DECARB CITY PIPES 2050

Recommendations to improve the regulatory framework

Deliverable 6.1

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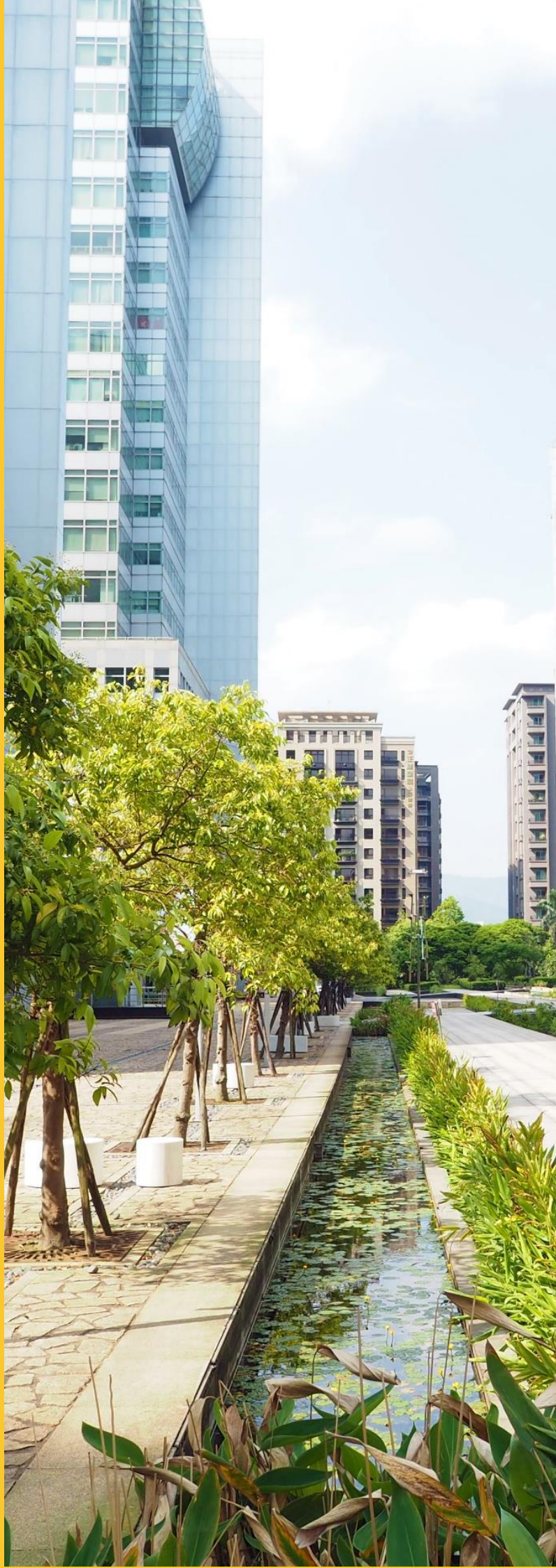

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Summary & Overview

Introduction

Against the backdrop of the heating and cooling transition, each city's approach is not only fundamentally shaped by its local social, economic and geographic characteristics. The scope of each city government in defining actions to decarbonize the heating and cooling sector is also influenced - and oftentimes constrained - by the national and/or regional legal framework. For cities to pursue their own goals and contribute to regional and national ambitions, the legal and policy frameworks shaped by the fossil fuel past must be adapted to enable a sustainable energy future.

For each participating city in this project, - Bilbao, Bratislava, Dublin, Munich, Rotterdam, Vienna and Winterthur – this report briefly outlines the **main national and/or regional policies and laws relevant for the city's H/C transition**. Each city formulated targeted policy recommendations to eliminate barriers and support the transition. These recommendations range from the use of fossil fuels and the harnessing of renewable energy potentials to the financial and data framework.
Lastly, the cities brought forward **recommendations to the European level** concerning issues which they consider best addressed at the supra-national level.

The summary below provides an overview of where cities currently stand in managing fossil fuels in the heating and cooling sector. It also provides a cross-city summary of key recommendations that affect many or all cities to some degree.

Cities' Current Heating (and Cooling) Policies

Table 1 provides an overview of the different policies that are in effect in the respective cities with respect to the use of fossil fuels for heating and cooling. It is important to note that this table provides an overview on the usage or restriction of specific fossil fuels and not on heating system types. As many cities and/or countries have different regulations concerning new buildings and the existing building stock, the table differentiates between these two.

TABLE 1: OVERVIEW OF EXISTING POLICIES REGARDING THE PROHIBITION OF OIL, COAL AND GAS FOR HEATING

State / City	Prohibition of Oil & Coal for Heating		Prohibition of Natural Gas for Heating		Comment
	New Buildings	Existing Buildings	New Buildings	Existing Buildings	
Spain / Bilbao	Yes	Yes, for coal but not for oil (cannot be replaced)	No	No	Commitment to remove oil/coal heaters by 2030
Slovakia / Bratislava	No	No	No	No	
Ireland / Dublin	No	No	No	No	nZEB standards for new buildings make fossil fuel heating difficult. A ban is being discussed for new and renovated buildings.
The Netherlands / Rotterdam	No[1]	No[1]	Yes	No	[1] New legislation in development
Austria / Vienna	Yes	No	in parts of Vienna	No	Renewable Heat Act (Erneuerbare Wärme Gesetz) on federal level in development.
Germany / Munich	Yes	No	No	No	Government plans that new heating systems installed are to be operated with a share of at least 65% of renewable energies.
Canton of Zurich / Winterthur	Yes	Yes (cannot be replaced)	Yes	Yes (cannot be replaced)	New cantonal energy law in force since 2022.

Summary of Cities' Recommendations

- While the legal framework for H/C decarbonisation varies widely for the cities, all of them have already implemented or are recommending policies and laws that **restrict or ban the use of fossil fuels or "fossil fuel boilers"**, from Winterthur, who profits from an already strict cantonal law prohibiting fossil fuel boilers, to Bilbao who is looking into preventing the expansion of the gas network.
- In particular, cities are calling to **prevent the substitution of existing fossil fuel heating systems** with new ones (BIL, DUB, MUN, VIE) as well as the switch from oil or coal to gas (BIL). Some emphasize on **targeting the heating system itself and not (only) the use of fossil fuels**, i.a. in order to not incentivise the use of green gas in the

[1] Oil & coal only play a very minor role in heating in the Netherlands.

low-temperature sector (VIE). Cities generally recommend preserving green gas for hard to decarbonise sectors.

