

Heat Pump Awards 2026

Application submission

Triple Heat Pump District Energy System for NEB Tischlerei Melk

Heliotherm Wärmepumpentechnik Ges.m.b.H | Building Solutions Award

1. Application overview

Award category	Building Solutions
Title of the project	Triple Heat Pump District Energy System for NEB Tischlerei Melk
Organisation Name	Heliotherm Wärmepumpentechnik Ges.m.b.H
Exact address of the project	A-6336 Langkampfen, Sportplatzweg 18
Funding	Private; EU funds
Organisations involved in the project	Fürst Holding GmbH, HydroSolid GmbH, Green4Cities GmbH, AKXSO GmbH
Project ending date	30/09/2028
Project website	www.heliotherm.com
Sector of application	Residential; Commercial

2. Applicant & EHPA contact details

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EHPA member involved	Heliotherm Wärmepumpentechnik Ges.m.b.H, CEO Andreas Bangheri
Role of EHPA member	Heliotherm is a Heatpump manufacturer and also an active member in EHPA Manufacturers Committee.

3. Project description and benefits

Project description (goal, problem addressed, and solution provided by the heat pump)

The NEB Tischlerei Melk project demonstrates how former industrial sites can be transformed into climate-neutral, future-ready districts powered entirely by renewable energy. At its heart is an innovative heat pump concept developed by Heliotherm: a fully modulating “Triple Heat Pump” system consisting of two individual units capable of intelligently selecting the most favorable of three renewable thermal sources to maximize efficiency under changing operating conditions. The current design combines geothermal boreholes, ambient air and an adiabatic cooler (with an ice storage system being evaluated as an alternative), allowing the system to utilize the most suitable energy source throughout the year.

The project addresses one of the key challenges of the energy transition: how to combine highly efficient heating and cooling with fluctuating renewable electricity generation while

supporting grid stability. To achieve this, the heat pump is integrated with predictive energy management, photovoltaics, thermal and electrical storage systems, and demand-side flexibility. The system continuously adapts to weather forecasts, energy demand and renewable energy availability.

By combining renewable heating and cooling, smart control, district-scale flexibility and circular urban regeneration, the project showcases a practical blueprint for future net-zero communities that can be replicated throughout Europe.

Expected or achieved benefits

The project demonstrates how renewable district energy systems can become significantly more efficient, flexible and resilient. Instead of relying on a single heat source, the Triple Heat Pump continuously selects the most favorable of three renewable energy sources, maximizing efficiency under changing operating conditions.

From an economic perspective, the project promotes a life-cycle cost approach to district development rather than focusing solely on initial investment costs. By combining highly efficient renewable heating and cooling with predictive energy management and energy storage, it creates a proof of concept for a long-term, economically sustainable district energy model.

The project also delivers important social benefits. Developed within the framework of the New European Bauhaus, it aims to create a community where sustainability, quality of life, inclusion and intergenerational interaction become integral parts of the district concept rather than technical afterthoughts.

From an environmental perspective, the project contributes to climate neutrality, resource efficiency and circularity. The redevelopment of a former industrial site demonstrates how existing areas can be revitalized instead of expanded, while renewable energy, reduced emissions, biodiversity measures and sustainable resource management contribute to the overall environmental performance of the district.

Obstacles/barriers encountered during development

One of the main challenges of the project is the integration of multiple technologies, systems and stakeholders into a single coordinated district energy concept.

A particularly important challenge is the coordination of the various control and optimization functions. Clear interfaces must be established between the heat pump control system, the predictive energy management platform and the overall building automation strategy to ensure efficient and reliable operation. In addition, the project requires close collaboration between technology developers, building planners, architects, energy consultants, system integrators and future operators. As the district and its future uses continue to evolve, system requirements, loads and operational scenarios must be continuously reviewed and aligned among all stakeholders.

Successfully bringing these elements together is one of the project's greatest challenges, but also one of its greatest strengths. The experience gained will help establish practical approaches for future climate-neutral district developments.

Why should this project win an award?

This project demonstrates how the energy transition can move beyond individual buildings and become a practical solution for entire communities. It combines climate-neutral heating and cooling, renewable electricity, energy storage and smart energy management within a real mixed-use district under development in Melk.

What makes the project particularly compelling is that it is not a theoretical concept. The technologies are being developed, implemented and validated under real operating

conditions as part of the transformation of a former industrial site into a sustainable and future-ready neighborhood. The project also creates value beyond energy efficiency. It supports the principles of the New European Bauhaus by combining environmental sustainability, long-term economic viability and social value within one integrated development.

Most importantly, the project is designed to be replicated. If successful, the concept can provide a blueprint for future districts across Europe and demonstrate how renewable energy, flexibility and community-oriented development can work together in practice.

