

WHITEPAPER **Wim Boone**

## Data Thermics

An opportunity for waste heat utilization from data centers in district heating networks

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ingenium

## MANAGEMENT SUMMARY

Belgium is experiencing a data center wave that must comply with stricter European regulations regarding waste heat. This whitepaper demonstrates that waste heat extraction is not only technically feasible but also forms an attractive business case.

Data centers produce significant amounts of heat that have been largely lost until now. By integrating this waste heat into local district heating networks, surrounding buildings and industries can be supplied with sustainable heat. This leads to lower cooling costs for the data center, reduced energy consumption for customers, and significantly lower CO<sub>2</sub> emissions overall.

The financial justification is solid: investments in waste heat extraction are recovered through heat revenues and energy savings, supplemented by government subsidies. This transforms data centers from purely energy-intensive installations into strategic partners in the local energy transition.

Waste heat extraction is therefore no longer an experimental concept, but a feasible and profitable solution that brings together regulation, sustainability, and economic value.

Belgium is in the midst of a new data center wave. International players and local operators are investing massively in new capacity, but this growth comes with clear conditions: increasing energy demand, stricter European regulations, growing pressure around sustainability, and limited electrical grid capacity.

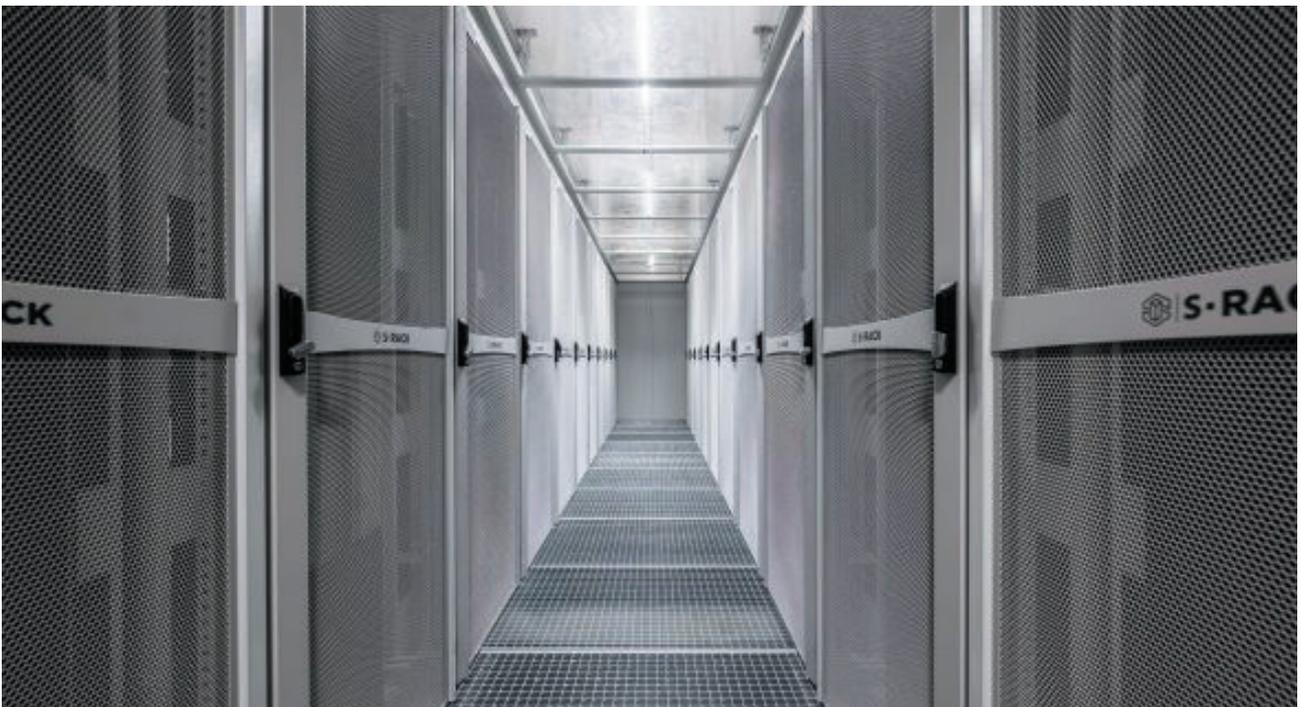
With the revision of the **Energy Efficiency Directive** (EED), waste heat becomes more than a voluntary choice. Data centers with a total energy input above 1 MW must demonstrate the reuse of waste heat or justify why this is not feasible.