- **Substitution of fossil fuel systems in combination with building renovation** should be encouraged through a multitude of possible instruments, including subsidies (BRA, BIL, VIE) and grants (BIL, DUB), energy plans (MUN), or by legally requiring it (MUN), e.g. for the least-efficient buildings (VIE, WIN).
- All cities have different local **renewable heat potentials** for which they will need support or changes in the legal framework to exploit, including aquathermal (BIL, ROT, BRA) and (deep) geothermal energy (BIL, MUN, VIE), waste heat from industry (BRA, ROT, VIE) and waste water heat (BRA, MUN, WIN). In many cases, a **simplification of procedures and permits** is needed to speed up their uptake. Also, in this regard, cities are recommending to reduce regulatory or financial barriers for (large-scale) heat pumps.
- **Energy zoning / heat plans** are seen as central instruments for planning and enabling the heating and cooling transition (BRA, DUB) and may sometimes even be applied to rule out certain heating systems (VIE), energy carriers or mandate energy standards in buildings (MUN). In general, cities recommend establishing or supporting **heat planning with clear strategies and roadmaps, targets, and timelines**, sometimes on a neighbourhood level (ROT). This should also include gathering public support for the transition (BIL).
- The **expansion of and incentives to connect to district heating systems** require legal support, possibly on different levels (EU or national), notably also energy zoning (DUB, VIE, MUN). A connection mandate could be envisioned for new buildings (BIL). There often is further need for a funding framework, (partly) through public money (DUB, ROT). Financial and workforce needs are also critical for planning and building DH systems and promoting connection (WIN, DUB).
- Wide **financial incentives and subsidies** are necessary both for investments in infrastructure and for home owners (BIL) and need to reflect and alleviate the social and economic inequalities that arise particularly with legal obligations related to heating systems switches and building refurbishments (BRA, MUN, VIE).
- Most cities require more **data** for heat planning and recommend new regulation obliging stakeholders, i.e. grid operators and utilities, but also chimney sweepers, to provide data on heat consumption and heating systems (BIL, ROT, VIE).

Status Quo & Policy Recommendations of Cities to National Level

Bilbao

90% of the city is currently supplied by natural gas, with the majority through individual boilers. The only existing operative district heating (DH) is a small network based on biomass and natural gas that supplies heating and cooling to a hospital. There is a first city vision towards electrification of heat, but only few examples are implemented yet. Bilbao advocates for experimentation and showcasing solutions, specifically for the development of a large-scale heat-pump and a low temperature DH network of geoexchange in the Zorrozaurre island project. EU funded projects, e.g. ATELIER, are a fundamental support for these strategies.

Climate neutrality target: 2050

Bilbao is following Spain's plans as outlined in the integrated national energy and climate plan to become climate-neutral by 2050. This is further reflected in the regional Climate Change Strategy of the Basque Country to 2050.

Liquid and solid fossil fuels

The installation of coal heating system was prohibited by the RITE (Regulation for Thermal Energy Systems) in 2007 both in new buildings and in refurbished energy systems. Oil heaters are not prohibited at national level but the Basque Sustainability Law published in 2019, has the strong commitment to abandon oil by 2030 (specific regulatory measures have not been deployed yet). Existing oil boilers which are being replaced (mostly because they are old and inefficient) are generally being replaced by gas boilers.

Fossil gas / gas infrastructure

Currently there is no ban on gas or on gas heaters planned. There are still no plans or discussions about decommissioning of gas infrastructure. There are no limitations on the use of fossil and green gas in the heating sector.

Recommendations

- Push for national e.g. revision of the building regulations and regional framework (laws/subsidies, compliance of Sustainability Law articles) that hamper the expansion of the gas network, promote the decommissioning of individual boilers and foster the use of renewable alternatives.
- Legislation that forces new construction buildings to connect to a DH system when that is possible.
- Evaluate the possibility to skip the replacement of oil boilers by gas boilers and analyse other alternatives (like heat pumps).
- Stronger political support and investment to phase out natural gas.
- Subsidies and awareness campaigns regarding renewable energies.

District Heating (DH)

Currently, there are no laws in place that favour DH over individual heating systems. A DH pilot based on a geoexchange low-temperature network is being implemented in the still non-urban development area of Zorrozaurre, and both residential, tertiary and industrial buildings will connect to the network. At the same time, gas infrastructure is expanded all over the city, supported by existing legal frameworks.

Recommendations

- Change of mentality around DH centralized systems. Implementation of pilot projects (Zorrozaurre) and dissemination of the advantages of DH.
- Viability studies and analysis of DH implementation in Bilbao city.
- Tendering of pilot projects for implementation of DH in most favoured city areas, where ESCO are willing to invest.
- Subsidies and grants for decarbonized district heating systems (e.g. special offers to citizens in order to persuade them to connect to the DH).
- National and regional directives/laws that stimulate the creation of DH systems. Implement article 40 of Decree 254/2020 where the evaluation of centralized system in urban planning is requested -
- Acceleration of the procedures and permits in the administration, for example regulating the use of public space for energy infrastructures within the city and facilitating the tendering processes

Renewable Energy

In the Basque Country (on the regional level), the Energy Sustainability Law stipulates that public administration buildings must cover their electricity and heat demand at least by 32% through onsite renewable energy generation. Waste heat from companies, data centres etc. is not considered a major energy source in Bilbao, as there are not large industries or computing centres within the municipality. Individual solutions (e.g. air-source heat pumps) and centralized DH networks based on geothermal energy or hydrothermal exchange are contemplated as most favourable solutions for decarbonisation.

Heat pumps (HP)

The deployment of heat pumps is currently hampered through local heritage protection laws in some specific areas, such as the old town of Bilbao (e.g. attachment to the roof is usually prohibited). The high upfront investment costs and, generally, lack of knowledge, expertise and experience of installation of heat pumps to substitute centralized boilers in multifamily buildings are also an obstacle. New construction buildings are likely to be equipped with HP but in already existing buildings is not very usual.

Recommendations

- Evaluate the potential of the river and the ground as an energy source: How to adequately access and harness them? How to plan, fund and deploy geothermal & hydrothermal DH systems?
- Remove local regulations that hamper the implementation of HPs in certain cases due to heritage protection (e.g. allow use of roofs in part of the cities for location of energy systems)
- Carry out a comprehensive spatial analysis of renewable energy sources.
- Need for convenient business models and subsidies for residential sector to change from fossil-based to decarbonised heating systems (e.g. implementation of HPs in combination with PV installations). Awareness campaigns for installation companies.