4. Technical specifications

Capacity of unit(s)	The installation consists of two Triple Heat Pump units, each planned with a nominal capacity of 70 kW. The units will be operated in parallel, resulting in a total installed capacity of 140 kW.
Energy sources used	The heat pump system is powered by electricity, primarily generated by on-site photovoltaics and supplemented by grid electricity when required. Through a predictive energy management platform, heat pump operation is coordinated with renewable energy availability, energy storage systems, electricity prices and district demand. A unique feature of the Triple Heat Pump is its ability to continuously select the most favorable of three renewable thermal sources: geothermal boreholes, ambient air, and a third renewable source currently planned as an adiabatic cooler, with an ice storage system being evaluated as an alternative. This enables highly efficient operation while maximizing flexibility and the use of locally available renewable energy.
Coefficient of Performance (COP)	Based on preliminary project assessments, the Triple Heat Pump concept is expected to achieve a seasonal performance factor (SPF) of up to 5.9. A key factor behind this performance is the system's ability to continuously select the most favorable of three renewable energy sources, depending on operating conditions. As the project is currently under development and the heat pump systems have not yet been installed, no measured COP values are available at this stage. Performance data and operating-point-specific COP values will be generated during the demonstration and monitoring phase.
Service provided	The district energy system provides space heating and space cooling based on the Triple Heat Pump concept. Domestic hot water (DHW) is generated locally in areas with elevated hot water demand, such as the hostel, using dedicated booster heat pumps.

	This allows the central system to operate at optimized temperature levels while ensuring an efficient and hygienic hot water supply.
Refrigerant type	The project intentionally evaluates two different low-GWP refrigerant solutions. The two Triple Heat Pumps are operated in parallel under identical boundary conditions, with one unit using R290 (propane, GWP = 3) and the other R454C (GWP = 148). The monitoring phase will provide valuable real-world data on efficiency, operating behavior and practical applicability, helping to identify the most suitable refrigerant solution.

Heat pump details (compressor technology, heat exchanger, system configuration)

The planned installation consists of two 70 kW Triple Heat Pump units operated in parallel, providing a total installed capacity of 140 kW and a high degree of operational reliability. Each unit is based on modulating scroll compressor technology and is integrated into a common brine circuit. The brine circuit enables the integration of multiple renewable thermal sources, including geothermal boreholes, ambient air via dedicated outdoor evaporators, and a third renewable source currently planned as an adiabatic cooler, with an ice storage system being evaluated as an alternative.

5. Renewable energy integration and grid response

Integration of renewable energy sources

The project maximizes the use of locally available renewable energy by combining on-site photovoltaic generation, thermal storage and intelligent energy management. At the core of the concept is Heliotherm's Triple Heat Pump, which can dynamically select the most favorable of multiple renewable thermal sources depending on operating conditions. This integrated approach increases renewable energy utilization, improves seasonal efficiency, reduces peak electricity demand and enhances the overall flexibility of the district energy system.

Response to energy demand / smart grid integration

Flexibility is one of the central objectives of the project. The heat pump system is integrated into a predictive energy management platform that continuously analyses weather forecasts, expected heating and cooling demand, photovoltaic generation, storage levels and electricity market signals.

Based on these inputs, the system proactively adapts its operating strategy and can shift heat production to periods with abundant renewable electricity, favourable electricity prices or available storage capacity.

Thermal and electrical storage systems provide additional flexibility by decoupling energy generation from energy consumption. This allows the district to maximize self-consumption of renewable electricity, reduce peak loads and support future smart-grid and demand-response applications. The result is a highly flexible energy system that actively contributes to grid stability while maintaining user comfort and system efficiency.

6. Innovation, monitoring and replicability

General (all awards)

Why the project is innovative *(all awards)*

The project combines several innovations into a single integrated energy concept. Its core innovation is the Triple Heat Pump developed by Heliotherm. Instead of relying on a single environmental energy source, the system can actively choose between three renewable thermal sources and continuously operate under the most favorable conditions. This approach has the potential to achieve higher seasonal efficiencies and greater operational flexibility than conventional heat pump systems.

The project goes beyond heat pump technology alone. The Triple Heat Pump is embedded within a predictive energy management system that coordinates renewable electricity generation, thermal storage, battery storage and district energy demand. By combining forecasting, optimization and multi-source operation, the system can proactively adapt to changing conditions and maximize the use of renewable energy.

Another innovative aspect is the evaluation of two different low-GWP refrigerants, R290 and R454C, under identical real-world operating conditions. This will provide valuable insights into the future application of sustainable refrigerants in highly flexible multi-source heat pump systems.

Monitoring approach (performance, cost, and carbon targets) *(all awards)*

Real-world performance is a key part of the project. The Triple Heat Pump will be demonstrated and monitored under actual operating conditions within the site of the Tischlerei Melk, allowing the project team to verify both the technical performance and the wider sustainability benefits of the concept. Using Heliotherm's RemoteControl platform, operational data from the heat pumps, renewable energy sources and storage systems is continuously collected and analyzed. The measured performance is used to assess efficiency, energy use and carbon reduction potential.