## INTRODUCTION

**Ingenium has conducted several feasibility studies over the past year regarding waste heat extraction from data center projects. You can read the main findings below.**

The fact that Flanders subsidizes these studies through the VLAIO greening scan at a cost limited to approximately €1,600 sets the bar very low for data centers to examine waste heat extraction both technically and financially-economically.

These scans are therefore not a theoretical exercise, but a decision-making tool that brings together compliance, energy efficiency, and **financial feasibility**.



## DATA CENTER AS A SOURCE OF HEAT AND CONSUMERS

We note that waste heat extraction can generally be classified as follows regarding the water temperature regime:

- Low regime 30°/20° resulting from air-cooled data centers
- Medium-high regime 50°/40° resulting from liquid-cooled data centers with heating of buildings and food industry as application area
- High regime 90°/70° using heat pumps as add-on to air-cooled or liquid-cooled data centers

Based on the waste heat capacity of the data center, typical heat consumers are diverse, namely (planned) district heating networks or heat consumers:

- (semi-)residential: heating of buildings or even entire neighborhoods, nursing homes, swimming pools
- agriculture and fisheries: greenhouses, aquaponics, ...
- industry: heating of buildings and industrial processes (e.g., sludge drying) at high or medium-high regime

## INGENIUM COMBINES TECHNOLOGY AND BUSINESS

The preparation of the financial-economic picture takes into account on the one hand the CAPEX costs of implementing the extraction and on the other hand the OPEX costs of maintenance and electrical consumption.

Recent greening scans show:

- technically feasible waste heat extraction **from approximately 1 MW**
- **heat prices between 10 and 40 euros per MWh**, depending on scale and the temperature regime offered

A calculation example shows the following savings: a 10 MW data center that exports its heat for half the year at a heat price of €10/MWh generates revenue of **€400,000/year**. A considerable sum.

For the data center developer, the technical impact is limited, the impact on PUE is positive, and the necessary investments for extraction can be recovered through the district heating network.

*“We received multiple scenarios, with clear figures for energy, CO<sub>2</sub>, and IRR.”*

— Technical Director colocation-datacenter

## INGENIUM COMBINES SUSTAINABILITY AND BUSINESS

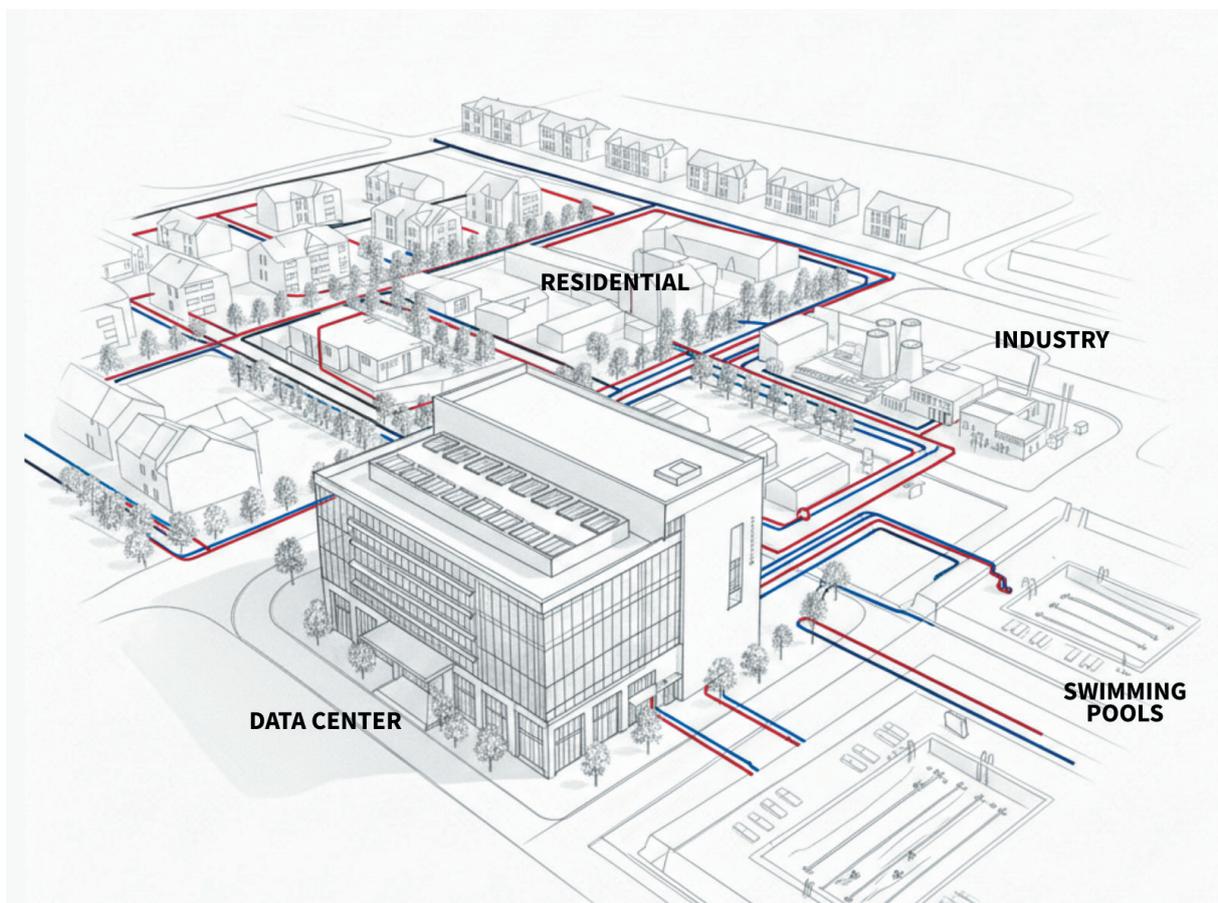
The obligation to conduct a feasibility study for waste heat utilization often proves to be a **catalyst for more efficient design** in practice. After all, waste heat extraction means less energy needs to be cooled away.