Energy Efficiency

The national Technical Building Code prescribes that a minimum annual contribution of renewable energy must cover the hot domestic water (DHW) needs of buildings with at least 100l/d demand (60% RE when the HDW demand is lower than 5000l/d and 70% if it is higher). This directive is applicable to residential, private and public buildings. Solar power, biomass boilers or heat pumps are most likely renewable source systems. In addition, buildings with more than 1000 m^2 constructed are forced to use PV energy to produce electricity.

There are also updated (2019) limits for non-renewable and total primary energy in new and refurbished buildings. These measures have favoured an energy efficiency building design and installation of renewable energy in building projects. The main challenge is the speed of renovation in the existing building stock.

Funding schemes for Refurbishments

The National Institute for Diversification and Saving of Energy, for example, has established an annually updated funding programme (implemented in the Basque Country through the Basque Energy Agency) to support for energy rehabilitation of existing buildings, covering i.e. thermal renovation, energy efficiency improvements of heating systems (e.g. the replacement of conventional energy for solar thermal) or lighting installations. These funding covers also the switch from a fossil-based heating system or switch to a renewable heating system based on e.g. biomass, aerothermal or geothermal energy.

Data

Data from cadastre and energy certificate database can be used for a detailed diagnosis of the energy performance of the building stock, based on simulations. The availability of real data from distribution companies or energy retailers, would allow for a better calibration of the models and improvement of the energy planning practices.

Recommendations

- Agreement between energy network (gas and electricity network) and municipality in order to provide real disaggregated data periodically.

Bratislava

The city of Bratislava is almost entirely dependent on natural gas for heating, and it is yet unknown how it will change in the future. Nevertheless, around 60% of its buildings are already connected to district heating.

Climate neutrality target: 2050

Slovakia has its climate neutrality target set for 2050. Although the National Energy and Climate Plan contains some measures to increase the share of renewables in district heating, there is no regionally specific plan for H/C decarbonisation in the city of Bratislava up to 2050.

According to the Slovak Heat energy law, every municipality over 2,500 inhabitants in Slovakia needs to establish a “koncepcia” for heat energy. The term “koncepcia” represents a policy document between a strategy and an analytical document. It is only binding in the context of the municipal land use plan, where it indicates what technologies for heating can be used in each area of the city. The document is mostly of descriptive nature, while also including a set of basic scenarios and recommendations which are not binding in any regard. The most recent “koncepcia” for the City of Bratislava dates back to 2019 and is set to be updated after 5 years, i.e. in 2024.

Liquid and solid fossil fuels

Solid fuels such as coal and coke are not forbidden in Bratislava and are still used for heating households to a very limited extent (about 2,500 households according to data from 2017, probably less now). Liquid fossil fuels (heavy and light oil) are only used for industry, specifically for the oil refinery Slovnaft.

Fossil gas / gas infrastructure

The city of Bratislava is almost 100% dependent on natural gas and a phase-out will require a lot of political, financial and technological effort in the near future. Most of the city is either connected to DH (powered by gas) or connected to a gas network for individual boilers. The current gas crisis, together with increased pressure from the EU to decrease dependency on Russian gas, might accelerate the progress of searching for other (renewable) sources of energy for H/C. However, concrete plans and projects focus on specific regions (e.g. with large geothermal potential), not including Bratislava city and the wider region.

Recommendations

- A binding H/C Decarbonisation Roadmap should be developed, ideally on regional level, with a concrete timeline for phasing-out of fossil fuels in accordance with REPowerEU.

District Heating (DH)

The high temperature DH system in Bratislava is **mostly powered by gas**. According to data from the last census (2021), **about 60% of buildings are connected to DH.** The Slovak Heat Energy Law sets a threshold for “efficient district heating” to 50% from renewable sources. Any new or renovated building with heat consumption over 30 MWh/year should be connected to the DH system if it is efficient. Buildings already connected to DH can be disconnected only if the

system is not efficient (less than 50% of renewable sources) and if the alternative heat supply allows the use of at least 20% more of renewables compared to the DH system.
Districts without DH are connected to gas networks that power individual boilers in houses. Most DH infrastructure in Slovakia is 25-30 years old, meaning it is at the end of its life cycle and renovation will have to occur in the years to come.
Bratislava is planning to renovate its waste incarceration plant to produce both electricity and heat, connecting this plant to the DH system. There is potential to renovate the DH system (ideally transition to low temperature) and connect new waste heat sources as well as heat pumps using the Danube river/underground water.

Recommendations

- The City of Bratislava and/or the national government should make an analysis to determine the possibilities and obstacles of transitioning to 4th generation DH.
- Energy zoning planning should be introduced as a tool in land use planning.
- Both these efforts need to be supported by the state since heat production and distribution is privately owned, and the ownership is very fragmented.

Renewable Energy

Bratislava has a significant potential for renewable energy in the area of PV as well as for heat pumps with water-to-water systems, as a large part of the city can potentially use groundwater in the gravel alluvial deposits of the Danube as a heat source. The city's wastewater management company is now using biogas produced in the wastewater facilities to generate electricity and heat for its own buildings. According to the "Koncepcia", this biogas can be used to produce biomethane which could be further distributed to households or to source DH and replace fossil gas. The City of Bratislava also collects kitchen waste which could be used for producing biogas/biomethane in the future. Waste heat potential has not been explored yet.

Recommendations

- The City of Bratislava and/or the state should conduct an analysis of the potential use of the Danube river, waste-water management facilities and waste heat from industries, data centres, sewage systems etc. for H/C.

Energy Efficiency

Slovakia has a Long-term Building Renovation Strategy (2020), which provides a plan to reduce emissions from buildings by 87% in 2050 compared to the baseline year of 1990. This should be achieved both by increasing energy efficiency of buildings, technology and infrastructure and expanding the use of renewable energy sources. The ratio of deep renovations should increase to 40% by 2050, with medium renovation increasing to 40% as well. The nZEB criteria for new buildings after 2020 are as proposed in the EU directive on energy performance of buildings. Still, the decarbonisation of buildings does not require a full phase-out of fossil gas, however the strategy was published in December 2020, which means that the current gas crisis, in addition to REPowerEU and the deployment of EU ETS II might soon incentivise policy makers towards reconsidering phase-out.
One of the main barriers to accelerating the renovation of buildings, as identified in the long-term strategy, is that public procurement is still oriented towards choosing the lowest bidder, not the best quality. This means that not only can this have an impact on the quality of the renovation itself, but it also reduces the quality of i. e energy certificates and audits.

Recommendations

- Slovakia should develop a clear methodology for using qualitative criteria in public procurement to ensure that renovations of buildings, technology and infrastructure as well as energy documentation is not dependent on the lowest price on the market.

