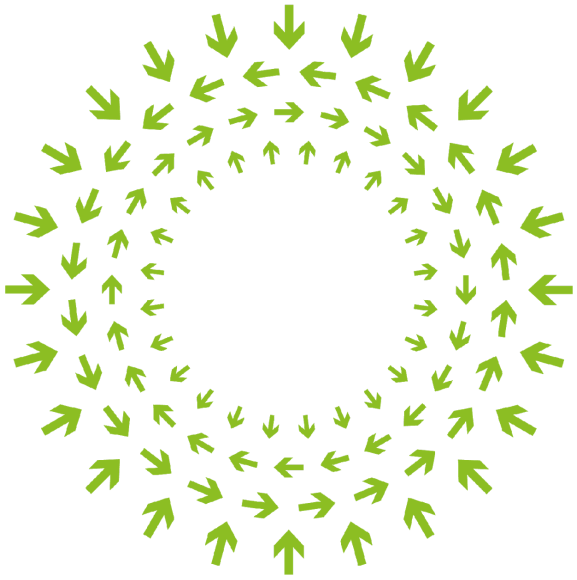

OPEN Compute Project

Policies to Accelerate Data Center Heat Reuse: Achieving Economic and Climate Change Goals

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1. Executive Summary

Data centers generate significant amounts of heat, and the industry uses significant amounts of power to cool them. But this liability can be turned into an asset by reusing this heat in industrial and commercial settings with needs for low temperature heat. Doing so helps to save money and reduce carbon emissions both at data centers, through reduced power needs for cooling, and at industrial and commercial facilities, through an avoidance of carbon-intensive fuels to generate heating, cooling, and hot water. Key sectors which could use data center heat include commercial buildings such as large retail and office buildings, pharmaceuticals, food and beverage, hotels and resorts, medical and research laboratories, hospitals, bioethanol plants, and desalination and water treatment plants.

While data center heat reuse is a proven approach which has been available for more than a decade, only a limited number of projects have occurred as projects must overcome certain barriers. Those barriers include lack of knowledge of the technology and the opportunity; lack of proximity and connections between data centers and heat users; variations in local climate conditions cause differing heat needs; high risks and high costs of implementation; and lack of national and sub-national policy to facilitate and incentivize it.

Fortunately, governments in Canada, Europe (Germany, the Netherlands, etc.), and the United States (US) have begun to adopt policies which could help. Governments at all levels should adopt policies to seize this opportunity.

To accelerate the development of these policies, the Heat Reuse Subproject of the Open Compute Project Foundation intends to engage with others in the data center industry, potential commercial and industrial users of data center heat, other potential alliance partners, and national and sub-national policy makers. The OCP will also invite engagement and collaboration from those and other mission aligned and interested parties.

2. Introduction

This white paper is the second in a series of white papers that the Open Compute Project Foundation Heat Reuse Subproject will publish. The first white paper, Data Centers Heat Reuse 101 was published June 2023 and describes why now is the time for heat reuse and what is needed for wide-scale adoption to turn heat from a liability into an asset that potentially can be a source of income and assist in meeting sustainability goals.

This white paper's objective is to serve as the first step for engaging intersectoral communication between data center industries, heat demanding activities and policy makers. This paper introduces the opportunities and challenges of doing heat recovery at data centers and how the governments can help to make heat reuse happen more often. During this work a non-comprehensive analysis has been done to present the major initiatives around the world that are requiring or recommending data center heat reuse, promoting it via subventions and tax exemptions and developing tools that share information between parties. This whitepaper has been elaborated based on community-driven input during our monthly Heat Reuse Policies Workstream calls.

The Open Compute Project Foundation is an open forum, so please join our regular conversations about heat reuse and share your thoughts, insights, and experiences with the community, start with the following link:

https://www.opencompute.org/projects/heat-reuse

3. The Opportunity

Reusing data center heat presents significant economic and climate opportunities, as data centers operate year-round like large heat pumps. The data centers use electricity in servers for business or research needs, and practically all the electricity is turned into heat.

Heat reuse presents an opportunity for both data center owners and end users of the reclaimed heat. Data centers can monetize their heat by selling it to end users for their CO_2 avoidance. The price of the heat will depend on various factors, including the energy savings of the end user's infrastructure and the avoided operational expenses associated with cooling the data center. For the end users, the heat has a zero-carbon footprint, allowing them to avoid emissions that would have been generated to create the heat.

