EUROHEAT & POWER

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Harnessing Waste Heat from Data Centres for Sustainable Urban Development

Amidst the dual challenges of the ongoing climate and energy crises, Euroheat & Power strives to shed light on the untapped potential of waste heat from data centres. The exponential growth of data centres globally has resulted in an unprecedented surge in energy consumption, with 30-40% dedicated to the cooling of the systems. Simultaneously, there is a pressing need to accelerate the heat transition, as heating and cooling still account for 50% of the EU's energy demand, relying on fossil fuels for 70% of its supply.

District heating and cooling is part of the ready-to-deploy solutions to phase out fossil fuels in heating and cooling. It currently **represents 12% of the heat market, providing heat to more than 68 million EU citizens**, while 140 million citizens live in cities already equipped with a DHC network. DHC fosters **robust and scalable decarbonisation for heating**, **harnessing local renewable heat** and enables waste heat utilisation from industrial and urban sources**. Recovering urban waste heat alone could meet 14% of the European heat demand for buildings**, with the most significant resources coming from wastewater treatment plants (42%), **data centres (23%),** service sector buildings (19%), and residential buildings (9%)[i].

Harnessing the heat generated by both air and liquid-cooled data centres offers many benefits, addressing environmental concerns, curbing energy costs, enhancing energy efficiency, and contributing to the advancement and decarbonization of district heating and cooling (DHC) **networks.** Aligned with the definition of efficient district heating and cooling systems, **the DHC sector is committed to achieving full decarbonization by 2050 at the latest**. In parallel, data centre operators and trade associations have committed to **transforming data centres into climate-neutral by 2030** through the Climate Neutral Data Centre Pact (CNDP), and thus have the opportunity to provide carbon-free thermal energy for the DHC sector.

Euroheat & Power welcomes the recently adopted Energy Efficiency Directive, mandating data centres with a total rated energy input exceeding 1 MW to utilise the waste heat when technically or economically feasible. Nevertheless, several barriers impede the efficient and large-scale implementation of low-temperature waste heat sources for the majority of DHC grids. **Euroheat & Power, as a member of the advisory board of the recently established *'Net Zero Innovation Hub for European data center'*, and with members actively engaging with waste heat utilization from data centres, recommends considering the following:**

1. District heating and cooling networks are the only energy infrastructure enabling the utilisation of waste heat, hence we call for the support of DHC network developments.
2. Enable local heating and cooling plans with a public registry of decarbonised heat sources.
3. Identify best practices for business models derived from real projects, spread know-how and good practices, facilitate communication and provide training to stakeholders.
4. Require the mandatory development of de-risking instruments for clean heat projects and create incentives for sector integration, e.g. by adapting the electricity network charges and levies.
5. Encourage the building of new data centres in areas with available DHC network nearby.

1. Support district heating development and modernisation

District heating and cooling networks are the only energy infrastructure enabling the utilisation of waste heat and cold from various sources, including residential and tertiary buildings, industries, and urban facilities. Waste heat recovery systems also significantly increase primary energy savings at the building level and provide a free-cooling supply, further increasing the energy and cost-efficiency of the waste heat provider or for a district cooling network.

- ✓ To fully unlock the potential of waste heat from data centres, **the proximity of DHC networks is crucial, necessitating their robust development and modernization.**
- ✓ To maximize energy efficiency, **buildings connected to the grid must be optimized for low-temperature heating.**

2. Enable local heating and cooling plans with a public registry of decarbonised heat sources

For projects to take flight, developers require reliable data, particularly concerning data centres, including their locations and energy consumption/waste heat potential.

- ✓ **A public registry of decarbonized heat sources, encompassing data centres**, geothermal potential, and industrial waste heat, **would prove invaluable for project developers and municipalities embarking on decarbonization initiatives.**

An exemplary model is the European Waste Heat Map, which could achieve a more granular level of detail when conducting such research at the local level.

Such registries could also heavily support the recently adopted **local heating and cooling plans for municipalities with more than 45,000 inhabitants** introduced in the Energy Efficiency Directive.

