

Seizing Data Center Heat Reuse Opportunities. Guidelines for Local Authorities

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Executive Summary

This work highlights the opportunity to reuse excess heat generated by data centers, transforming a waste product into a valuable resource for local communities. Heat reuse can reduce energy costs, cut emissions, conserve water, and foster local sustainable economic growth and innovation. It highlights the opportunity local authorities and data centers have to work together to achieve higher intersectoral sustainability levels and enhance public perception. To accomplish these outcomes proactive collaboration, facilitating early infrastructure planning, and expedited permitting, are highly recommended.

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1. Compliance with Open Compute Project Tenets

Openness

This document is intended for widespread public use by any person interested in data centers and the reuse of their heat. Its target audience is local government officials from around the globe who typically know little about the potential for data center heat reuse, but also have considerable ability and authority to encourage and incentivize it.

Efficiency

This 2-page fact sheet is intended at expanding the reuse of data center heat, a key measure of future efficiency improvements at data centers. Reuse of data center heat not only makes data centers more efficient, but also makes offtakers who use the heat cleaner and more efficient.

Impact

This 2-pager is aimed at engaging local government officials from around the world and is part of a broader effort to transform how data centers address the heat they produce by encouraging its reuse rather than simply cooling it.

Scale

Project success experiences, especially in Europe, demonstrate data center heat reuse is viable, but also need policy makers at all levels of government to encourage and incentivize it at scale. This 2-pager is aimed at the vast number of local government officials who can play a role in accelerating the early steps which have already been taken so that data center heat reuse becomes a standard practice across the industry and around the globe.

Sustainability

Data center heat reuse improves the sustainability of both data centers and end users of data center heat. For data centers, reusing their heat means reducing the amount of electricity needed for cooling and the Scope 2 emissions that may be associated with it. For heat offtakers, data center heat reduces their greenhouse gas emissions because they can replace the use of fossil fuels to produce heat with much cleaner heat. Data center heat reuse may also achieve other sustainability goals such as reduced water use.

2. Introduction

As data centers expand throughout the world, large amounts of electricity to power and cool their servers will continue to be needed. Almost all the energy entering a data center converts into a byproduct in the form of excess heat, which is often released into the atmosphere by evaporating water in cooling towers without further use. Local authorities can and should encourage the reuse of heat data centers produce. Reusing data center heat can lower energy costs, cut carbon emissions, and often reduce water use for the community and local businesses, while also benefiting data centers from the impacts on their energy consumption, permitting, public and client perception.

3. Challenges

Data centers come often with notable challenges. They consume vast amounts of power and water, raising concerns about their environmental impact and sustainability, drawing occasionally negative publicity and leading some communities to resist new developments. Data center heat reuse offers tangible economic and community benefits, but these projects will require local government leadership to overcome key challenges. These include: a lack of awareness of the opportunity; a lack of connections between data centers and nearby heat users; a need to align supply and demand for heat; project-related trade-offs; cost justification of data center heat reuse projects; and lack of supranational, national, and sub-national policy to incentivize these projects.

4. The Opportunity

Reusing data center waste heat presents a significant opportunity to provide carbon-free heating across a wide array of sectors, delivering substantial environmental, economic, and social benefits[1]:

High Density Urban: District Energy, Building HVAC reheat, Swimming Pools, Hospitals/Hotels, Wastewater Treatment, Carehouses.

Intermediate Density Urban: District Energy, Private District Energy, Building HVAC reheat, Industrial Laundries, Swimming Pools, Hospitals/Hotels, Wastewater Treatment.

Low Density Populated Areas: Swimming Pools, Hospitals/Hotels, Wastewater Treatment.

Agriculture: Biomass Drying, Farms Heating, Greenhouses, Heat Storage, Ethanol Production

Coastal (Sea, Lake and Rivers): Desalination, Fish Farming.

Industrial: Industrial Laundries, Decarbonization, Food Processing, Pre-Heating, Wastewater Treatment, Innovative Technologies (cooling production, carbon capture, etc.)