Funding schemes

Multiple programs are in place to finance renovations from public funds, such as “Zelená domácnostiam” (EFRD) for new technologies using renewable sources of energy, “Obnov dom” (NGEU) for house refurbishments such as insulation or programs for public buildings renovations (NGEU). For bigger investments, including modernisation of the DH system, the EU Modernisation fund can be used. In addition, there is an allocation for retrofitting of public historical buildings under NGEU and public buildings in general under EFDR.
Still, not many of available funding options consider different socio-economic contexts of households. As a result, availability of renovation subsidies is limited to those who can afford some level of co-financing.

Recommendations

- The state should reflect existing social and economic inequalities in the system of subsidies for energy efficiency of buildings. Where possible, social housing should benefit from largest subsidies and aim for deep renovations.

Data

Data on existing heat infrastructure and supply as well as on renewables potential is centrally managed by the Slovak Energy and Innovation Agency (SEIA), however, it is not available to municipalities. In the context of energy efficiency, the state is planning a process of passporting all its buildings as part of REPowerEU measures.

Recommendations

- Address the accessibility to SEIA databases for municipalities and enhance the use of these databases in urban planning.
- REPowerEU measures for passporting buildings should include municipalities and their buildings, ideally combined with the introduction of data management in the field of energy.

Dublin

While district heating systems are not common in Ireland, in recent years, Dublin acts as a pioneer in developing new DH systems. According to the National Climate Action Plan, Ireland will install 2.7 TWh of district heating by 2030.

Climate neutrality target: 2050

Dublin is following the national strategy and aiming to be climate-neutral by 2050. Municipal regulations on H/C are not possible for existing buildings due to a lack of power of the municipality to enforce such changes. The latest City Development Plan, adopted in November 2022, does now require large sites to perform an analysis to prove that it is not feasible for sites to connect or future-proof for connecting to planned DH networks.

Liquid and solid fossil fuels

Though not prohibited, coal, oil and gas heaters are strongly discouraged under current national regulations for new buildings, which favour mostly heat pumps based on their energy performance. Additionally, Ireland's Climate Action Plan 2023 states that the installation of fossil fuel boilers in new homes and new non-residential buildings and existing buildings undergoing major renovation will be effectively phased out by the end of 2023 through performance-based regulations.

Recommendations

- Greater application of spatial energy planning at local level, including district heating zoning.
- New laws that prohibit the replacement of fossil fuel boilers in existing buildings beyond a certain date, e.g. 2030.
- In order to promote the replacement of individual heating systems in apartments in multi-family houses by central heating systems, new planning regulations could be brought forward that require developers to consider climate friendly energy systems in more detail for these types of building and developments.
- In order to encourage the substitution of fossil-fuelled heating systems in buildings in combination with refurbishments, those performing renovations could be directed more firmly to replace their energy system with a low carbon option.

Fossil gas / gas infrastructure

There is no ban of fossil gas, and the use of green gas and the decommissioning of gas infrastructure are not regulated. Cooking with gas is especially common in Dublin, with 69% of the households compared to 14% on the national average.

Recommendations

- A published national timeline for the phase-out of use of fossil gas for low-temperature usages.
- Green gas policy and regulation that requires green gas usage to be reserved for hard to decarbonise sectors like high temperature heat, aviation, shipping and potentially heavy transport.
- A published national plan and timeline for decommissioning of the fossil gas network for the residential, commercial sectors and public sectors where gas is used for space heating, water heating and cooking.

District Heating (DH)

There are currently no plans for the coordinated development of DH systems in Ireland at a government or municipality level, although CODEMA is working to promote and implement DH schemes in Dublin. However, a government steering group is currently assessing possible future policies and regulations, some of which are found in the recommendations below. Generally, there is ongoing work at a national policy level on these topics.

Recommendations

- A zoning approach to district heating, with support from the national and municipality level.
- A strategic roadmap towards district heating roll-out.
- DH consumer regulation and protection, and a regulatory regime for DH networks and heat suppliers.
- A DH network funding framework, backed by some portion of public money, with supporting policies to leverage additional investment.
- Build up capacity for local heat planning / DH network.

Renewable Energy

Recommendations

- Greater requirements at a local authority level for spatial energy planning.
- Improved grants and access to cheaper finance.
- National targets for delivery of decarbonised heating systems for social housing.
- Enhanced governance on sustainability criteria for non-EU biomass.

Energy Efficiency

In case of renovations where over 25% of the building envelope surface is renovated, requirements on energy performance as well as insulation, heating, cooling, ventilation and lighting system upgrades have to be met, in line with EPBD standards.

Funding schemes on Refurbishments

High levels of grant support are available for heat pumps and supporting energy efficiency measures, covering up to 50% of retrofitting costs.

Data

Concerning data availability, heat supply and infrastructure data for buildings is available in limited capacity through energy certificates and renewables potential is only explored on utility scale. There is no data collection on waste heat potential.

Munich

In the absence of coherent H/C planning in Germany on the federal level, a few states have financially supported the creation of energy zoning plans, like Bavaria, or mandated their creation, like in Baden-Württemberg. The upcoming federal heat law will draw from the learnings of these policies and aim for standardised heat planning across Germany.
The City of Munich is currently preparing a municipal heating strategy in close coordination with the Stadtwerke München GmbH (SWM). The Munich heating study (FfE, Öko-Institut 2021) serves as a decisive basis for the development and the decarbonisation of the DH system and the development of further decentralized heat supply solutions.

Climate neutrality target: 2035

Munich aims to become **climate-neutral by 2035**.
There is currently no coherent legal framework on H/C planning in Germany. On a federal level, Germany is discussing a law for heat planning, following *i.a.* existing energy plans in the state of Bavaria and laws in the state of Baden-Württemberg. A draft is expected at the beginning of 2023.
To achieve the overall goal of climate neutrality in the energy sector, provision of long-term debt capital (promotional loans) on a significant scale for all investments is needed. It must be possible to cumulate these promotional loans with other subsidies (e.g. BEW).

On federal level, an adjustment of the Federal Building Code is necessary in the sense of an obligation to take municipal heating plans into account, including area-specific regulations.

Liquid and solid fossil fuels

The **Buildings Energy Act** (GEG) **prohibits** the **installation of oil and coal heating systems in case of replacement** from 2026, with some exceptions, while also forcing the use of renewables. Oil and gas boilers installed before 1990 or older than 30 years are prohibited. The replacement obligation only applies to low-temperature boilers.