3. Support the development of business models

Waste heat recovery, often approached on a case-by-case basis, lacks standardized solutions due to individual and site-specific conditions. This results in high efforts to plan, design and operate systems. Consequently, the engineering and instrumentation efforts and connected costs are relatively high compared to other heat sources.

- ✓ **Identifying best practices for business models derived from real projects** could help waste heat owners and DHC operators in their dialogue. Creating a collection of best practices, and sharing information between stakeholders would be beneficial, however, standardizing contracts and clauses is not desired in light of the complexity and variability of waste heat utilization.

Waste heat actors have limited opportunities to meet and exchange with each other, they are focusing on their core activities and do not necessarily have the knowledge to cooperate to implement successful waste heat recovery projects. In general, waste heat utilisation is neither the core business nor the competence of the “waste heat owner”. Furthermore, the know-how of a

'waste heat owner' for supplying waste heat to DHC networks can be rather low, and its benefits are unknown.

- ✓ The development of **local, regional and national forums for matchmaking, facilitating contacts and exchange between waste heat owners and DHC operators**, as well as city planners and developers of large urban properties would help kick-start discussions on possible projects.
- ✓ **Spreading know-how, good practice and training stakeholders** that have little or no experience of waste heat, e.g. city authorities and DHC companies staff involved in contract negotiations or planning, would help the development of more projects.

4. Require the mandatory development of de-risking instruments for clean heat projects and create incentives for sector integration

Developing de-risking tools is essential to mitigate investment risks and manage upfront capital costs for clean heat projects. Harnessing waste heat still involves high CAPEX and long-term commitments with long pay-back periods, while investors need certainty. Moreover, the utilization of low-temperature waste heat relies on the use of heat pumps, which creates a dependency on the electricity markets and thus increases the uncertainty due to the future development of the price on average and its volatility.

- ✓ **De-risking instruments such as insurance schemes should be created to cover heat recovery from data centres,** as there is an inherent risk for these activities to close, relocate, or as a result of new technology waste heat potential decreases. Training of finance actors to waste heat project financing should also be promoted.
- ✓ **Adapt the electricity network charges and levies system**, so that the use of electricity for energy system integration becomes competitive. Data centre waste heat is generally low-grade and must be upgraded with heat pumps. In some countries, the cost of electricity (levies, network charges, etc.) worsens the business case with prohibitive costs, leading to a lack of attractiveness for waste heat projects.

5. Encourage the building of new data centres in areas with available DHC network nearby

One of the barriers to waste heat utilization from data centres is the geographical mismatch between the waste heat source and the heat demand. The DHC network does not necessarily extend near the location of the data centre. Especially large data centres are often located outside urban areas while DHC networks are usually concentrated in dense urban areas.

In order to achieve higher energy and resource efficiency **we suggest encouraging new data centres to be built in a location which could be technologically and economically feasible to connect to the nearby DHC network**.

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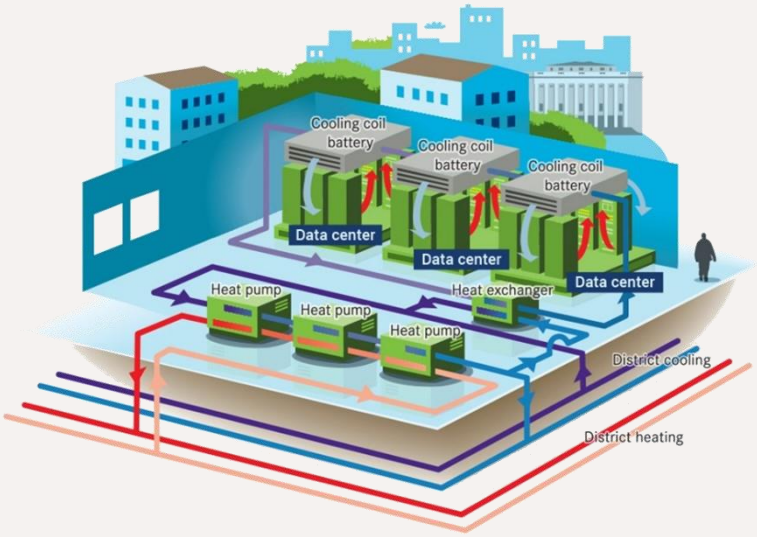
Examples from EU Member States of waste heat utilization of data centres via DHC networks

