 5,500 GWh to 6,300 GWh. The energy supply of the latter should rely evenly on heat pumps (25%), waste incineration (25%), geothermal (25%), and green gases to cover peak demand (25%). The City of Vienna stated in its Climate Roadmap (2022[5]) that green gas is to be available only for co-generation plants and other energy-efficient applications but not for heating buildings or supplying hot water.

To maximise the chances of its strategy to succeed, Wien Energie plans to establish a benchmarking, to compare itself with other cities and utilities on the decarbonisation path. The general aim would be then to foster collaboration amongst cities, to support each other and accelerate the transition at local level.

This article is partially based on this original article published on the website of Decarb City Pipes 2050 on 17 May 2022. Presentations are gathered in the Library section of the website.

[5] City of Vienna 2022: Climate Roadmap, https://www.wien.gv.at/english/environment/klip/program.html

Inclusive decarbonisation: The ambitious Lokstadt project in Winterthur

November is not usually considered a month to lift spirits. The city of Winterthur, Swiss partner of the Decarb City Pipes 2050 consortium, proved that this is not always the case. Colleagues there invited the project partners on a refreshing study tour of their emerging ecologically responsible neighborhood, Lokstadt.

A new neighbourhood strongly anchored in the history of the city.

The Lokstadt project is located on a part of the old site of the diesel engine maker Sulzer and the Swiss Locomotives & Machines factory (SLM). The industrial site, with a long history of production, was founded in 1834 and operated until 1989. Once shut down, Sulzer, still owner of the space, tried and find a way to bring back life in the area. After two first failed attempts in 1990 and 1992, the first successful housing project was awarded in 1999 and saw, in 2004, the "Kranbahn" housing project coming out of the ground. This marked the start of a new use of the area, with the construction of a building for the city government and the refurbishment of the former test facility for gas turbines into a school for health sciences.

In 2010, Sulzer Real Estate was bought by the company Implenia, which launched a new architectural competition to continue reviving what was to become the Lokstadt site. After a popular vote in 2015 to approve the public neighbourhood development plan, the first batch of constructions was realised between 2017-2020, all bearing names of former locomotives to keep the spirit of the old site. By 2026, the overall Lokstadt project will be finalised.

A space thought for living

The overall neighbourhood mixes industrial and modern style, keeping the spirit of the former area while bringing in a fresh touch. Beyond the past, the Lokstadt project aims at bringing back life to the present, through diversifying the use of spaces. Of the available 131,000m² above ground floor area, 21,000m² are reserved for outdoor space, including meeting places echoing the fora back in Roman times. The rest is occupied by residents and professionals. In total, 31 shops, SMEs, and restaurants are located in the site, to make sure that there are activities going on all around the day and favour exchanges. In terms of housing, 750 apartments, which will be able to welcome more than 1,500 people are being built, and 30% of the residential surface is reserved for residential housing.

In addition, a 100-meter tower, the Rocket, is under construction, to host 206 flats and 138 hotel rooms. This will be the tallest hybrid construction of the neighbourhood, mixing wood and concrete, creating less emissions during the construction phase and also afterwards.

From industry to nature: Creating an eco-neighbourhood

From the beginning, the aim of the Lokstadt site was to be energy efficient. The construction materials and the life of the building afterwards have been carefully studied to emit as little emissions as possible. The heating system is supplied by the local district heating (waste incineration). The Krokodil building, one of the spaces reserved for social housing, has 42% of its power consumption covered by PV. The building of 41,000m², composed of 248 flats, has a bearing structure in wood from the 1st floor on, which allowed to save 1,100 tons of greenhouse gas emissions during the construction time.

While the greenhouse gas emissions from construction and renovation can be more easily anticipated and regulated, it is more complicated when it comes to people's behaviours. That is why newcomers will receive a guide in a welcome pack, to ensure the most possible energy efficient behaviours. Managers of the project have also developed an app, which could propose monthly challenges to residents to cut down their carbon footprint. When it comes to mobility, many squares are thought for pedestrians, and there will be a limitation of the number of cars in the area. The maximum is set at 200 car drivers per hours during rush hour, with fines to be paid by the site managers if the threshold is overshot.

All these characteristics allowed the Lokstadt site to be certified as a 2000-Watts area. The project thus poses as a great example of how a historic neighbourhood in a city can be modernised and bring back life through inclusion.

What is the 2000 Watts certificate?

One of the modern aspects of the Lokstadt site is that it is 2000-Watts certified. There are two sides of the certificate:

1. The quantitative proof: Greenhouse gas emissions of the sites, non-renewable primary energy used, and total primary energy used have to be monitored and remain below a certain level
2. The qualitative evaluation: several aspects must be implemented to ensure a good quality of life on the site. This includes a management system, good communication with residents, use and diversity of the site, supply and disposal, building, and mobility aspects.

The certification is only valid for two years, which forces labelled sites to always strive for keeping standards, always improving, and work for the next certification

The original article was published on the website of Decarb City Pipes 2050 on 5 December 2022. Presentations are gathered in the Library section of the website.

Conclusion

Main takeaways

- A strong legal framework combined with a good engagement of utilities and other actors, especially those of the housing sectors, are often more important than technicalities themselves. With good communication work between energy experts, housing experts, citizens, and workers, even individual gas boilers in condominiums can be changed without too many obstacles!
- Neighbourhoods and districts are key scales to look at for decarbonisation potentials. Sometimes, they can even become energy positive when the right conditions are met.
- Neighborhood-specific resources are powerful allies for decarbonizing neighborhoods. It is often easier to start in a neighborhood where the resource is already available than to bring it in from far away. When it is available, geothermal, for example, can be one of the fast lanes to decarbonized heating systems. Developing pilot projects to solve investment problems and better mapping of data are then needed to bring it to neighborhoods.
- Data are essential for everyone, and the more precise the better, especially since heat planning is an iterative process. However, there will always be a discrepancy between the model outcome and the reality – and it is key to accept it. Good enough data should be good enough to move forward in the plan. Otherwise, the risk is to keep on digging for data while making no progress in the realisation. Data on infrastructure, data on energy demand and data on potential are strong allies for both cities and utilities looking at designing or updating heating and cooling plans. Further feasibility studies and pilot projects can help sharpen data and adjust hypotheses at a later stage for the next version.

Next steps

- In the context of Decarb City Pipes 2050, the sessions contributed to help cities with the establishment of their heating & cooling plans (WP3) and their transition roadmaps (WP4).
- Those presentations are, however, also be beneficial for cities outside of the consortium, since Decarb City Pipes 2050 aims at favouring replication of good examples and creation of a community of practice.
- The organisation of other capacity building sessions in the frame this project (WP4), on topics related to multi-actor dialogues, will provide the opportunity to maintain the connections between cities which have been created.
- Some cities established one-to-one contacts with other cities or experts who gave presentations during the sessions.

DECARB CITY PIPES 2050

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 893509