Recommendations

- The Buildings Energy Act (GEG) is very complicated with many exemptions. It must be made easier with clear requirements.
- Prohibition of individual fossil heating systems in new buildings and existing buildings with clearly defined exemptions (e.g. to allow hybrid heating systems).
- Energy zoning plans should be used as legal basis when defining heating system / energy efficiency requirements.

Fossil gas / gas infrastructure

The Buildings Energy Act (GEG) contains a ban of oil and gas boilers installed before 1990 or older than 30 years (with various exemptions). There are currently no bans or limitations to the use of fossil or of green gas in buildings.

Recommendations

- Prohibition of fossil fuels in new buildings and existing buildings with clearly defined exemptions (e.g. to allow hybrid heating systems). Also, rules for existing buildings are needed.
- Legal obligation to change to a fossil-free heating system when major changes to the building are made/or e.g. after a certain timeframe or according to the stage model of the EU-EPBD Directive.
- A legal obligation to change to fossil-free heating systems must address social issues (e.g. affordability).
- Energy zoning plans should be used as legal basis when defining heating system/ energy efficiency requirements.
- Determination of gas retreat areas in coordination with municipal heat planning after a certain timeframe.
- An obligation to use the share of renewable and decarbonised gases should be linked to actual local availability and not to theoretical targets.
- The federal level should ensure the expansion of the hydrogen economy and hydrogen networks, if necessary.

District Heating (DH)

District heating provides one third of Munich's space heating and hot water demand. The district heating network has a length of about 900 kilometres, while the district cooling network is about 30 kilometres long. The district heating network consists of 7 hydraulically separated heating water networks and a steam network. There are three active geothermal plants in Munich and three in the south of Munich. A significant expansion is planned until 2040.

On city-owned sites, a DH connection is part of the bill of sale. Since 2013, district heating is the preferred energy supply in large new development areas on municipal land. Furthermore, energy concepts with the aim to achieve a climate-neutral heat supply must be developed for large new developments according to the so-called climate roadmap for land-use plans.

Recommendations

- Make it legally possible to stipulate energy supply and building standards in binding land use plans (in combination with an energy plan).
- Energy zoning plans should be used as legal basis when defining heating system/ energy efficiency requirements.
- Close cooperation of cities with utilities and other energy suppliers.
- Calculation of the primary energy factor should not disadvantage district heating.
- Enactment of a "Geothermal Energy Development Act" as a central, tailor-made shell law to speed up approval procedures.

Renewable Energy

In the state of Bavaria, many municipalities have set up and implemented energy plans following a funding programme for energy plans of the state since 2012.
The Buildings Energy Act demands the use of renewables to some extent. The city of Munich demands the use of PV in new binding land-use plans. Waste heat potentials are currently not reported.

Recommendations

- Provide information on waste heat from data centres, industries, supermarkets and other sources of waste heat to cities.

Energy Efficiency

The Buildings Energy Act (GEG) sets out requirements for the energy performance of buildings, the issuing and application of energy performance certificates, and the use of renewable energy in buildings. Efficiency house (EH) 40 (or EH 40+) is set as the minimum standard for new buildings within the sphere of influence of the City of Munich (municipal housing associations, on municipal land, etc.).
High energy standards in new buildings (passive house or EH40) and, above all, the rapid and target-compatible energy refurbishment of the building stock to a high energy efficiency level (EH55) are the decisive factors for quickly reducing heat consumption.

Recommendations

- "Efficiency first", so as to reduce the demand for (renewable) heat.
- Regulations and incentives to build fossil free and energy-efficient buildings (EH-40 or passive house standard).
- Implement guidelines on the best possible energy standard in land-use plans.

Funding schemes

A number of funding programmes (both on the federal and state level) are available for the substitution of fossil fuel boilers, the centralisation of heating systems, and refurbishments, and for the construction and decarbonisation of DH systems. However, they are not well-known among the public and have a burdensome application process.
The new federal funding programme for efficient heating networks (Bundesförderung für effiziente Wärmenetze – BEW) as well as the federal funding programme for efficient buildings (Bundesförderung für effiziente Gebäude – BEG) should be permanently available.

An operating cost subsidy should be provided not only for the use of near-surface and deep geothermal energy with the help of heat pumps, but also for a direct use of deep geothermal energy. Due to the high investment and electricity costs for the pumps, deep geothermal energy also requires an operating cost subsidy. It should be examined whether the operating cost subsidy for heat pumps can be extended to deep geothermal energy.

Recommendations

- Long-term and permanently available funding programmes that create financial security and which are easy to understand and well-known (e.g. BEW, BEG).
- Provision of significant amounts of long-term debt capital (promotional loans).
- It must be possible to cumulate promotional loans with other subsidies.
- Enable operating cost subsidies for direct use of deep geothermal energy.

Data

The provision of data on the heating infrastructure, renewable energy potentials and waste heat are addressed in the Bavarian energy plans. There is some guidance available on which data should be used, but there is no legal obligation for data owners to provide data to cities, yet. The upcoming federal heat law aims to create an obligation for energy suppliers to deliver energy data to city administrations.

Recommendations

- An obligation for energy suppliers to deliver energy data to city administrations is highly requested, particularly for waste heat.
- Standardisation of energy data is recommended.

Rotterdam

Natural gas is the dominant energy source for heating, both in the Netherlands and in Rotterdam. Around 263,000 of a total of 350,000 buildings in Rotterdam are connected to the natural gas grid. While the city has large waste heat potentials from the port which can be fed into heat networks, hybrid gas/electric heat pumps as low-carbon alternative to gas will be the minimum heating standard in homes from 2026 onwards.

Climate neutrality target: 2050

Rotterdam is pursuing net zero emissions **until 2050**.

Liquid and solid fossil fuels

While coal and oil are of little relevance in the Dutch H/C sector, natural gas is the dominant and most prevalent energy source for heating applications, besides district heating systems.

Fossil gas / gas infrastructure

New buildings may not be connected to the natural gas grid, with the exception that the Municipal Executive may designate the surrounding area as an area where natural gas is strictly necessary for serious reasons of public interest, including social costs and benefits.
Nevertheless, around 263,000 buildings (255,000 residential homes) of a total of 350,000 in Rotterdam are still connected to the natural gas grid. Among those, around 17,500 homes receive heating from the DH system but still use the gas network for cooking and/or domestic hot water.
Three new pieces of legislation that will shape the heating transition in the future are currently in development: The **Municipal Instruments for the Heat Transition Act (WGIW)** is important for the planning of the district-oriented approach. The municipalities are given the power to designate which districts have to move away from natural gas in time (probably 8 years). The law contains guarantees for a careful process regarding the power to designate. Furthermore, the **Collective Heat Act (WCW)** will support the heating transition through market regulation, a new tariff scheme and sustainability as well as CO_2 requirements. Finally, on the municipal level, the **"environmental vision"** is a mandatory instrument under the environmental and planning act and constitutes an integral long-term vision about the physical living environment and its territory.