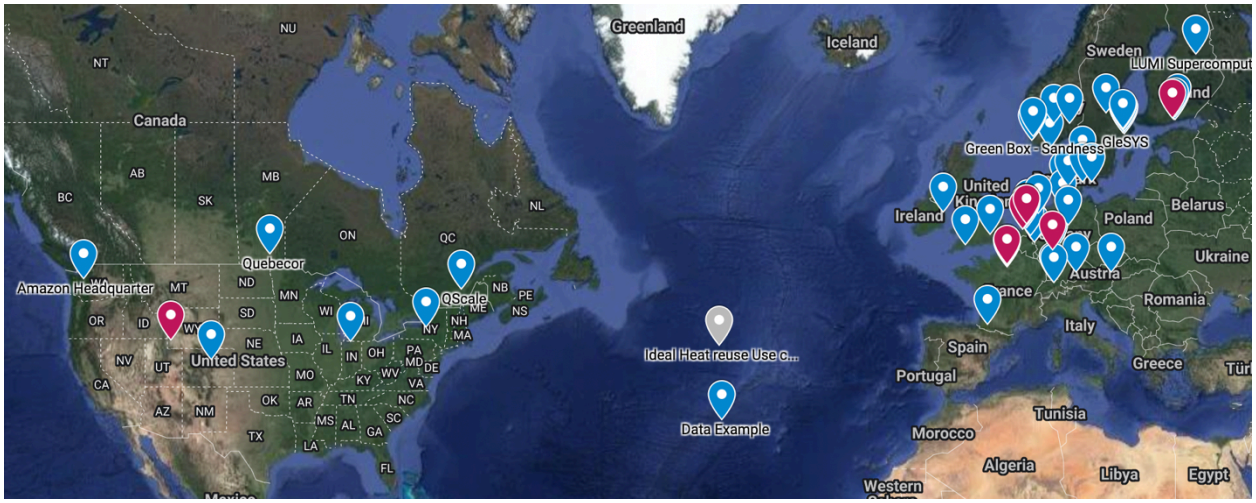

Figure 1 – Interactive OCP Heat Reuse subproject map of in-progress and operational data center heat recapture systems[1]

Heat reuse can contribute to decarbonizing buildings and industry. Specific opportunities include:

- **Space heating**, including district heating. Data center heat can be collected and distributed to nearby residential complexes or other industrial buildings in cooler climates for heating purposes. Concentrated districts comprising of data centers as well as industrial and residential buildings allow for an efficient network to facilitate heat transfer.

[1] OCP Heat Reuse Subproject Data center heat reuse map: https://www.google.com/maps/d/edit?hl=en&hl=en&mid=1bTp4Ugy7FGwfPadNlmfZpYwGY5Z5B7o&ll=28.87172622901383%2C-40.21607810348212&z=3

- **Pharmaceuticals** – Heating, dehumidification or process heat needed in pharmaceutical processing, which occurs in laboratories and clean rooms with strict 24/7 environmental controls. The reused heat is filtered, preventing concerns of contamination.
- **Food and beverage** – Many food and beverage manufacturing processes, including pasteurization, cooking, packaging, and cleaning, require hot water at temperatures produced by data centers. Heat is applicable to large, centralized fish, meat, and chicken processing as well as large breweries, high-volume greenhouses, and vegetable packing. Breweries can also harness heat for the beverage production process.
- **Commercial processing cooling and refrigeration** – Medical and research laboratories, hospital campuses, and large retail and office buildings require large amounts of mechanical cooling for seasonal and year-round cooling with high load factor (more so in the southern U.S.) that can be met with hot-water driven absorption. These needs would be most compatible with data centers sized from 1 to 10 MW.
- **Bio-ethanol production** – Bio-ethanol plants need sustained heat energy for the distillation and drying processes after sugars from the biomass input are fermented into ethanol. Heat from data centers has already been employed for bioethanol production within district heating grids in Europe.
- **Water distillation, desalination, and water treatment** – Repurposed data center heat can help power many water treatment projects.
- **General hot water pre-heating** – Data center heat can be used to preheat water for a wide variety of uses — space heating, domestic hot water generation, laundry, cleaning dishwashers, and pools. Pre-heating reduces end-user needs for fossil fuels to heat the water to its final desired temperature. This is a good match for large hot water users, such as hotels and resorts. In the hotel industry, water heating is the largest single end-use for energy, making up almost a third of total energy use.[2] These opportunities include industrial laundry operations.

As a relevant success story, we highlight Stockholm's initiative for attracting data centers to deploy their projects within its borders and harvest their excess heat. The Covenant of Mayors of the EU has elaborated a very interesting document describing this success story.

[2] These opportunities are drawn from *Data Centers Heat Reuse 101*, a paper by Cosimo Pecchioli of Alfa Laval, Jaime Comella of Cloud&Heat, David Sickinger of NREL, and Otto VanGeet of NREL, and from analysis done by David Gardiner and Associates for Intel.

The AWS project in Dublin is another interesting case study, because it occurs in a country without real history of district heating nor strong regulation to drive such schemes.

While specific opportunities always depend on specific project circumstances, the best opportunities are at facilities which need heat year-round and where the heat off takers are reasonably close to the data center source. For further detail, please refer to Heat Reuse Economics workstream's analysis at [insert link].

Higher density urban areas with an established district energy system may be prime candidates for heat transfer, where data centers near commercial buildings, residential areas, and other industry facilities maintain a short, maximally efficient path for heat transfer. Sparsely populated areas with a higher agricultural density may be prime candidates for seasonal data center heat reuse in ethanol production, food processing, and greenhouses. Coastal areas may be prime candidates for data center heat reuse in desalination, water treatment, and fish farming.

Several factors are making it an excellent time to accelerate data center heat reuse, including:

- Governments are moving to decarbonize their economies and are putting in place new policies to encourage it.
- Large institutional energy buyers, including Fortune 500 companies, colleges and universities, and governments have committed to ambitious climate goals and are seeking cost-effective solutions. Many data center companies have ambitious climate goals and are at the forefront of this move.
- Fossil fuel prices generally experience price volatility, and data center heat reuse will lower the risk of suffering economically from price shifts in the fossil fuel market.
- Greater adoption of direct liquid cooling in data centers to support increasing processor power has increased the amount and quality of heat available for possible reuse.