Beyond the direct applications of data center waste heat, its reuse enables a suite of benefits for the wider community:

Lowering Costs for both the community and local businesses by utilizing waste heat, as it can offer a low-cost alternative to traditional heating methods. Data centers themselves also benefit from the reduced energy required for cooling, creating a win-win scenario.

Reducing Carbon Emissions by displacing fossil fuel-based heating, contributing to local and global climate goals. This not only benefits the environment, but also enhances the public image of data centers as key contributors to sustainability.

[1] https://www.opencompute.org/documents/20230623-data-centers-heatreuse-101-3-2-docx-pdf

Diversifying the local economy with potential new businesses and jobs and a modernized local grid, telecommunications, and heating infrastructure, fighting against the depopulation for areas with currently less working opportunities, usually in rural areas.
Fostering innovation, being the resulting synergies, a potential catalyst for further innovations, attracting other forward-thinking businesses and projects that can benefit from the excess heat.

Here we show some examples of successful data center excess heat reuse cases:
Equinix Paris heats the 2024 Olympics swimming pool; Stockholm Exergy has connected multiple data centers to its district heating network; NREL Colorado's data center heats several campus buildings; Green Mountain Stavanger provides heat to a lobster farm.

5. Action

To encourage data center heat reuse, local authorities can implement policies such as:

- **Implement policies and incentives to address challenges** – Apply financial incentives and regulatory mandates, such as regional, national or supranational (e.g., EU) regulations, grants, subsidies, or tax incentives. Engage with industry associations and potential partners.
- **Make data center heat reuse a focus of economic development** – Local governments can promote data center heat reuse by connecting data centers with potential heat end users. If data centers are developing in your area, investigate the opportunities for heat reuse and analyze what local end-users could use the data center's excess heat. Proactively attract activities/businesses that could benefit from the low-carbon (and possibly low-cost) heat.
- **Allow transition periods, plan a timeline, and facilitate early discussions** – Large data center projects require 18-24 months to plan. Engage in early discussions with developers during their site selection process. Secure heat reuse agreements prior to permit approval.
- **Leverage infrastructure planning** – Plan for data center heat reuse by including data centers and nearby heat users in zoning considerations and ensure pipeline heat connections when planning infrastructure. For example, locate industrial land for a data center nearby industrial land for a brewery or nearby rural land for greenhouses.

6. Conclusion

By leveraging heat reuse, local authorities can deliver multiple benefits to their community: sustainable economic growth, lower costs, jobs creation, economic diversification and innovation, while locally reducing emissions and water use. This requires proactive planning, early engagement, and a commitment to fostering synergies between data centers and the broader community. In turn, data centers benefit through accelerated permit approvals, potentially reduced cooling costs, and improved public perception and attractiveness to clients.

The Heat Reuse Subproject of the Open Compute Project is planning to further deliver guidance on the topic discussed in this article. For more information about how to seize the data center heat reuse opportunity, please visit:
https://www.opencompute.org/wiki/Cooling_Environments/Heat_Reuse

7. About Open Compute Foundation

The Open Compute Project (OCP) is a collaborative Community of hyperscale data center operators, telecom, colocation providers and enterprise IT users, working with the product and solution vendor ecosystem to develop open innovations deployable from the cloud to the edge. The OCP Foundation is responsible for fostering and serving the OCP Community to meet the market and shape the future, taking hyperscale-led innovations to everyone. Meeting the market is accomplished through addressing challenging market obstacles with open specifications, designs and emerging market programs that showcase OCP-recognized IT equipment and data center facility best practices. Shaping the future includes investing in strategic initiatives and programs that prepare the IT ecosystem for major technology changes, such as AI & ML, optics, advanced cooling techniques, composable memory and silicon. OCP Community-developed open innovations strive to benefit all, optimized through the lens of impact, efficiency, scale and sustainability. Learn more at www.opencompute.org.