Recommendations

- Municipal Instruments for the Heat Transition Act ("WGIW", intended to come into effect on 01.01.2024)
  - should provide municipalities with the authority to designate which districts have to move away from natural gas,
  - designate the timing and locations of the transition to an alternative to natural gas,
  - should provide a timeframe for the natural gas grid to be removed.

District Heating (DH)

Currently, around 55,000 homes (of 255,000) in Rotterdam are connected to the district heating network. The DH network is primarily using waste heat, and will be supported by geothermal and aquathermal energy in the future.

Recommendations

- Collective Heat Act ("WCW", intended to come into force on 01.06.2024)
  - to prefer a more public-owned approach (in contrast to private-focused) as proposed by the minister. It is important to gain public support and trust in the heat transition. Public direction is therefore necessary.
  - Tariffs should be cost-based rather than linked to the price of natural gas.
  - In order to be able to influence investment moment of heat companies with the aim of using these moments to unlock sustainable sources, an annual CO_2 standard has been laid down in the new Heat Act that maximizes the average CO_2 emissions.

Renewable Energy

Waste Heat

The city of Rotterdam is working on a study to investigate the waste heat potential in the city. Similar studies are being conducted for geothermal and aquathermal energy. While the city has an abundance of heat sources, a lack of electrical grid capacity is the limiting factor to harnessing this heat.

Heat Pumps

Amsterdam aims to quickly transition to more sustainable homes and use less natural gas, both for the climate and due to rapidly rising gas prices. In sustainable heating for homes, the hybrid heat pump will therefore become the standard from 2026. From that year on, when the boiler needs to be replaced, the new heating system is more sustainable. In addition, hybrid heat pumps require lower upfront investments concerning insulation for family house owners.

Recommendations

- Collective Heat Act ("WCW")
  - to include a 'collection right' for heat companies, which forces companies/producers to make waste heat available to them only at the price associated with extracting and transmitting the heat.
- High investments into the electricity grid are required to accommodate future electricity demand, i.e. for heat pumps, electric cars, PV and wind energy.

Funding schemes

With the Investment Grant Renewable Energy and Energy Saving (ISDE), homeowners can receive a subsidy for connecting to a DH network, if this home is their main residence at that moment or immediately after a renovation. There is also the subsidy "energy saving own home" (SEEH) for home associations.

Homeowners can borrow money from the National Heat Fund ("Warmtefonds") at a low interest rate for energy-saving measures. In some cases, they can even borrow interest-free up to a maximum of € 25,000.

Under the Incentive Scheme for natural gas-free rental homes (SAH), homeowner associations and tenants of one or more rental properties can receive a subsidy when making an existing house natural gas-free (through disconnecting from the gas grid) and connecting it to a district network.

Recommendations

- More direct government investment in heat infrastructure is needed to start a district heating, and tends to yield better results than by focusing on subsidies.

Data

Although a lot of data is already available to the city administration, there are some gaps or instances where the data needs to be more accurate. Crucial data for the heat transition include data on heat demand (from the gas grid operator), on electricity demand for the cooling demand (for peak consumption on hot days), temperature data of the district heat infrastructure, on heating and cooling sources, on insulation and building properties, on energy and material prices and more. Studies on waste heat, geothermal and aquathermal energy potential will greatly increase the data situation.

Recommendations

- Regulation is needed to make data from grid operators or other stakeholders available to the city despite overruling privacy concerns and capacities of stakeholders to make the data available.

Vienna

Around 30% of non-ETS emissions in Vienna are rooted in the buildings sector, of which close to 90% are caused by roughly 600'000 gas heating systems, mostly individual gas heaters. At the same time, around 430'000 households in Vienna are supplied through district heating. Through energy zoning, Vienna has since 2020 designated "climate protection areas" where fossil fuels for heating in new buildings are prohibited.

Climate neutrality target: 2040

Vienna is aiming for **climate neutrality** in **2040**, with an intermediate target to reduce GHG emissions by 55% by 2030 compared to 2005.

Liquid and solid fossil fuels

On the federal level, the Oil Boiler Installation Prohibition Act (2020) **prohibits the installation of oil and coal boilers** in new buildings. The upcoming Renewable Heat Act ("Erneuerbares Wärme Gesetz) is still in the legislative process at the federal level and is expected to enter into force by 2023. If adopted, it will mandate a phase-out timeframe for coal and oil heaters in existing buildings till 2035.

Fossil gas / gas infrastructure

If adopted on the federal level, the Renewable Heat Act will forbid (any) gas for heating in new buildings. Gas-heating in existing buildings will be regulated as follows: The use of *fossil* gas for heating will be forbidden after mid 2040, which means that switching to *green* gas in 2040 is an allowed option. But not in buildings that are located in "district heating zones" (areas where [decarbonised] district heating is or will be available). These zones will probably have to be designated by public authorities (e.g. the City of Vienna). In these areas the gas *boiler* is addressed by the Renewable Heat Act: it will have to be replaced with district heating or any other renewable heating system. In these areas owners of buildings with individual gas-boilers in each flat will have to build a "central heating" system and tenants or owners of the flats in these buildings will have to connect to such a central heating system within 5 years.

Currently, the federal Gas Act (Gaswirtschaftsgesetz) supports and catalyses further expansion of gas infrastructure, i.a. by obligating DSOs to connect customers to the gas grid upon request. Regulated grid tariffs are financing and perpetuating gas infrastructure.

On the state/city level, **energy zoning plans** ("Energieraumpläne") (developed district-wise since 2020) have designated climate protection zones in Vienna where **gas boilers** in new buildings are **prohibited**. Gas for cooking is currently not yet being addressed (but might be addressed soon)

Recommendations

- Adoption of the Renewable Heat Act on federal level is key to accelerate the transition of heating systems in existing buildings and to create planning security.
  - Installation of gas heating systems should be generally forbidden in buildings, not just fossil gas as a fuel, and it should also prohibit the use of green gas.
  - The obligation for centralising heating systems in buildings with individual systems should be general, not just in DH areas.
- Abolish the connection obligation in the Gas Act.

- Mandate and support the phase-out of cooking with grid-bound gas on provincial level is possible and desirable.
- Other aspects to be addressed:
  - Distribution of costs for decommissioning (and possibly dismantling) of the gas network.
  - Distribution of costs for maintaining the network despite declining number of gas consumers.

