

# New report advocates using waste heat from data centers in district heating

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A new report from the Cool-Data project sheds light on the possibilities for utilizing flexibility and waste heat from data centers in Denmark. DTU's researchers answer five questions about how the energy can be utilized in the district heating.

In the project Cool-Data a team of researchers from DTU (DTU Compute, DTU Construct, and DTU Management), together with four companies and a utility, work on developing and implementing an innovative integrated cooling and [storage system](#) adapted for small and medium-sized [data centers](#) (up to 500 servers). The cooling process produces a lot of heat that could be used in the surrounding energy system.

In a new report, Cool-Data provides a comprehensive review of the rules and incentives affecting the provision of flexibility and waste-heat recovery by data centers in Denmark as the European Union wants data centers to be connected to the surrounding [district heating](#) network to use the surplus heat..

We have asked the researchers, Juan Jesús Jerez Monsalves, Claire Bergaentzlé, Martijn Backer, and Dominik Franjo Dominkovic from DTU to answer five questions about how the research contributes to the EU's plan for data centers to be connected to the surrounding district heating in order to use the waste heat.

## **Why should small and medium size data centers be integrated into the surrounding energy system?**

Small and medium data centers have significant advantages for providing waste heat to district heating. The most important benefit is their location: they are usually located close to existing networks, greatly reducing potential network extension investments and transmission losses and thereby improving their waste heat's cost-competitiveness.

Additionally, waste heat from small data centers can be recovered even in district heating networks covering a small area, without the district heating company risking a significant part of its supply on a single

facility. Finally, data centers with a heat output lower than 250 kW are exempt from price regulation, allowing more flexibility during their negotiation with the district heating company.

The importance of smaller data centers in the energy system is also reflected in the EU Energy Efficiency Directive revision, which is part of the Fit for 55 package. This revision originally mandated new data centers larger than 1 MW to perform a [cost-benefit analysis](#) for waste-heat recovery, including its use in district heating systems. However, an amendment has been recently approved to include data centers larger than 100 kW, highlighting smaller data center's potential contribution to European energy security.

Another even greater benefit from small and medium size data centers is that they can often utilize their waste heat directly in the commercial building(s) where it is located, which is even more efficient than utilizing the waste heat in a district heating grid. Contrary to big data centers, they are often located in commercial buildings.

## **Why does it not happen today?**

Until 2021, the regime that regulated waste-heat suppliers hindered the participation of small participants; they were subject to the same budget notifications and price verification requirements as district heating companies. These requirements added administrative burdens and costs that adversely selected small suppliers. Additionally, the previous tax on waste-heat recovery further limited the cases in which its recovery would be economically feasible.

The new regulation in place since 2022 has passed the administrative burden to the district heating companies, which have the tools and expertise to handle it. It has also removed the tax on waste heat produced from electricity, effectively removing data centers' main barriers to

providing heat. Some time is required to observe more data centers recovering waste heat, as these regulatory developments are quite recent.

Furthermore, established practice is missing on who should actually handle the waste heat, especially when we need to add heat pumps to the system (in order to raise the waste heat temperature). It is not clear if the operator should be the data center owner or the district heating company, and who should invest in heat pumps.

## **Would it always be a good business case to use the waste heat?**

Technically, air-cooled data centers, the most common type of data centers' cooling systems, require heat pumps to raise the waste heat temperature to that of the district heating network. The lower this temperature gap is, the less electricity the heat pumps consume.

Therefore, the economic feasibility of this type of project is determined by three main factors: electricity prices, heat pump investment costs, and connection to the district heating network (and its expansion).

Considering that current regulation places a ceiling on the waste-heat price, projects that do not have good conditions in these areas might have production costs above the ceiling and would not be able to sell heat to district heating companies.

## **What could make it more accessible for the data center/district heatings?**

The current regulatory framework requires more certainty in the calculation methodology that determines the price ceiling. The Danish Energy Agency set up the 2022 ceiling at 77 DKK/GJ, considering the

heat production costs from biomass boilers and heat pumps. Potential changes in this methodology and the high electricity prices observed this year introduce substantial uncertainty on the ceiling value for the following years, increasing the risks for waste-heat recovery projects.

In the case of new data center projects, an early engagement of developers with district heating companies and authorities is the most impactful. Hopefully, this communication should occur before the project is presented for permitting. When waste-heat recovery is considered from the planning stages, developers can consider potential revenues from waste heat to determine the project's optimal location and the cooling system design. Once the data center has been built, retrofitting is usually too expensive.

The mandatory cost-benefit analysis currently in discussion at the European Parliament will make project developers aware of potential benefits from waste-heat recovery. However, how strongly this influences their decisions will depend on the local context.

## **How much interest do you find in industry organizations?**

Great interest has been shown by the industry, especially as the EU is preparing a mandatory regulation on waste heat reuse. Industry partners are willing to engage in different testing and demonstration sites.

On the other hand, the data center industry is a conservative one in which security and reliability standards have always been a top priority.

Due to the latter, data centers are usually keen on using only the technologies and set-ups that have passed many tests in real world operation. This is the main cause why the roll-out of the [waste heat](#) reuse

set-ups has been slower than technically possible.

**More information:** Juan Jesús Jerez Monsalves et al, Regulatory Frameworks and Business Models for Data Centres Integrated to the Energy System, *Technical University of Denmark* (2022). [DOI: 10.11581/dtu.00000242](https://doi.org/10.11581/dtu.00000242)

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