However, **the greatest savings in energy consumption and CO<sub>2</sub> emissions lie outside the data center**, with the companies and buildings that connect to a district heating network. We use the energy used in the data center twice: once for data processing and then again for heating surrounding buildings. They can thereby obtain their heat demand largely or completely from the district heating network.

If we account for the avoided natural gas consumption of surrounding buildings, we see from the greening scans potential **CO<sub>2</sub> reductions of approximately 5,500 tons per year** for a data center with a capacity of 10 MW.

Translated to the financial impact when applying ETS 2, taking into account an estimated price of €50/ton CO<sub>2</sub> emissions, this gives **an avoided expenditure of €275,000/year**.

And a considerable amount of power that is cooled through the district heating network instead of through cooling machines that consume energy. Thus a win-win in terms of both finances and sustainability.



## THE BUSINESS CASE: SAVING ENERGY AND CREATING VALUE

An important distinguishing element of the VLAIO greening scan is the **financial justification**. In multiple projects, it has been demonstrated that waste heat valorization also pays off economically:

- **up to 30 percent lower OPEX** for cooling
- in some configurations even **net energy cost savings**
- **attractive internal returns**
- and **subsidies up to 40–55 percent** of the additional cost through VLAIO instruments, such as ecology premium+, GREEN investment support, or strategic ecology support

*“The business case also stood up financially.”*

— Investment manager, data center developer

## FROM CLOSED INFRASTRUCTURE TO LOCAL ENERGY PARTNER

Data centers are increasingly viewed as more than energy-intensive buildings. By supplying **waste heat** to district heating networks, they grow into **structural partners for cities and municipalities**, especially in zones with high heat demand.

In some cases, in addition to the data center, there is also **production of local renewable energy**. To avoid injection onto the electrical grid and to maximize the use of this green electricity for the data center, in addition to heat, the electrical aspect is also included in the business case. Again a win-win where the data center gets maximum green electricity but can also help with **energy flexibility** to the electrical grid.

After all, heat and electricity are two sides (energy forms) of the same coin that we look at together to arrive at a technical and financial optimum.

## CONCLUSION

Waste heat extraction is no longer an experimental sidetrack. For an increasing number of data center projects, the **VLAIO greening scan by Ingenium** forms the starting point of that transition — from energy consumer to strategic heat source.

Ingenium combines in-depth **technical expertise in data centers, district heating networks, and electrical smart grids** with **strong economic and financial justification**.

As a **recognized service provider for VLAIO greening scans**, Ingenium translates regulations into **feasible and profitable solutions**.

*Would you like to know how your data center can fully utilize waste heat?*

*Contact us at [wim.boone@ingenium.be](mailto:wim.boone@ingenium.be).*

