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Point of View

Decarbonizing Urban Heat: Utilizing Waste Heat Potential in Frankfurt

Major cities such as Frankfurt have significant potential for the usage of unavoidable waste heat and ambient heat as green energy sources for district heating. Data centers, sewage treatment plants and industry can play an important role as urban sources of waste heat. In order to feed waste heat into a district heating network, large heat pumps are usually needed, which use electricity to lift waste heat to the temperature level required for district heating.

The energy transition toward a climate-neutral energy supply presents challenges for existing power grids. Driven by the increasingly widespread use of electric vehicles, the increasing number of data centers and the accelerating electrification of the heat supply, available grid capacities must be utilized resourcefully to enable decarbonization in Frankfurt.

Removing obstacles to the use of waste heat by large heat pumps in Frankfurt

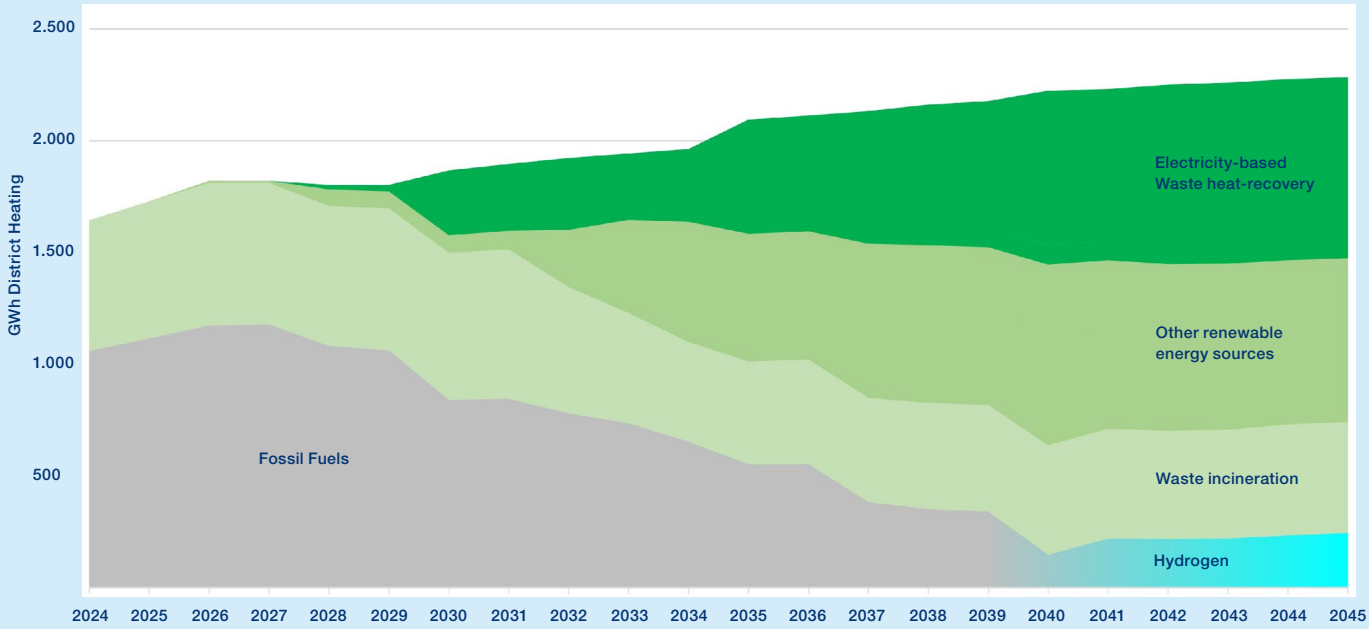
Examples from practice indicate two central challenges for utilizing waste heat by installing large heat pumps in Frankfurt. First, the power grid in Frankfurt operates near capacity, which means large heat pumps compete with other major consumers due to limited grid capacity. Second, suitable placement areas for large heat pumps are often not available at the waste-heat source. This affects the desired heat transition because high waste-heat potential, e.g., from data centers—cannot be used for the time being. To meet these challenges, several solutions will be discussed that may help to realize waste heat potential in cities.

Prioritize connecting large heat pumps to use grid capacity efficiently

According to the German Energy Industry Act (EnWG), grid operators are obliged to grant grid access based on objectively justified criteria and without discrimination. Therefore, existing capacities must also be distributed without discrimination. One possible solution, given limited power grid capacity, would be to amend or supplement the EnWG with regard to the non-discriminatory network connection. Here, connection requests for large heat pumps for waste heat utilization could be prioritized as it is already required by law for renewable energy generation plants. Such a regulation would allow large heat pumps to be connected to the grid with priority, enabling the utilization of waste heat potential and thereby advancing the decarbonization of district heating.

Primary Energy Sources for District Heating in Frankfurt 2024–2045

Source: Compiled by Mainova AG



Mainova plans for Frankfurt's district heating mix to be based on approximately one-third electricity-generated waste heat by 2045. Waste heat thus represents an increasingly important pillar of Frankfurt's energy transition.

Utilizing data centers and their waste heat to decarbonize district heating in Frankfurt

Frankfurt is the largest internet hub in Europe and has therefore significant waste heat potential with regard to its many data centers. This potential can be utilized for the energy transition. According to the German Energy Efficiency Act, data center operators are obligated to avoid or utilize the waste heat they generate. Energy suppliers can purchase this waste heat from data centers and use it for the decarbonization of district heating networks. At the municipal level, there are several options for improving the utilization of this waste heat.

Measure 1 Initiate negotiations with operators of existing data centers regarding placement areas for large heat pumps in order to utilize the generated waste heat.

In addition to the necessary power grid capacity for operating large heat pumps, suitable areas are needed on which to install them. To secure and designate such areas, the municipal administration could enter into an open dialogue with the operators of the data centers to negotiate to what extent potential placement areas for large heat pumps can be made available. The result of these negotiations could be a written agreement that specifies suitable areas for the placement of large heat pumps. This would be an important prerequisite for putting large heat pumps into operation and thus being able to utilize waste heat.

Measure 2 **Operators of newly constructed data centers should be required to provide placement areas for large heat pumps and reserve sufficient power grid capacities.**

In the case of planning and construction of new data centers, the placement requirements for large heat pumps to process waste heat, as well as the necessary power grid capacity, should be included in urban planning. A key prerequisite for the utilization of waste heat is the proximity of the heat processing system to the waste heat source. Therefore, it is absolutely essential that data center operators include areas in their planning processes where large heat pumps and other required infrastructure can be installed. A suitable supply of installation space could thus become a condition for the construction of new data centers. Such an obligation can be imposed by the city for all newly constructed data centers through the instrument of an urban development contract.

Conclusion

The heat transition can only succeed if all stakeholders work together in a constructive and structural manner. The proposed procedures aim to make optimal use of potential existing placement areas and electricity grid capacities for waste heat utilization by large heat pumps. This will make an important contribution to the decarbonization efforts by allowing to utilise waste heat potentials faster.

What is an urban development contract?

Urban development contracts are concluded between municipalities, landowners and investors who wish to develop their properties. Within the framework of an urban development contract, municipalities can, according to Section 11 of the German Federal Building Code (BauGB), agree on regulations with third parties that go beyond the possibilities of the development plan. In terms of content, provisions addressing the above-mentioned framework conditions may be included in the urban development contract, provided that the requirements included are proportionate. For example, obligations to utilize the waste heat generated and the pre-installation of corresponding heat transfer stations to district heating networks could be regulated in these contracts.

In the course of this, sufficient power grid capacity and land area could be allocated for the construction and operation of large heat pumps in order to make the waste heat usable for district heating.

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