The monitoring process creates a continuous learning loop: insights from the collected data are used to identify optimization opportunities, improve system operation and validate the benefits of the Triple Heat Pump concept. In addition, the project enables a direct comparison of two low-GWP refrigerant solutions, R290 and R454C, under identical real-world operating conditions, generating valuable insights for future generations of high-efficiency multi-source heat pumps. This ensures that the project delivers not only an innovative idea, but also measurable evidence of its contribution to efficient, flexible and climate-neutral district energy systems.

For Large Heat Pump or Building Solutions Award

Why the project serves as a model for others *(Large Heat Pump or Building Solutions Award)*

The project demonstrates an innovative approach to renewable heating and cooling for mixed-use districts. For the first time, a large-scale district energy system combines a heat pump that can use three different renewable energy sources and dynamically switch between them based on real-time conditions. The system is integrated into a predictive energy management platform that continuously optimizes energy generation, storage and consumption across the district. This combination of multi-source heat pump technology and predictive control goes beyond current standard practice and enables significantly higher efficiency and operational flexibility.

The demonstration is particularly relevant for existing districts undergoing transformation, where buildings often differ significantly in age, energy performance and temperature requirements. By selecting the most suitable heat source for each operating condition, the system can efficiently supply a highly diverse building stock. The project therefore provides a practical blueprint for how renewable district energy systems can be implemented in real-world mixed-use developments.

Potential for expansion to other locations/industries *(Large Heat Pump or Building Solutions Award)*

Yes. The solution has strong scaling potential and can be transferred to many different district types and building portfolios. The multi-source heat pump concept is especially suitable for existing urban and rural districts that are being redeveloped, expanded or densified, where energy demands vary between buildings and over time.

Potential applications include:

- Mixed-use urban districts combining housing, offices and commercial spaces.
- Brownfield redevelopment projects.
- Industrial and business parks with simultaneous heating and cooling demands.
- University campuses and educational facilities.
- Hospitals, care facilities and public buildings.
- Tourism and hospitality developments.
- Municipal district energy systems.

Because the technology can integrate multiple environmental heat sources depending on local availability, it can be adapted to different geographic and regulatory conditions. The predictive control system is likewise scalable and can coordinate additional buildings, renewable generation assets, thermal storage systems and future flexibility services. The concept therefore offers a highly replicable pathway toward fully renewable district heating and cooling systems. This scalability is one reason why the project was conceived as a demonstrative NEB lighthouse project with broad transferability.

Barriers to replication elsewhere *(Large Heat Pump or Building Solutions Award)*

The main technical challenge lies in the intelligent management of multiple heat sources. To achieve maximum efficiency, the system must continuously evaluate which energy source delivers the best performance under current conditions. This requires advanced monitoring, forecasting and control algorithms while maintaining a reasonable level of system complexity and investment cost. Standardized control architectures and digital energy management platforms can help simplify deployment in future projects.

Regulatory barriers depend on the selected energy sources and local conditions.

Groundwater usage, geothermal systems, environmental permits, noise regulations and spatial planning requirements can vary significantly between jurisdictions. Early involvement of authorities and the development of standardized approval procedures would help accelerate replication.

Financially, integrated district energy systems typically require higher upfront investments than conventional solutions. In addition, ownership and operating models must be clearly defined. If the energy infrastructure is financed by one stakeholder while energy cost savings primarily benefit another, investment incentives may be weakened. Energy contracting models, energy communities and long-term operator structures can help create attractive business cases and align incentives.

Operationally, successful implementation requires coordination between property owners, energy operators, technology providers and users. Replication can be facilitated through modular system designs, digital monitoring tools and standardized implementation processes developed from the lessons learned in the NEB Tischlerei 150+ demonstration project.

Business opportunities for expansion, licensing, or commercial production *(Large Heat Pump or Building Solutions Award)*

Yes. The project creates significant business opportunities for commercial deployment, licensing and international replication.

The core innovation is not only the hardware itself but the combination of a multi-source heat pump system, predictive control strategies and district-level energy management. These components can be transferred to many future district developments and retrofit projects. As cities and property owners increasingly seek renewable alternatives to fossil heating systems, demand for flexible and highly efficient district energy solutions is expected to grow.

Potential commercial opportunities include:

- Deployment of the Triple Heat Pump concept in new district developments.

- Retrofitting existing mixed-use districts and industrial sites.

- Licensing of control algorithms and predictive energy management software.

- Development of standardized modular energy system packages.

- Energy-as-a-Service and contracting business models.

International expansion through partnerships with real estate developers, utilities and municipalities.

The project therefore has the potential to evolve from a demonstration case into a scalable market solution supporting the decarbonization of districts across Europe and beyond.

For Innovation Award

Technology/technique developed solely for this project *(Innovation Award only)*

No answer provided.

Differentiation from state-of-the-art solutions & market maturity *(Innovation Award only)*

No answer provided.

Regional benefits (energy savings, emissions, jobs, infrastructure) *(Innovation Award only)*

No answer provided.

Commercial potential *(Innovation Award only)*

No answer provided.