Data centres are located in most major cities and can provide a local heating network with sustainable heat for the built environment. This has been operational and a reality in various places for years. Please find below a few examples:

- ✓ In Dublin, Ireland, Tallaght District Heating Network recycles Amazon's data centres waste heat to warm 50,000 m^3 of public sector buildings, commercial spaces and 135 affordable rental apartments.[ii]
- ✓ Facebook reports that the heat from its data centres in Odense, Denmark, is warming 7,000 homes in the area.[iii]
- ✓ A data park in Stockholm, Sweden, aims to use waste heat from data centres to heat 10% of the city by 2035.[iv]
- ✓ The data centre Bahnhof Thule, situated in the centre of Stockholm, consists of three data halls, with three heat pumps connected in a series, see picture below. [v]



At normal operation, the heat pumps use the district cooling network's return line and cools it down to the desired temperature for use in the data centre. The heat produced is delivered to the district heating supply line, thus making the district heating network the heat sink for the heat pump. The total cooling capacity is approximately 1,200 kW when district cooling at 5.5 °C and district heating at 68 °C is delivered. The heating effect corresponds to approximately 1,600 kW.

- ✓ Near Paris, France, Val d'Europe's new heating system will utilise excess heat from local data to provide a new district heating network of 4km distribution pipelines.[vi]
- ✓ Apple is looking to expand a Danish data centre where heat energy is used in nearby Viborg to capture excess heat for the city.[vii]
- ✓ Data centre company GleSYS will warm 1700 residential buildings in Falkenberg, Sweden, with excess heat.[viii]
- ✓ Data centre in Aalsmeer, Netherlands, heats a school, sports centre et swimming pool with waste heat[ix]
- ✓ Helsinki's Telia Data Centre's excess heat can warm up to 25,000 residences in the adjacent town of Espoo.[x]

- ✓ In Germany, Braunschweig's district heating network using data centre waste heat serves about 56,000 houses and apartments, as well as commercial and municipal buildings.[xi]
- ✓ WarmteStad's new heat plant on Zernike Campus, in Groningen in the Netherlands, will use waste heat from adjacent date centres to function and heat more than 10,000 households by 2026.[xii]

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[i] ReUseHeat-Handbook-For-Increased-Recovery-of-Urban-Excess-Heat.pdf
[ii] "Local community buildings in Ireland to be heated by Amazon data centre", 2020.
[iii] "Facebook plugs its Danish data centre into Odense district heating system", 2020.
[iv] "The city where the internet warms people's homes", 2017.
[v] "Open District Heating in Stockholm, Sweden", 2020.
[vi] "Excess heat from a datacentre in Val d'Europe, France", 2020.
[vii] "Apple to expand its Vibord (Denmark) data centre; will capture excess hear energy", 2022.
[viii] "A unique venture – surplus energy from a new data centre in Sweden is transformed into district heating", 2020.
[ix] "NorthC's Aalsmeer data centre ships waste heat to local customers", 2021.
[x] "Data centres are a forgotten source of emissions", 2019.
[xi] ReUseHeat project
[xii] "WarmteStad starts building sustainable heat plant Zernike campus", 2021. and "QTS refits Dutch datacentre to warm thousands of homes with waste heat", 2022.

Euroheat & Power is the international network representing the district energy sector. We promote the rapid roll-out of sustainable heating and cooling in Europe and beyond, with the objective of full decarbonisation before 2050. As we work towards this common objective shared with the EU, we appreciate the efforts of the Commission to drive progress in the run-up to carbon neutrality in 2050.