4. Key Challenges

Data center heat reuse faces a few barriers, which include:

- **Lack of knowledge and awareness of the opportunity.** Data center operators and potential heat end-users are often unaware of the technical solutions that can facilitate heat recovery, transfer, and reuse, as well as the benefits of implementing such systems. Because of this knowledge vacuum, stakeholders are disinclined to collaborate across compatible industry sectors to spark dialogue for exploring heat recovery solutions and appropriate use cases.
- **Lack of proximity and connections between data centers and heat users.** Transporting heat over long distances can be costly and challenging, so it is advantageous to locate data centers near facilities which could use their heat. Data centers and heat users often have a hard time connecting as they are not often located near each other or do not know they are located close to each other. Collaboration between data center and heat host is also hard to establish as possible users do not think of data centers as possible heat providers and data centers do not think of themselves as energy providers. Planning and zoning for data centers is often isolated from the infrastructure development within industries that could benefit from heat. Germany currently requires data centers to include proximity of off takers as a consideration in site selection. If the data center company fails to do so, their project may not be approved. While policies such as this have the potential to address the issue of proximity between data centers and off takers, they may disincentive operators from choosing locations with these regulations if they are not applied uniformly at the national or European level.
- **Supply and demand discrepancies.** In some cases, due to challenges posed by distance and geography, as mentioned above, matching recovered heat supply to appropriate demand sources may not be tenable. Additionally, local climate conditions can vary and create large seasonal demand for heating in colder regions but not in others. Agricultural ventures such as greenhouses, fish farms, or those with biomass dehydration may also need varied levels of heat at different times of year. These scenarios present challenges for viably exploiting 100% of recaptured heat at any given time.
- **Data center heat reuse projects may face project development risks and costs.** As a nascent industry, data center heat reuse projects face technology and financial challenges. End users have little experience with the technology and need it to work. The complexity of connecting data centers to heat users may create risks for any

project. Finances may also be challenging, as even the easiest and most straightforward cases can have costs to install and maintain underground pipes, pumping stations, heat pumps, controls and more.[3] Additionally, incongruencies between the financial horizons for data center operations and potential heat consumers end up highlighting risks and stifling investment. According to CleanTechnica, "Energy companies often want commitments to provide heat energy for 10 or more years, which is longer than the financial planning horizon for some data center owners, according to industry experts."[4]

- **Lack of national and sub-national policy.** In most countries, few policies exist at all levels – municipal, state/provincial, and national – to promote, incentivize, and facilitate data center heat reuse, despite its potential to lower carbon emissions significantly. Governments are only just starting to become aware of data center heat reuse as a viable mechanism to reduce greenhouse gas emissions, cut costs, and enhance national security. For example, in Denmark, no legal requirements currently exist for data centers to recover excess heat, but policies are in development. In some cases, policies, such as laws that restrict heat transactions for non-utility providers or increased electric utility charges, can inhibit the recovery and reuse of data center heat by causing poor payback on projects. Policies that incentivize heat reuse can reduce the technology and financial risks of these projects and help achieve governments' decarbonization goals. Section 5 outlines examples of these policies.

[3] Ibid.

[4] Clean Technica, (https://cleantechnica.com/2022/12/29/-heat-from-data-centers-can-bolster-district-heat-systems/)

5. Governments Can Adopt Helpful Policies

Governments at all levels should adopt policies to encourage data center heat reuse in buildings and industry. Multi-national, national, state, and provincial, and local governments have a wide area of policy tools which they can use to encourage the reuse of data center heat.

Fortunately, some have begun to seize this opportunity. They are using a range of policy tools to lessen the barriers to data center heat reuse by analyzing possible uses, sharing information, and promoting collaboration; offering incentives; and adopting heat reuse required standards and requirements.

