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EU'S HEATING AND COOLING STRATEGY TO SCALE UP EFFICIENCY AND DE-CARBONIZATION OF DISTRICT HEATING AND COOLING AND INDUSTRIES

1 KEY PROPOSALS

The energy use for heating and cooling ("H&C") represents about 50% of the EU's energy use and about 70% comes from fossil fuels. Therefore, very relevant and important H&C strategy should ensure, enable and accelerate the de-carbonization, energy security, energy efficiency and affordability in the heating and cooling and its potential to integrate with the low carbon electricity system. This will require to effectively and imperatively phase out the use of fossil fuels in buildings and industries.

Efficient district heating and cooling¹ ("eDHC") as targeted beyond 2030 should play a growing role in urban areas in the strategy's subject matters and delivery. Our key proposals for the preparation of new H&C strategy are the following:

1. **Strengthen national engagement and resourcing to timely and functionally sensibly implement FF55 legislation (RED3, EED and EPBD)** in order to boost the transformation of the DHC systems and on-site heating and cooling solutions to become energy efficient and de-carbonized **with a view towards 2040**.
2. **Design and summarize key fundamental regulatory characteristics as core enablers for the de-carbonization, electrification and energy efficiency of the DHC sector and on-site H&C sector with special focus on the potential for energy system integration.**
3. **Acknowledge the significant diversity across Member States in terms of regulatory frameworks, market structures, and technological readiness.**
4. **Establish a knowledge center² to monitor systematically and consistently heat market transition, to recognize best practices, to co-ordinate between Member States and to present tested and well-justified non-binding policy and regulatory advice** which should be tailored to varying national heat market conditions (i.e. regulatory regimes, emission reduction barriers and drivers, and de-carbonization outcomes).
5. **Emphasize further the feasibility of different technologies (including RE CHP), regulatory solutions and the benefits of electrified and de-carbonized DHC both from heating and cooling system and from low carbon electricity system perspectives i.e. energy system integration as a necessary enabler.**
6. **Ensure regulatory accuracy and predictability** both in the EU and Member States since this is a key prerequisite to successfully carry out the de-carbonization transition which can take at least 10-15 years in municipalities or countries still using mainly fossil fuels.
7. **The DHC system operators should have a clear mandate and incentives to take the key role in the low carbon heating and cooling planning: target-setting, CAPEX planning, financing and deployment.** The governments, national authorities and municipalities need to provide critical political and regulatory frameworks to boost for de-carbonization and electrification of heating and cooling, and especially DHC.

¹ EED 26§: Efficient DHC criteria: fuel/technology mix and/or emission limit

² Comparable example: The Agency for the Cooperation of Energy Regulators (ACER)

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8. **Design long-term and comprehensive public financing schemes linked with the planning of low carbon heating and cooling** that would cover the majority of technologies which DHC systems need to implement during their journeys of emission reduction.
9. **Collect and prepare an EU level sectoral assessment of the potential, barriers and most applicable sectoral solutions to boost waste heat reuse** with access to DHC infrastructures based on national comprehensive assessments (EED 25§) and other existing analysis.
10. **Waste heat from an industrial or a tertiary process should entirely be treated in parity with renewable energy.** A wide-ranging by-product definition should be the most relevant criterion for waste heat.
11. **CAPEX support should be prioritized in industrial heat and cool de-carbonization** over operational support to deploy forerunning pilot cases at scale since high upfront costs create a main barrier. Investments in industries and tertiary sectors e.g. in data centers to de-carbonize and reuse waste heat need significant CAPEX. Prerequisites for the development of electricity markets, new demand and production should be covered by the Electrification Action Plan.

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FORTUM IN BRIEF

Fortum produces and sells fossil free electricity (nuclear, hydro, wind and solar) to Nord pool and end-customers, as well as produces and sells DHC to buildings in the Nordics and Poland. Our DHC systems are transforming to become fossil-free by 2030. Our paper is based on our long DHC sector and industrial experience especially from Finland and Poland, and on monitoring the FF55 package (RED3, EED and EPBD) transposition.