District Heating (DH)

Existing Energy Zoning Plans designate areas within Vienna in which gas heating systems in new buildings are prohibited. The decarbonisation of the DH system is indirectly supported through EU-ETS as well as through subsidies from the federal level for DH providers. An important geothermal energy reservoir has been discovered beneath the north-eastern city territory of Vienna with great potential (hundreds of MW) for decarbonising the DH system.

Recommendations

- Extension of Energy Zoning Plans to the whole building stock of Vienna, implemented in synchronisation with the federal Renewable Heat Law.
- Improving procedures and permits for deep geothermal energy, especially for projects across provincial borders (adaption of Mineral Resources Act (MinroG)).
- Exemption of large heat pumps from electricity levy.
- A proper and uniform definition of waste heat (preferably at EU level).

Renewable Energy

New buildings in areas designated by the Energy Zoning Plans are required to use renewable energies or DH for heating. Subsidies are available for new buildings as well as for the decarbonisation of existing buildings (thermal insulation and switch from fossil boilers to district heating or heat pumps) on federal and city level. Recently a legal possibility for geothermal probes in public land was introduced.

Recommendations

- Enhance possibilities for integrating local renewables in DH.
- Reduce (or eliminate) the fee for approval for geothermal probes in public land.
- Biomass should generally be a very minor option, especially in dense areas.
- Obligations for companies to use their own waste heat or at least to offer it to district heating systems.

Energy Efficiency

Recommendations

- The Building code of Vienna should oblige owners of the least-efficient (“worst”) buildings) to refurbish their buildings before 2040 (criteria and subsidy schemes have to be clarified).
- Desirably, refurbishments are done in timely connection with the fossil-fuel phase out of heating systems. This could be supported e.g. by tailor-made subsidies.
- Adaptations of different acts pertaining to housing law (Tenants Act, Condominium Act, …) to facilitate the switch to renewable energy systems and to distribute incurring costs fairly and in a socially just manner.

Funding schemes

Subsidies from the City of Vienna are available for building owners (optional) and from federal state for building owners when connecting to DH network, as well as subsidies from the federal state for DH providers for grid expansion and decarbonisation.

Recommendations

- A common, long-term funding scheme between the federal government and the provinces supporting the switch to heating networks and heat pumps, and energy efficiency refurbishments while reducing social impacts.

Data

Recommendations

- Obligation for chimney sweepers (heating systems), energy grid operators (information about gas applications, metering points, consumption, etc.) to provide data to city authorities.
- Obligation for energy grid operators to provide consumption data to public authority in order to identify potential waste heat sources.

Winterthur

Today, 25% of the heat demand is covered by district heating (DH), with more than 80% based on renewable energy. Peaks are covered by fossil-based energy. A strict energy law for the canton of Zurich (in place since autumn 2022) gives Winterthur an advantageous position for fully decarbonising its heating sector. For two years, no new connections to the gas network have been built.

Climate neutrality target: 2040

Enforced by a referendum Winterthur pushes for a **net-zero emissions** goal **until 2040**. In its interim goal for 2033, it strives towards 1 t CO_{2eq}/year/pers.

Liquid and solid fossil fuels

Through the new cantonal energy law, which entered into force on 1 September 2022, the canton of Zurich has forbidden fossil fuel heating systems in new as well as in old buildings. This means that, once a **fossil energy-based heating system** needs replacement, it **cannot be replaced** by a new one.

Recommendations

- Mandatory replacement date for existing fossil energy-based heating systems: e.g. 2030 or 2035.
- Mandatory refurbishment of houses with very high energy consumption.

Fossil gas / gas infrastructure

The city's **new energy plan** entered into force in **January 2023** and will also include a **timeframe for the phase-out of the gas grid** (with intermediate milestones for 2030, 2033 and 2040) and thus also for heating and cooking applications.

The gas DSO ("Stadtwerke") has a very progressive, self-imposed gas network strategy to avoid stranded assets and stay on track to follow the provisions of the energy law (e.g. the interim goal of 1t CO2eq/year/person in 2033):

- For two years, no new connections to the gas network have been built.
- In areas with an existing DH system, the provision of gas will be stopped in the year 2030.
- In areas with lower heat demand density (and no future DH), the supply of gas will end in the year 2033.
- In areas where DH will be built in the next years, the provision of gas will end in the year 2040.

Green gas will only be used for high temperature applications (e.g. industry) and to cover the peak demand of DH.

District Heating (DH)

Currently, 25% of the heat demand in Winterthur is covered by District Heating (DH). By 2035, up to 50% is to be covered by DH, thus requiring that huge new areas will have to be covered by DH and infrastructure networks will have to be built. Currently, more than 80% of the DH is based on renewable energy. Peaks, however, are currently covered by fossil-based energy,

lowering costs. These peaks will be covered by green gas by 2033. Renewable energy potentials for DH are waste heat, wood and groundwater.

Recommendations

- Defining the permit of interim solutions: In areas where the DH is not yet built a fossil energy-based heating can be installed for max. 6 years, if the owner signs a commitment to connect to the DH as soon as it is available.
- Combining the different heat pipe systems with different frameworks from the same DSO (Stadtwerk) to create one business unit within the Stadtwerke with a single pricing system for the whole city.
- DH system expansion requires more financial and human resources to plan, build and sell the district heating pipes and connections.
- Due to the urgency created by the new energy law, the waste water treatment plant should provide additional energy to cover the heat demand of the northern part of Winterthur.

Renewable Energy, Energy Efficiency and Funding Schemes

Barriers for heat pumps and biomass boilers are low, with low costs and low-level documentation. There are very low administrative burdens to get a permit to install a heat pump since January 2023. If a fossil energy-based heating is replaced by a heat pump with earth probe for a one-family-house, one gets 11,000 € from the cantonal funding programme. This programme also supports the refurbishment of houses so as to ensure both – the replacement of the heating system as well as the refurbishment of a house. Energy experts and employees of the city administration of Winterthur offer cost free advice for heating replacements.

Recommendations

- Funding programmes should be maintained to keep demand for Heat Pumps, biomass boilers, DH-connections and refurbishments high.

Data

Gas, district heating and electricity data is provided through the DSO. The energy consumption data concerning heat demand of 70 % of the buildings of Winterthur (buildings with connection to DH, with a gas heating or with a heat pump) are available.

Recommendations

- An online geographic information system with energy information (heating system / energy consumption, size of the building, use of the building, …) is being established and will be available for planning and monitoring.