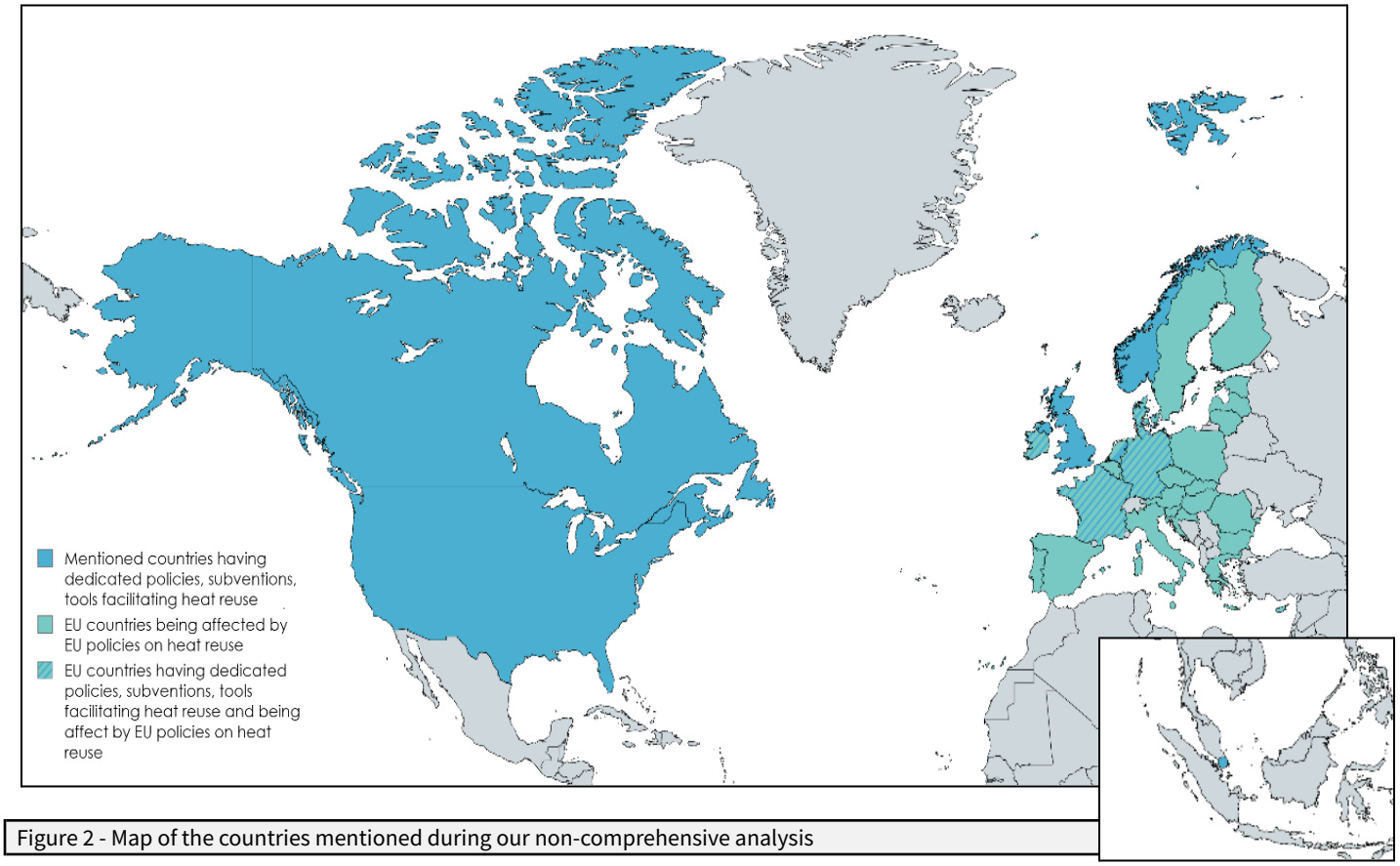

Figure 2 - Map of the countries mentioned during our non-comprehensive analysis

a) Data Center Heat Reuse Requirements and Recommendations

The following is a non-comprehensive list of policies governments have adopted to require or recommend the efficient reuse of heat from data centers:

- **The EU Energy Efficiency Directive (EED)** – Member States are required to carry out comprehensive assessments of the potential for efficient heating and cooling

operations every five years, starting in 2015. These assessments included considering heat from data centers. In 2019, the EU integrated new requirements for these assessments, including mapping out potential sources and users of heat, as well as examining trends for future demand. The law specifically requires that Member States evaluate technical solutions for integrating heat into district heating systems, as well as quantifying thermal outputs and analyzing the potential for retrofitting heat recapture systems (See Appendix). In July 2023, The EU Parliament and EU Council agreed to revised provisions in the EED, which took effect in October 2023. A reporting framework for data centers has been formulated within this directive and the quantity of exportable excess heat will have to be reported from 2024 on. The EED states that "Member States shall encourage owners and operators of data centers in their territory with a power demand of the installed IT equal to or greater than 1 MW to take into account the best practices referred to in the most recent version of the European Code of Conduct on Data Centre Energy Efficiency."

- The "**EU Code of Conduct on Data Centre Energy Efficiency**" was established in response to the rising energy consumption of data centers. The governing set of rules sets aggressive intentional principles for its participants and is overseen by the Joint Research Centre, the European Commission's science and information administration. The objective of the set of principles is to make the proprietors and administrators of the data centers reduce their energy utilization without diminishing their reliability. The members sign a voluntary enrollment in which they commit to recognizing chances to save energy through an initial energy estimation and energy audit and elaborate and present an activity plan for energy savings. The set of principles has a section dedicated to excess heat recovery, where it is suggested to provide the excess heat to surrounding heating demands with or without increasing the temperature of the excess heat. For participating companies, these activities are expected for newly built data centers or retrofits.
- The **EU Taxonomy** has a section on data centers ("Data processing, hosting and related activities'') where it is stated that to do a substantial contribution to climate change mitigation (one of the conditions to declare an activity -in this case the erection and operation of a data center- as "sustainable" based on the EU Taxonomy) the data center must follow the expected practices in the above mentioned "European Code of Conduct on Data Centre Energy Efficiency" and let them be verified by a third-party. The EU Taxonomy offers a framework to define activities as sustainable. It has categories covering a diversity of sectors and will have to be followed to report along the CSRD, which will be the compulsory reporting framework for ESG for around

50.000 companies in the EU (and will affect non-EU companies with activity within the EU).