In the EU, many countries in the heating sector are dependent on fossil fuels (average ab. 70%) and DHC operators produce over 42% from renewable energy and waste heat sources. DHC sector in Finland is estimated to become almost carbon free by early 2030's. Espoo DHC system (ab. 2 TWh) in Finland is targeting carbon free heating by 2029 based on waste heat, heat pumps, electric boilers, thermal storages and biomass.

H&C operations in Poland sell heat (ab. 3,4 TWh). They have declared the ambition and investment programs to full de-carbonization already by 2027. Fortum has also regulatory and investment experience in low carbon DHC in the other Nordic countries and Baltics.

3

SCALING UP EFFICIENT AND ELECTRIFIED DHC

3.1

Current situation

The increase of the de-carbonization and energy efficiency, and the growth of DHC infrastructures in the EU has been relatively modest (except for some countries) during the last years or even decades. The benefits and scalability of efficient DHC systems are, however, relatively well recognized and EU regulatory steering has been imposed on top of several national policy actions. This indicates that either those measures have not exactly been fit for purpose or that there exist large financing and affordability gaps.

Historically, many DHC systems have been tightly price- and profit-regulated in many ways. This might have deteriorated DHC systems' long-term financial positions since the duration of

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regulatory periods is often too short or the nature of it is too political to plan for and to deploy long-term investment programs. Less regulated DHC systems, i.e. in the Nordic countries, have instead developed more and are shortly reaching significant de-carbonization of heating and cooling.

National legislation and regulation plays a key role in assessing and enhancing how fair and equal the competitive conditions in heat markets between low carbon heating solutions are and should be. The Commission should underline the importance of establishing a level playing field between them concerning steering for buildings energy performance, pricing, customer protection etc. Customers' free choice of their heating and cooling and the competitiveness of heating solutions and services are very basic and fundamental enablers for improved energy efficiency and carbon neutrality.

The fundamental benefits of DHC are politically and regulation wise rather well internalized and tolerably well established by EU legislation but delays seem to occur in the national imposition and delivery of wanted outcomes. The H&C strategy should focus on identifying implementation barriers which naturally are largely different across Member States. It shall be appropriate to identify barriers and consider regulatory solutions separately across various heat market and DHC regimes and in industries based on their current status and achieved outcomes:

- a. Low carbon and fossil technologies in the electricity markets, DHC systems and on-site H&C sector (both ;
- b. Readiness of electricity markets and grid infrastructures to boost for growth in demand and production of low carbon electricity;
- c. Market shares of efficient and non-efficient DHC systems (EED 26§) and
- d. Shares of low carbon fuels and electricity in different industries.

Parts of the above analysis (a, b and d) could be covered also by the Electrification Action Plan.

Member States differ significantly in the condition of their electricity grids and in their capacity to expand and modernize them. While some countries possess resilient and flexible infrastructure capable of integrating renewable sources and handling increased loads, others face urgent investment needs to upgrade aging networks and enable cross-border energy flows. This challenge can also be covered by the Electrification Action Plan.

The above comparable and categorized analysis should create better situational awareness to define and assess the effectiveness and expedience of the H&C strategy and legislative initiatives. Although the H&C strategy will not include legal proposals at this stage, better structured national and comparable information would directly give indications about the efficient regulatory measures for the Commission, and for the Member States who can also legally act on their own.

The categorization of the barriers and solutions across different H&C markets and industries would make the H&C strategy better focused on the typical de-carbonization and energy efficiency barriers in different type of heat market developments since there are probably quite limited new 'one fit for all' solutions to be introduced, except for new public EU financing schemes.

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3.2 Increase political and regulatory predictability and accuracy

The main policy drivers to boost de-carbonization and electrification have been renewable energy and energy efficiency targets, and related regulatory requirements (FF55) which however are yet under national transposition. Therefore, the timely and effective implementation of FF55 package at national level and subsequent regular impact assessments (ex-post monitoring and governance) should remain as a priority. Strengthening the national motivation and engagement to timely and functionally implement FF55 legislation (RED3, EED and EPBD) would support and boost the transformation of existing DHC systems to become energy efficient. Also, the implementation of effective ETS2 steering will become a key driver when in place.