Policy Recommendations to the EU-Level

The partners of the Decarb City Pipes 2050 project consider the **promotion of district heating** (especially in dense urban areas) **and heat pumps** (particularly in less dense areas or in new buildings) and the phase-out of heating with gas (and oil and coal) as the two most essential strategies to decarbonise the heating sector.

We acknowledge that the “Fit-for-55” package and the “REPowerEU” plan will bring many improvements for the promotion of these two energy systems (or for their decarbonisation). However, given the short time available until the 2050 net zero emissions target, and the fact that in European cities well over a hundred million units equipped with gas, oil or coal heating have to be converted, there is a **need for even greater emphasis on the part of the EU for the heat transition, especially in cities**.

In the following, we present ideas on further measures the European Union could take to support the decarbonisation of the heating & cooling sector in cities.

A European Strategy for Renewable Gases

The ongoing debate about “renewable gases” has created considerable uncertainty for stakeholders and for municipalities in particular.

In climate and energy policy discussions at the municipal, regional or national level, substituting fossil gas with renewable gas in the heating & building sector is often lauded as a simple solution. Different actors are promoting this simple switch from fossil to renewable gas both as a cost-effective and as the politically and administratively least burdensome option.

As a result, in several of the cities participating in the “Decarb City Pipes 2050” project, there is widespread uncertainty – among politicians, administrators and the real estate sector – as to whether decarbonisation of the municipal heating sector will require any change in the gas infrastructure at all. Often, the question arises: Do we really need a (costly) phase-out of gas boilers and the gas distribution grid and the simultaneous development and expansion of alternative grid-based infrastructures for district heating and heat pumps?

In addition, when discussing the availability and costs of renewable gases, some argue that green gas should be tradeable between EU member states (verified through certificates) or could be imported at low cost from outside the EU. These aspects further underline that this issue is of European dimension.

Against this background, a comprehensive European green gas strategy should aim to clarify the following questions:

1. Realistic quantitative projections: what quantities of biomethane, green hydrogen etc. will be available in the EU by 2030/2040/2050, on the one hand through domestic production (including quantities per Member State) and, on the other hand, through imports from third countries?
2. If these quantities of renewable gases are not sufficient to cover the EU's total gas demand (for manufacturing, industry, transport, power and district heating etc.): For which uses should these scarce quantities be prioritised? In which areas of application should renewable gases be used, and where not?

According to the expertise of the Decarb City Pipes consortium, the use of renewable gases, in particular of those bound to and delivered through a pipe system, should principally be excluded from the use in buildings for low-temperature purposes such as heating and cooking.

Legal and investment security requires technology clarity

Consequently, the EU should explicitly allow and preferably encourage Member States or their (often municipal) authorities to **impose bans or deadlines on the use of certain heating technologies for both new and existing buildings.**

These bans should not primarily address the fuel (i.e. fossil oil or fossil gas), but rather the heating/combustion system itself (gas and oil boilers). Technology neutrality is to be welcomed in principle, but in the case of the heating transition and the urgency to fully decarbonise the building sector, it is not wise to wait for possible (but unlikely) future innovations or (likely insufficient) green gas quantities in the foreseeable future.

On the contrary, all stakeholders that are now faced with planning and implementing the decarbonisation of their buildings and homes or their energy systems and grid infrastructures need technology clarity: **Which heating systems will still be allowed in the future, which ones will not and in which timeframe will bans enter into force?**

This would give house and flat owners, tenants and property managers, as well as energy suppliers and grid operators, project planners, installation technicians and component manufacturers and finally the national and municipal planning authorities the necessary long-term planning and investment security.

Obligation for integrated planning of energy infrastructure

To achieve climate neutrality in cities, **joint integrated planning of energy infrastructures** for electricity, (renewable) gas supply and district heating **is needed at the municipal level** (as well as at the supra-regional and national level). The planning of the grid and of energy generation and storage must be carried out across different energy sources and companies. The "thinking in silos" of individual energy suppliers and distribution system operators (DSOs), each looking only at their own energy source and network, should be avoided and subordinated to the common goal of climate neutrality.

The need for integrated energy planning exists in all partner cities of the Decarb City Pipes consortium: to a lesser extent in cities with a horizontally and vertically integrated municipal energy supplier ("Stadtwerk"), and to a larger extent in cities with several (private) suppliers for electricity, gas and (no) district heating.

A corresponding requirement for energy planning through the EU would stimulate such integrated planning processes among energy suppliers, distribution system operators (DSOs) and municipal/regional authorities, and would also encourage municipal administrations to build up the necessary human resources.

Essential cornerstones of EU rules on integrated energy planning should include: climate neutrality targets; removing conflicts of interest in municipal/regional planning and defining energy planning as a primarily public task, of course at eye level with energy suppliers and grid operators; and establishing plans for the expansion of electricity and district heating grids, as well as for gas grid decommissioning areas.

Supportive regulation for the phase-out of gas (distribution networks)

Current regulations implicitly assume the expansion (or at least the stagnation) of gas sales and not – as required for climate neutrality – a decline in gas consumption and consequently also a resizing of the gas grid. By gradually replacing more and more gas boilers in an existing grid, network tariffs will – under current regulations and cost allocation – increase progressively for the remaining end customers over time. (If the number of gas heaters in a city is halved, the network tariff will double for the remaining customers. The "last customer" would theoretically have to pay the entirety of the network costs). This causes social and economic problems in the medium term, and is especially unfair to customers who, in the course of a municipality or region's gradual energy planning, will only be able to exchange their gas boilers at a later date.

(Example: In city district A, the district heating network expansion will "arrive" as early as 2025, and gas consumers in this area will thus have the opportunity to replace their gas heaters at an early stage and are shielded from successively increasing network tariffs. Another district B may however be scheduled for district heating connection only after 2035; its residents heating with gas are asked not to implement any other solutions in their buildings/apartments in the meantime so as not to undermine the high connection rate required for district heating networks. If nothing is changed in the current regulation for setting network tariffs, they would have to pay higher network costs year by year and be exposed to the danger of increasing energy poverty).

Again, a timely solution to this problem will provide planning security in this regard. A solution could be, for example, that the depreciation period for a specific DSO gas grid section should reflect the time of the decommissioning of this grid. It might also be discussed whether at least part of the cost increases related to network tariffs might have to be borne by the state. This could include the socialisation of stranded investments by DSOs for gas grid (expansion) investments if they happened before a point in time where the political support for climate neutrality and rapid fossil gas phase-out was not yet clear. The reference date could e.g. be the adoption of the Paris Climate Agreement in 2016.

DECARB CITY PIPES 2050

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