- **The German Energy Efficiency Act ("EnEfG")**, enacted in 2023, mandates heat reuse requirements for new data centers and other businesses, whose annual energy consumption exceeds 15 gigawatt hours. In general, these businesses will be required to implement energy or environmental management systems and to document their energy efficiency measures in detailed plans and publish them. Businesses will also be required to avoid generating heat during production processes going forward or, where this is not possible, to make effective use of the heat. For data centers specifically, the legislation requires the establishment of energy efficiency standards for new data centers, which will be required to reuse increasing amounts of heat over time and to make economical use of cooling system power. The legislation also establishes efficiency requirements for existing data centers but not for heat reuse. (See Appendix).
- In the **Netherlands, the Greater Amsterdam Region** standards and initiatives call for greater sustainability of data centers and focus, in part, on heat reuse. (See the Appendix for detailed links to the policies.) Key components include:
    - **Sustainability and Energy Efficiency Requirements**: New data centers must adhere to stringent energy efficiency standards, including achieving a low Power Usage Effectiveness (PUE) rating, indicating high energy efficiency. Heat reuse will improve the data center ERE/ERF and may improve as well data center PUE[5].
    - **Preparation for Heat Reuse:** While there is not an explicit legal mandate for heat reuse in all new data centers, there is a growing emphasis on designing data centers with the capability to integrate heat reuse systems. This means that new data centers are encouraged to include infrastructure that allows them to capture and redistribute waste heat efficiently.
    - **Collaboration with Local Governments:** Data center operators are encouraged to work with local governments and communities to explore and implement heat reuse projects, including assessing the feasibility of using waste heat for heating nearby homes, businesses, or public facilities.
    - **Participation in Sustainability Initiatives:** Data center operators in the Netherlands are part of broader sustainability initiatives, such as the Climate

[5] Heat reuse generally avoids using artificial cooling and/or fans to reject the heat into the environment unless the data center artificially uses a heat pump to boost the temperature and this heat pump is operated by the data center itself (in this case the PUE would increase).

Neutral Data Center Pact, which advocates for sustainable practices in the industry, including efficient energy use and potential heat reuse.

- **Future Developments and Regulations:** Regulations and requirements are subject to change and will likely become more stringent over time. This includes more explicit mandates for heat reuse in new data center projects.[6]

- Since 2021 in Norway, data centers with more than 2 MW capacity are recommended to explore applications to use their excess heat. They are encouraged to conduct a cost-benefit analysis of deployment of heat recovery projects.
- **U.S. Government Executive Leadership** – In 2015, President Obama issued Executive Order 13693, which required improvements in government data center energy efficiency. It required agency chief information officers to promote data center energy optimization, efficiency, and performance; all government data centers to install and monitor advanced energy meters within three years; and established a power usage effectiveness (PUE) target of 1.2 to 1.4 for new data centers and less than 1.5 for existing data centers. This order was revoked under the subsequent administration.
- **U.S. Consideration of Data Center Energy Sustainability** – Legislation has been introduced in the US Congress which would require use of sustainable energy. The Federal Data Center Enhancement Act of 2023 does not explicitly require sustainable energy generation FROM data centers via heat reuse, but heat recovery could plausibly fall under or be added to its requirements for government data centers to examine the use of "sustainable energy sources". See Appendix.
- **U.S. Data Center Optimization Initiative (DCOI) -** Under the US Federal Information Technology Acquisition Reform Act (FITARA), the DCOI aimed to consolidate and optimize federal agencies' data centers. In 2021 and 2022, nearly 150 data centers closed due to consolidation, generating approximately $612million in cost savings. From the beginning of the initiative in 2012, Agencies have a cumulative total of $6.6 billion in cost savings and avoidances.
- **Singapore's Green Data Center Standards**: Singapore's Infocomm Media Development Authority (IMDA) has adopted Singapore Standard (SS) 564, a two-part standard for energy efficiency and environmental sustainability in data centers. The Standard is based on the ISO 50001 energy management standard but adapted for Singapore. SS 564 Part 1 provides guidelines for establishing, implementing, maintaining, and improving an Energy and Environmental Management System (EnEMS) for data centers. Its main objective is to enable data centers to follow a

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systematic approach in achieving continual improvement of energy efficiency and environmental sustainability. It covers aspects like establishing policies for energy efficiency, setting targets and objectives, data measurement, and reporting. SS 564 Part 2 offers guidance on how to enhance the energy and environmental performance of data centers by providing more detailed guidelines on specific energy and environmental management aspects, including best practices, performance metrics, and documentation. The focus is on practical steps that data centers can take to reduce energy consumption and environmental impact, thereby improving overall efficiency and sustainability. The standards note that heat reuse can be a key strategy to achieve their key goals, including being more energy efficient and reducing carbon emissions; providing innovative solutions for environmental management by providing heat to buildings, district heating networks, and industrial processes; compliance with green buildings standards; improving social responsibility and sustainability reporting for data centers; and delivering cost savings for data centers and nearby facilities.[7]

b) Analyzing Data Center Heat, Gathering/Sharing Information, and Promoting Collaboration

Governments have adopted policies to analyze data center heat reuse opportunities, share information, and promote collaboration between data centers and potential heat users. While the following list is not comprehensive, it serves as a collection of policy examples for reference:

- **EU Heat and Cold Matching Platform** – The EU has funded the Heat and Cold Matching Platform, which will allow energy-intensive industries and other excess heat and cold sources to explore ways of reusing their excess thermal energy. It will enable easy matching between sources and users for residual heat and cold; explore economically viable business cases for the use of excess heating and cooling; optimize techno-economic parameters of proposed solutions; and lower energy costs, improve competitiveness, and reduce environmental impacts.
- **Bytes2Heat Matching Tool** (Germany only) - The German Federal Ministry of Economics and Climate Protection has funded the open-source project "Bytes2Heat". Within this project, expert interviews were conducted to identify the challenges involved in utilizing waste heat from data centers. Building on this, innovative

[7] Infocomm Media Development Authority, Green Data Centre Standard, https://www.imda.gov.sg/regulations-and-licensing-listing/ict-standards-and-quality-of-service/it-standards-and-frameworks/green-data-centre-standard.

solutions were developed during design thinking workshops, which were further developed into publishable open-source end products in the prototyping phase. These include a best-practice project overview, a profitability calculator, a policy and funding overview and a matching tool. Both heat sinks and heat sources (especially data centers) can register here and search for potential waste heat utilization partners based on their search settings.

- **Ireland heat exchange platforms.** The Heat Atlas provides a map with potential users of heating energy, district energy networks and potential excess heat providers. Codema provides maps of the waste heat and district heating potential in and around Dublin.
- **Hot Maps**: map depicting different origins of the heat from different industries at different temperature levels and different users of the heat.
- **Pan-European** thermal atlas: mapping the heating needs densities and potential sources of heat.
- **Norwegian** heat map, a tool where municipalities and businesses can find out where there is a requirement for heat. Data centers are also listed in this map as heat producers.
- **U.S. Government Project Leadership** – For 10 years, the Department of Energy's National Renewable Energy Laboratory (NREL) has had its own data center heat reuse project. Governments can be leaders in adopting data center heat reuse, promoting these projects, and encouraging others to adopt them.

c) Incentives for Data Center Heat Reuse

The following is a non-comprehensive list of policies governments have adopted to promote the viable reuse of heat from data centers:

- **Washington state's industrial symbiosis program** – a program designed to connect otherwise unlinked firms' industrial operations to share industrial waste with reuse potential, including heat. This is a competitive grant program supporting Research and Development and implementation of industrial waste coordination projects (which would include data center heat). (See Appendix)
- **U.S. Department of Energy Cooling Operations Optimized for Leaps in Energy, Reliability, and Carbon Hyperefficiency for Information Processing Systems (COOLERCHIPS) program** - The U.S. DOE provided $40 million in funding to 15 projects to develop energy efficient cooling solutions for data centers.

- **Germany's fund for decarbonizing district energy** – The German Ministry of Economics has made available a fund of three billion Euros available through 2026 to decarbonize the district heating sector. Municipalities, energy suppliers, and energy communities can apply for funding. The federal funding for efficient heating networks fund will finance the new construction of heating networks that have at least 75% heat feed-in from renewable energies or heat as well as the expansion, densification, and decarbonization of existing heating networks. For more information, see this summary in English or this broader summary of the country's policies in German.
- **Germany's fund for energy efficient buildings** – Since 2021, buildings with a DGNB Certification and fulfillment of the additional requirement of the QNG label are eligible for funding. The funding is available for both new buildings and renovations to existing buildings. For more information, visit this page.
- **Germany's Heat Planning Act** – The Heat Planning Act went into effect in January 2024 and requires municipalities to establish a plan to decarbonize heating. The method for doing so depends on the locality, with waste heat from industrial and commercial operations being one. The goal of heat planing is to inform building owners if they should connect to an existing heat network or adopt a stand-alone solution.
- **France** has a subvention line called "fonds chaleur" among others, dedicated to the reutilization of excess energy from the industry and the data centers and offers tax reductions to data centers utilizing their excess heat
- **New York state's thermal network legislation.** In 2022, New York state adopted the Utility Thermal Energy Network and Jobs Act, which allows creation of Thermal Energy Networks, utility-scale infrastructure projects that connect multiple buildings into a network with shared sources of thermal energy. Within a network, heat from large industrial buildings can be used to heat smaller residential buildings. While not specifically intended for data center heat reuse, it is a model that could be applied to data centers.
- **Quebec incentives** – Quebec offers grants which QScale**,** a Canadian company focused on developing "sustainable supercomputing colocation centers," has used to build a data center complex that employs heat recapture and reuse. QScale estimates that up to 75% of its project costs will be recouped by government grants, allowing the company to effectively *give away* its excess heat to local end-users.
- **Denmark** – The Danish government repealed the tax on excess heat if the company supplying the heat is certified by the Danish Energy Agency.[8]

[8] Ramboll, (https://www.ramboll.com/extract-heat-from-data-centres/analysis-from-ramboll#)

- **UK**– The British Government recently funded five projects for reusing the excess heat of data centers, through £65 million.[9]

[9] Circular online, (https://www.circularonline.co.uk/news/funding-announced-for-heat-network-using-waste-heat-from-data-centres/)

6. Engagement

To expand the use of effective data center heat reuse policies, stakeholders from across the data center industry and others must be aligned in their call for them. The Heat Reuse Subproject Leadership in collaboration with the Open Compute Project Foundation Alliance Lead, aims at building bridges with others in the data center industry, potential end users of data center heat, other potential OCP alliance partners, and national and sub-national policy makers. We call on those organizations to actively collaborate with each other to accelerate the adoption of new policies that connect different sectors and make data center heat reuse economically viable. These initiatives can deliver economic and climate change benefits, improving business and society.