The H&C strategy could design and summarize key fundamental regulatory characteristics which should act as enablers for energy efficiency (waste heat), de-carbonization and electrification of heating and cooling sector and especially of DHC sector. It should also emphasize the need for regulatory accuracy and predictability both in the EU and Member States since this is a key prerequisite to successfully carry out de-carbonization transition because it will take at least 10-15 years in municipalities and countries still using mainly fossil fuels.

The Commission should consider establishing a guidance center³ to collect data and benchmark between national regulatory models, their emission reduction barriers and drivers in the buildings sector. Such a body could analyze similarities and differences, and prepare recommendations for national ministries, competition and regulatory authorities to support their development in the low carbon transition. Main fundamental targets would be to support fair competition in heat markets for the benefit of customers and society, and to provide comparable knowledge from different frameworks and better in-depth understanding of the achieved outputs (why and what).

3.3 Future DHC integrates closely with low carbon electricity system

Scaling up low carbon DHC infrastructure (networks and production) offers most cost-efficient and fastest pathway to de-carbonize the buildings sector. In rural areas building specific low carbon heat and cool solutions e.g. heat pumps can provide option for de-carbonization when the access to low carbon electricity is sufficiently available. Sourcing obsolete and large waste heat can only be advanced when having an access to DHC infrastructure. Reuse of waste heat can reduce significantly fossil fuels and besides improve domestic security of heat supply. The H&C strategy should address on one hand separately the scale up of low carbon DHC in urban areas and on the other hand the political, regulatory, technical and financial barriers for de-carbonizing on-site heating and cooling in rural areas and in industries.

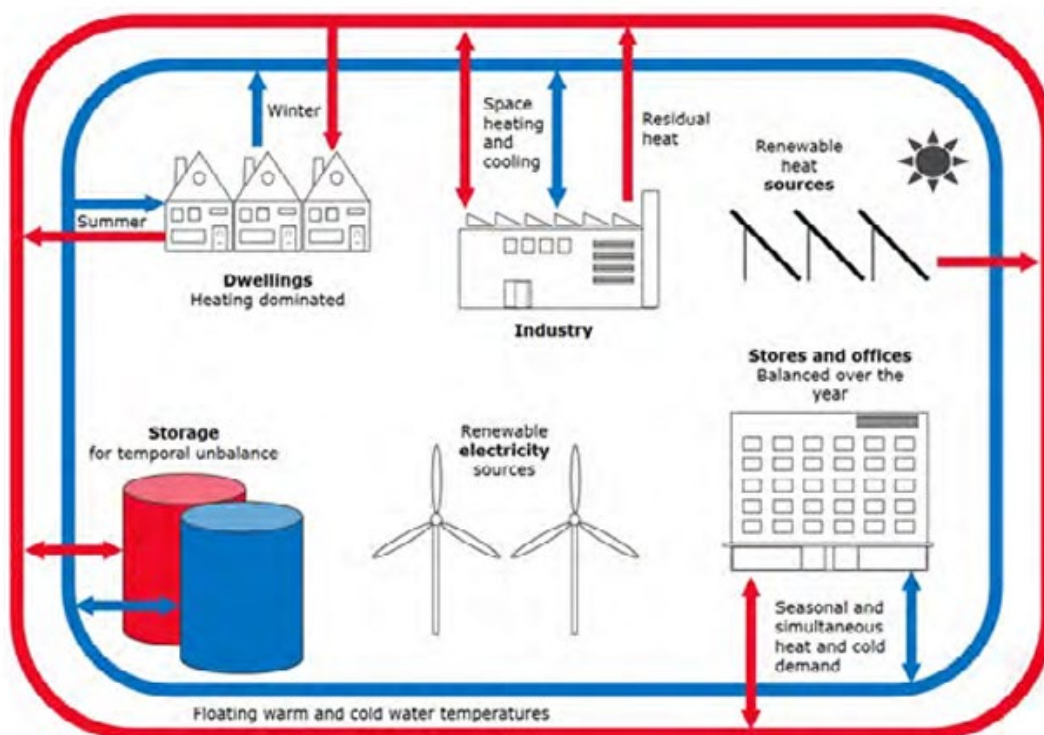
The H&C strategy should address benefits of electrified and de-carbonized heating and cooling from both DHC system and from electricity system perspective. It shall be less costly and more scalable to electrify DHC than each building individually. Investments in grid capacity and peak demand in heating shall be lower. The underlying policy belief is that energy efficiency can be best promoted through more system integration and flexibility, and that de-carbonization of

³ Comparable example: The Agency for the Cooperation of Energy Regulators (ACER) which covers electricity and gas grids. EU does not have similar instance to promote heat market competition and DHC system developments.