Others in the Data Center Industry

The most relevant actors in these area could be:

- Senior business leaders at data center companies who see the business opportunity and can make the case for this being a priority for Government Affairs staff.
    - Energy supply managers for data center companies to get to utilities.
- Government Affairs staff from data center companies.
- Coalitions of data center companies focused on government policy, such as the Information Technology Industry Council and others focused on sustainability such as Climate Neutral Data Center and the Infrastructure Masons (IMasons).
- Global, regional, and national data center associations such as the Data Center Coalition, the European Data Centre Association (EUDCA), the German data center association, the Swedish Datacenter Industry Association, etc.

Potential End Users of Data Center Heat

Groups in the United States could include:

- International District Energy Association (IDEA)
- Clean Energy Buyers Association (CEBA)
- Renewable Thermal Collaborative
- American Hotel and Lodging Association (AHLA)
- American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
- Association of Energy Engineers (AEE)

- International Society of Sustainability Professionals

Groups in Europe could include:

- European Hotel Managers Association (EHMA)
- Euroheat & Power
- European Heating Association (EHI)
- European Association for Wastewater Heat Recovery (WWHR Europe)
- European Federation for National Water Services (EurEau)
- FoodDrinkEurope
- European Public Real Estate Association (EPRA)

Other Potential Alliance Partners

Other potential relevant actors for these alliances include those who could enable data center heat reuse, such as natural gas or electric utilities. This might include the national trade association of the gas utilities who service retail customers, the American Gas Association, as well as large electric utilities, such as the Edison Electric Institute.

It will also include firms which advise end users and data centers on their energy use or carbon footprint, such as the National Association of Energy Service Companies (NAESCO).

The International Energy Agency is a very relevant international actor promoting policy, analyzing data, and generating reports. District heating, energy efficiency, excess heat are among the topics they focus on.

Policy Makers

At the national level in the United States, policy makers with whom to engage could include key elements of the Executive Branch which are seeking climate change solutions, including the White House and the Department of Energy, as well as Congressional committees which are similarly focused.

At the state level, it may be appropriate to engage with Governors, state energy officials, cities' environmental councils, utility regulators of the utility and gas industries, and environmental officials. These officials each have their own national association, including:

- National Governors Association (NGA)
- National Association of State Energy Officials (NASEO)
- National Association of Regulatory Utility Commissioners (NARUC)
- Environmental Council of the States (ECOS)

At a European level, relevant policy makers are the European Commission which is the institution in charge of drafting and promoting policies and the European Parliament and the European Council, which are involved into the review of these policies and can amend them[10]. Individuals, companies, and organizations can provide feedback during the consultation periods for policies that are published online. In the EU there are also citizen initiatives to propose legislation to the European Commission, requiring at least 1 million signatures from at least a quarter of the Member States of the EU.

Since each Member State legislates independently and is also in charge of transposing the EU directives, policy makers of each EU Member State are at least equally relevant for the suggested collaborations and discussions.

[10]How EU policy works: https://european-union.europa.eu/institutions-law-budget/law/how-eu-policy-decided_en#:~:text=EU%20policies%20are%20typically%20decided,come%20to%20agreement%20on%20legislation .

7. Conclusion

Beyond presenting the current status of the opportunities and challenges of reusing heat from data centers and the current policies in different geographies to encourage it, this paper is a call to action for all to contribute to a higher global energy efficiency, lower costs, mitigate the carbon footprint of our activities, and address climate change. We call upon sectors and policymakers to collaborate with us to incentivize data center heat reuse to achieve these objectives.