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buildings and industries can be supported through significant low carbon electricity production (nuclear, pumped storage hydro, wind and solar) growth.

We illustrate these two perspectives. The picture 1 demonstrates various characteristics and several interfaces of future energy efficient, flexible and decarbonized DHC system which has diverted from fossil fuels. All described technologies are readily available.



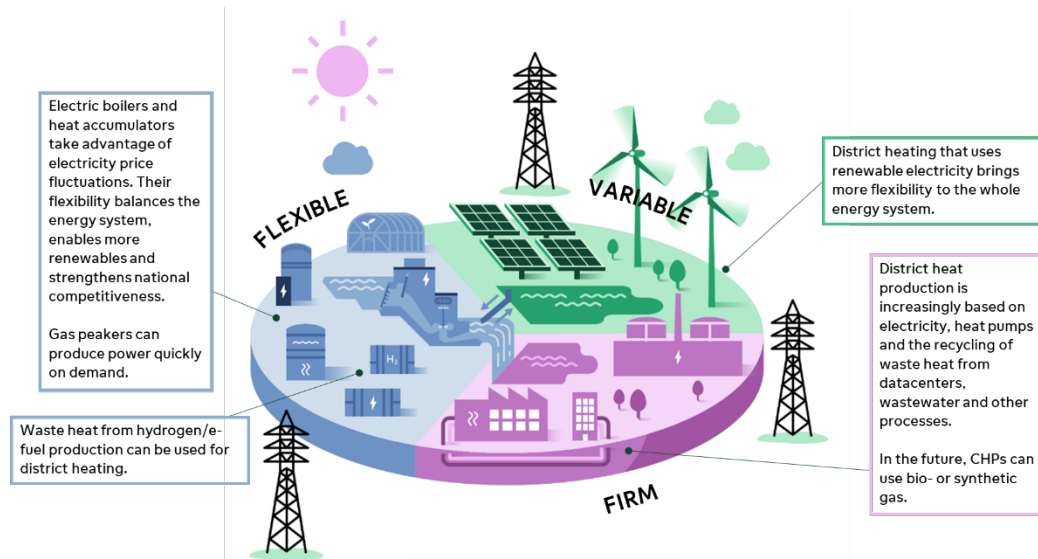
Picture 1. A circular representation of a 5GDHC system⁴.

The H&C strategy should identify all available technologies and presumably identify some new technologies which could be applied in foreseeable future across the EU. Most important of all is to identify and overcome barriers for large scale and rapid transition in various segments - for DHC systems and on-site H&C solutions separately.

Secondly, as shown in picture 2, electrified DHC systems enable the more rapid growth of intermittent renewable electricity production i.e. wind and solar and can act as one of the most important sources for demand side flexibility. Renewable CHP (biomass, biogas and energy from waste) integrates with the electricity system. It has a balancing role to provide more electricity during the peak demands for heating which should be secured.