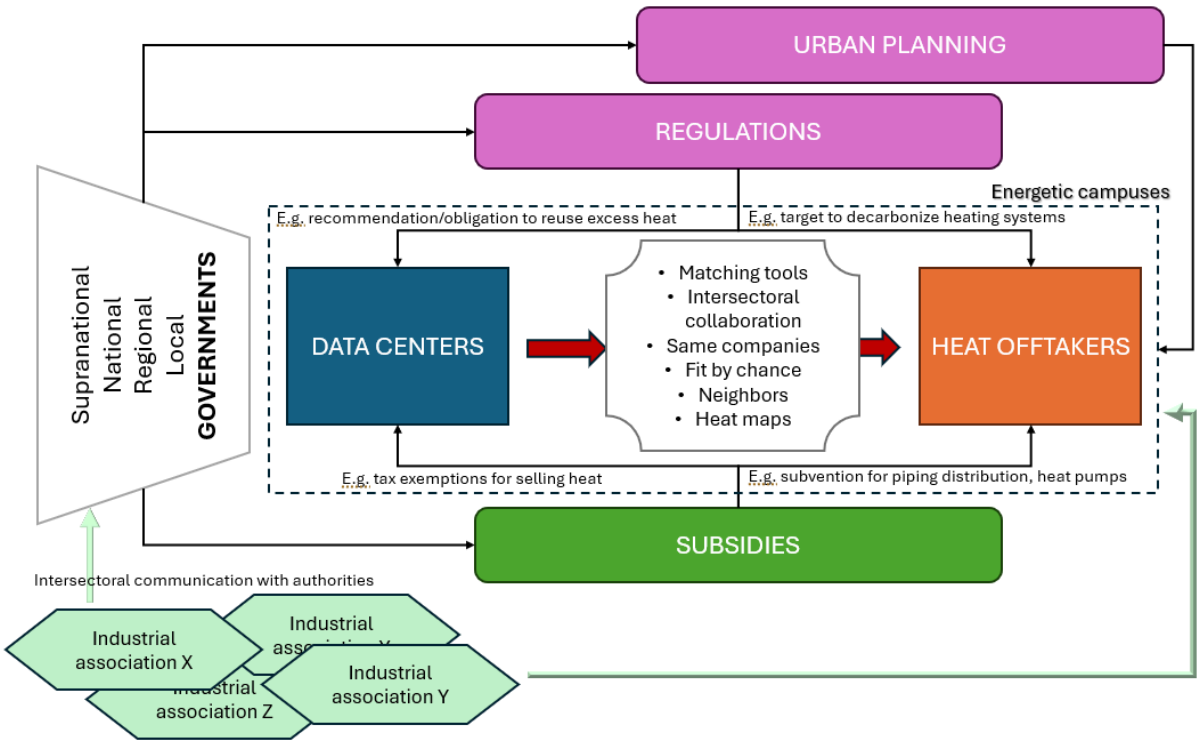

Figure 3 - The heat reuse policy ecosystem

The Open Compute Project Foundation and its Policies Workstream of the Heat Reuse subproject, call on all actors interested in energy efficiency and decarbonization to engage in a collaboration with the data center industry to develop and promote policies to reuse the heat the industry produces. Additionally, we call on all relevant policymakers to join with us in advancing policies to reuse heat from data centers, which will deliver economic and climate benefits for all.

Appendix– Detailed Information on Policies

EU's Energy Efficiency Directive (EED)

The EU's Energy Efficiency Directive (EED) was revised in October 2023 and includes a reporting scheme for data centers, which is currently under revision. In EED, Data centers were listed as an example of waste heat as "the heat resulting from the operations can be delivered off-site instead of being dissipated into the environment".

Article 14 of EED requires Member States to conduct a comprehensive assessment of the potential for efficient heating and cooling, including an analysis of the share of energy from waste heat in the district heating sector. The first assessment took place in 2015 and are to be updated every 5 years.

In 2019, the EU adopted a recommendation for the components of an assessment. Member States must:

- Show on a map the location of the potential sources of heat and cold that could satisfy demand in the future.
- Examine the economic potential for using waste heat within suitable geographical and system boundaries.
- Identify suitable technical solutions i.e. for low-temperature waste heat as an input to a district heating system.
- Identify, describe, and quantify:
    - Thermal power generation installations that can supply or can be retrofitted to supply waste heat with a total thermal input exceeding 50 MW.
    - Industrial installations with a total thermal input exceeding 20 MW which can provide waste heat.

Washington State Industrial Symbiosis Grant Program

Washington State's Industrial Symbiosis Grant Program is a competitive grant program that supports research, development and implementation of industrial waste coordination projects, including data center heat reuse.

Eligible programs must be administered by the Department of Commerce and administered regionally, with each region provided a dedicated facilitator as well as technical and administrative support. The Department of Commerce may however coordinate with other agencies, representatives of business and manufacturing networks, and other entities to develop material flow generation data and increase multisectoral outreach.

Factors considered in grant selection:

- The grants must be distributed equally geographically - in western and eastern part of the state, urban and rural areas, and small towns and large cities.
- Time to implementation and the scale of economic and environmental benefits.
- Grants require a one-to-one nonstate matching of funds.

Individual grants may not exceed $500,000.

German Energy Efficiency Act ("EnEfG-E")

- Power usage effectiveness (PUE) of 1.3 within 2 years of operation on or after 1 July 2026
- Energy efficiency register for data center firms provide public accountability and transparency
- Mandate that measurements must be provided to the government
- **New heat regulations.** See this source.
- "Data centres that go into operation on or after 1 July 2026 must be constructed and operated in such a way that they have a share of reused energy of at least 10%.
- For data centres that start operations on or after 1 July 2027, this percentage increases to 15%.
- Data centres that begin operation on or after 1 July 2028 must have a planned share of reused energy of at least 20%."

Greater Amsterdam Region Policies (The Netherlands)

- Datacenter Policy Resolution Municipality Haarlemmermeer (paragraph 6.4.1)
- Explanation Zoning plan - Adopted October 22, 2020 (page 16-17)
- Council decision: Amsterdam Location policy for Data Centers (paragraph 5.1, sub 10 and paragraph 6.5)
- Datacenter strategy Dutch regional government authority Noord-Holland (p 21-22)
- Guidelines for sustainability and innovation in data centers in North Holland (p6 table at i. and j.)

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About Open Compute Project

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.