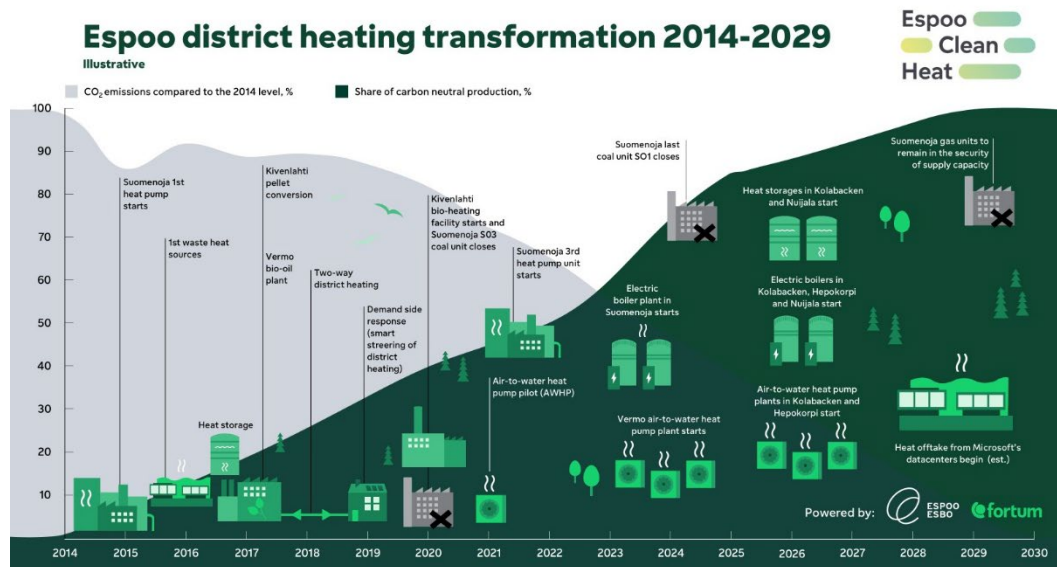
⁴ @“5th generation district heating and cooling systems as a solution for renewable urban thermal energy supply. Source: [2024 SCM Solution Booklet-District heating and cooling.pdf](#)

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Picture 2. District heating is in a heart of the electricity system. Source: Fortum

Fortum has deployed an electrification strategy in a DHC system (Espoo Clean Heat) prescribed above. The emissions will be reduced by 2029 as shown in picture 3 (curve: carbon neutrality).



Picture 3. Emission development (green background color) in Espoo DHC system towards 2030. Source: Fortum/Espoo Clean Heat. [Espoo Clean Heat | Fortum](#)

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3.4 Transition from coal dominance – experience from Poland

Fortum in Poland is both a DHC producer and distributor (ab. 3,4 TWh). Poland has the 2nd largest DHC sector in the EU and the share of renewables is ab. 20%. The transformation of DH systems requires very large investment expenditures and relatively long transition time. The analysis prepared by the Polish District Heating Association (PTEC) concluded that decarbonization investments of roughly 300-466 bill. PLN (72-112 bill. EUR) will be needed by 2050⁵. These CAPEX would include new DH production and transmission/distribution infrastructures, and modernization of the buildings sector.

The H&C strategy and its recommendations should take into account the differences across the Member States and remain flexible to allow for local adaptation. Any one-size-fits-all approach overlooks national constraints and misses opportunities for more tailored national solutions to overcome main barriers. The flexibility of H&C strategy is a crucial success factor to recognize regional realities, to act supportive and effective for country-specific implementation plans and to ensure that all Member States can advance their decarbonization of H&C at a pace and scale that is both ambitious and realistically achievable.

CAPEX requirements depend on local technical and other conditions, and on the chosen new technologies. DHC operators have the responsibility for local heating planning and their long-term financing ability creates a main barrier. Deployment of large CAPEX programs in very short time would put high pressure on the affordability of heat prices, since the new CAPEX will be directly affecting the price levels.

Polish DH networks are generally high-temperature systems. The modernization of DH networks should facilitate the easier integration of Power-to-Heat technologies into existing systems, which can be achieved by lowering the temperature parameters of these networks to improve compatibility. Another challenge will be the implementation of new standards for zero-emission buildings, including those undergoing major renovations, in line with the requirements of the EPBD. The low energy efficiency of buildings leads to high heat demand and increases pressures to choose lowest cost emission-intensive heating solution instead of low carbon solutions. This fact hinders the achievement of climate goals if new buildings will choose fossil-based on-site heating instead.

The transformation of the DHC sector is heavily dependent on the future development of national heat market and DH regulations. To ensure alignment with EU climate objectives, it is essential to effectively both transpose the RED3, EED and EPBD into national legislation and to update the key national strategies such as KPEiK (NCEP) and PEP2040, as well as to develop a dedicated national DHC strategy that supports the compliance with and deployment of these requirements.

The most important fuels and technologies to decarbonize the DH sector include biomass, geothermal, large-scale heat pumps and electric boilers with access to low carbon or renewable electricity and combined with thermal storages. Use of gas will absolutely be needed as a transitional fuel source since it is very challenging to fully replace it in short time horizon especially in bigger DH systems and without risking the strict reliability requirements.

⁵ [PTEC-Report-Impact-of-EU-regulations-on-the-transformation-of-the-centralized-district-heating-sector-in-Poland-assessment-of-the-effects-and-recommendations-for-national-regulations.pdf](#)

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So far the de-carbonization has been based on biomass-CHP. Key potential direction in transforming the DHC sector is the electrification and integration with renewable electricity. The heat pumps, electric boilers and heat storage systems enable efficient utilization of surplus energy from renewable intermittent electricity and contribute to emission reduction and increased system flexibility. It will be essential to introduce regulatory provisions that allow heat produced by electrode boilers to classify as renewable heat. This is relevant because of the low share of renewable electricity and should be enabled for example through direct line connections and power purchase agreements (PPAs) for renewable electricity.

The development of efficient DHC systems in connection with the growing electrification of the heating sector is a fundamental enabler. A strategic approach to the maintenance and modernization of the combined heat and power (CHP) fleet is essential, with a focus on biomass, biogas, and hydrogen technologies. When modernized they can serve as stable sources of dispatchable capacity and enable shifting electricity production to periods of low RES generation by utilizing the inertia of district heating systems. This allows CHP to be included in the planning of dispatchable capacity in the power system. Heat storages are another key elements in integrating the electricity and heating sectors. They enable system balancing during peak hours and increase the flexibility and competitiveness of DHC systems.

The implementation of the RED3, EED and EPBD together with the development of local heating plans is essential for achieving climate goals in Poland. This process requires both technical and financial support for DHC operators and municipalities, as well as the standardization of business and contract models to ensure consistency and scalability.

Our experience from Poland confirm that increasing electricity demand translates into challenges with the adequacy of generation resources, especially during periods of high heat demand and low intermittent RES generation. Poland is already facing shortages of dispatchable capacity and a growing number of RES curtailments imposed by the transmission system operator (TSO). Although curtailed RES generation could be utilized by heat pumps and electric boilers most of the curtailments occur during warm periods which do not coincide with peak heat demand.

3.5 Distinct benefits from electrified DHC infrastructures

There are several benefits for the society from electrified DHC – mainly energy efficiency and fossil fuel freedom. This provides that the electricity production is already (as in the Nordic countries) or will largely become low carbon based on nuclear, hydro, wind, solar, biogas and hydrogen (RFNBO). Electrified DHC systems offer a wide range of societal benefits, especially when integrated with renewable energy sources and advanced technologies:

a. Environment

- Lower CO₂ and pollutant emissions. Electrified DHC can significantly reduce greenhouse gas emissions and local pollutants (e.g., NO_x, SO_x, particulates) by replacing fossil-fuel-based individual heating systems.
- Efficient use of waste heat and renewables. These systems can harness surplus heat from industrial processes, data centers, and renewable sources like geothermal, solar thermal, and biomass.
- Climate resilience. By reducing reliance on fossil fuels and improving energy efficiency, DHC systems contribute to climate mitigation and adaptation.

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b. Energy system integration and efficiency

- Energy efficiency and cost savings: Centralized production and distribution of thermal energy allow for economies of scale, reducing energy costs and improving overall system efficiency.
- Reduced infrastructure investment: Electrified DHC systems can lower the need for new renewable electricity capacity by using electricity more flexibly and efficiently.
- Grid flexibility and stability: When integrated with CHP and thermal storage, these systems can act as flexible loads or even microgrids, enhancing grid resilience.

c. Society and public health

- Improved air quality: Reducing emissions from individual boilers improves urban air quality, leading to better public health outcomes.
- Lower energy bills: Efficient centralized systems can reduce and stabilize heating and cooling costs for consumers, especially in dense urban areas.
- Increased energy security: DHC systems, especially those with CHP can maintain operations during grid outages, supporting critical infrastructure like hospitals and universities and supporting regional energy security of supply.

d. Technology and innovation

- Smart energy management: Integration with digital technologies (IoT, cyber-physical systems, digital twins) enables real-time optimization, predictive maintenance, and better demand-side management.
- Cost effective maintenance: Electrified DHC systems have lower O&M costs than conventional combustion plants.
- Support for decarbonization: Electrified DHC systems are compatible with future energy systems that rely heavily on renewables and electrification.

3.6 Scaling up efficient and electrified DHC – acceptance, planning and financing

The H&C strategy should highly underline the benefits of energy efficient and electrified DHC both from DHC system and from electricity system perspective to increase its awareness and acceptance. They can be promoted through more system integration and flexibility, and that the de-carbonization of buildings and industries can only be enabled through low carbon electricity production growth.

We propose to the Commission to consider an indicative 2040 target for scaling up efficient DHC infrastructures in the EU. Understandably, national starting points vary significantly why national target setting should be left for Member States to determine on a voluntary basis. The target should be limited to focus only in urban areas.

EED 25:2§ has now introduced mandatory municipal heating and cooling planning scheme⁶ which has to be transposed into the national legislation by October 2025. The Directive does not clearly stipulate the schedules for deploying the planning. The obligation should be much

⁶ EED 25:2§: Municipalities with over 45.000 inhabitants have to prepare a municipal heating and cooling plan to target for de-carbonization and energy efficiency.

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better focused, have lower thresholds and include mainly those locations whose heating (and cooling) is based on fossil fuels and whose DHC systems are yet not meeting with the efficiency criteria (EED 26§). In countries and DHC systems, who already meet with the EED and RED3 requirements, these planning obligations could be relieved to simplify and better focus EU and national regulations.

We would emphasize the importance of local and joint (DHC operator and municipality) heating and cooling planning steered by national low carbon targets and timelines. The DHC operators should have strong incentives to take the lead in the target-setting and low carbon planning since they are finally also largely responsible for the materialization. The operators have a decisive position in the local de-carbonization path since they know the customers, the technologies, available heat sources and the competition in the heat markets. The municipalities should push for carbon neutrality targets but the DHC operators will make the transition to materialize at scale.

A key barrier is the access to long-term financing of the targeted transition. It will take typically at least 10-15 years in bigger systems and 3-10 years in smaller ones. A solution should be to design and offer long-term and comprehensive public and private financing schemes that would cover all substantial major CAPEX initiatives which DHC systems need to implement during their journeys of emission reduction (to finance investment programs instead of step-by-step finance decisions). Such an approach would substantially accelerate the transformation, and reduce the administrative and reporting burdens.

Under long-term financing schemes individual DHC operators would be encouraged to carry out full transformation during a realistic and achievable timeline. The financing platform should be a combination of equity, own loans, public national and EU financing. At the same time, the national authorities should provide regulatory predictability and stability with validity for several years to safeguard those low carbon investments. The solutions and support schemes for on-site low carbon heating when electricity systems gradually develop in parallel can be developed at national level.

The importance of fair and equal competitive conditions in the national and local heat markets needs more focus. All accessible low carbon heating and cooling solutions should be treated equally with technology neutrality principle. This requirement is extremely relevant in the national transposition of energy performance of buildings (EPBD) steering i.e. primary energy or weighting factors which steer the acceptability of low carbon heating. As indicated by EPBD, those factors for efficient DHC should be based on system specific parameters since DHC is a local heat solution. Further, the life-cycle global warming potential (GWP) steering should also be based on DHC system specific factors. These steering principles should be highlighted in the strategy and later on more strictly presented in the future revisions of EPBD. Reuse of waste heat and use of low carbon electricity should be incentivized in the DHC system specific factors. Technology and competition neutrality should be emphasized between DHC and on-site low carbon heating since the customers value their freedom of choice and the fair competition would best enhance price competitiveness and affordability.

The predictability of policies and regulations is a very relevant driver. When the constructors or the building owners in urban areas can not foresee upcoming renovations and de-carbonization of existing DHC infra, they will choose from available on-site low carbon alternatives. This would not be optimal for the energy system integration and for the DHC infrastructure development, and this does not support the development of effective demand-

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side flexibility. Electric boilers and thermal storages connected to DHC systems can act as market-driven and very effective demand-side flexibility sources for the power system.

3.7 **Overcoming barriers for waste heat reuse**

The potential for waste heat reuse through DHC infrastructures in the EU is huge. Hence specific focus to overcome the barriers is critical for improving energy efficiency and diverting from fossil fuels. The current RED3 24§ and EED 26§ only concerning data centers are too narrow and cautious to effectively promote the reuse. One key driver is that the DHC operators and waste heat producers can have more incentives i.e. tax credits and public infrastructure financing to deploy it. More functionally effective EU and national regulations should be considered together with all relevant parties and put in place.

Waste heat potential has already been mapped in the Member States when EED 25§ and its predecessors have been implemented. Based on national Comprehensive Assessments it should now be possible to draw better sector-specific conclusions how most effectively to boost reuse of various type of waste heat. Waste heat from an industrial or a tertiary process should entirely be treated in parity with renewable energy where the by-product criterion is the most decisive. Examples can be several: waste heat from food or other process industries, sewage water, heat from thermal treatment of non-recyclable and hazardous waste and from data centers.

Similar to the data collection already made from data centers (EED 12§), the Commission could collect data from other main sectors who produce waste heat as their bi-product. The Commission should thereafter prepare an EU level sectoral assessment of the potential, barriers and most applicable sectoral solutions to boost waste heat reuse. Very likely in many cases the main barrier is the lack of access to DHC infrastructures. More transparency from the good precedent case studies would also help to increase awareness. Another key enabler will be access to financing because financing waste heat off-take (pipes, heat pumps, industrial process redesign) is not at all at the core of industry or tertiary sectors having waste heat.

4 **HEATING AND COOLING DE-CARBONIZATION IN INDUSTRIES**

By electrifying industrial processes based on fossil fuels and combustion, significant savings in primary energy use and emission reductions can be achieved in industry, as electricity production is based on renewable and emission-free energy sources. In industry, electrification can be divided into direct electrification, electrification solutions that utilize heat pumps, and indirect electrification, where electricity is used to produce, for example, hydrogen or synthetic fuels.⁷ The greatest electrification potential is focused on electrifying heat-using processes. Generating high temperatures with electricity will be possible in the future based on current technological developments.

Heavy energy intensity, lack of infrastructure capacities and limited low-carbon technologies at commercial scale (e.g. CCSU, green hydrogen) in many industries make their decarbonization and electrification very uncertain and costly. Industrial process requirements (e.g. availability and continuity) further reduce the possibility for demand side flexibility which is a critical precondition for balancing volatile electricity sourcing: prices and adequacy. Such a requirement will be increasing because more and more intermittent electricity production is launched.

⁷ Motiva Report: Electrifying Energy Efficiency in Industry. 12/2024. Experience in Finland. Report in Finnish.

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Currently available technological solutions are rather dependent on the required temperature levels. There are more solutions available below 200o C (e.g. various heat pumps, waste heat, biomass and electric boilers) compared to other temperature levels. Higher temperatures can mainly and only be reached with combusting technologies (e.g. biomass, hydrogen or biogas). The affordability of those available technologies (e.g. high upfront costs and unavailability risks) becomes a key barrier for the deployment at scale.

Those substantial barriers mentioned above and concurrent uncertain geopolitical and economic developments across Europe consequently lead to insufficient lack of trust in new solutions and lack of readiness to take new energy related investment decisions and to deploy them timely. Lack of financial incentives or imperfections in carbon pricing create also barriers but are typically country specific. Sectoral characteristics of industries are rather diversified (temperatures, role and types of energy, solutions, etc) why the Commission should look them separately in most typical categories.

Reliance on domestic fossil-based inputs in some industrial processes and countries is likely to remain strong and will be politically and economically very challenging to depart from. Access to biomass will gradually tighten when sustainability and cascading aspects get even more attention and criteria get stricter. This leads to increased price levels. When industrial structures are older the adaptability to clean technologies is low.

Clean and innovative technologies require high up-front CAPEX and can only become eligible for equity and loan financing when they receive sufficient public support. To boost more decarbonization investments, CAPEX support should be prioritized over operational support in order to realize forerunning pilot cases at scale.

National emission reduction road maps in industries⁸ can have very relevant political steering role (example Finland). Hence the current EU framework is targeting to 2030 and is being transposed and since industries are already aiming beyond 2030, we recommend that H&C strategy for industries should collect current emission reduction objectives and key measures by each industry sector with a view towards 2040.

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⁸ Työ- ja elinkeinoministeriön julkaisu • Energia • 2024:45 Yhteenveto toimialojen vähähiilitiekartoista (report in finnish)