Heat Pump Award (HPA)

Winning projects of 2023

Cover photo: Axel Towers, Copenhagen, Denmark

Contents

The Heat Pump Award

Awarding the most outstanding heat pump projects

Heat Pump Award Ceremony 2023, Marriott Hotel Brussels, Photo by Vivian Hertz

The Heat Pump Award (HPA) is an EHPA project which recognises the most efficient, smart and sustainable heat pump project at local level.

It was launched in 2011 under the name Heat Pump City of the Year (HPCY) Award, to highlight cities and regions that have implemented an energy-efficient project that takes advantage of heat pump technology.

The international appeal of this award has grown year after year and now attracts contestants from all over the world.

Its ceremony takes place each year.

The Award aims to:

1. Collect best practice examples of heat pumps in urban areas to present to EU authorities
2. Create role models for those who still hesitate to change
3. Raise people’s awareness of the potential of heat pumps
4. Recognise the innovative and continuous work in the sector

Stats since 2011:

293 submissions
(each year we receive more than the previous)

227 participating cities

39 participating countries
from Europe and beyond

In 2023

Five different projects were recognised in five different categories:

- **Heat Pump City of the Year**: heat pump projects deployed at local level and with the city support
- **Decarbuilding Award**: smart use of waste heat and heat pumps in industrial processes
- **Decarbindustry Award**: projects developed in residential and tertiary sectors
- **Lighthouse Heat Pump Award**: innovative heat pump projects that present a high level of creativity to solve a unique problem
- **People's Choice Award**: the most popular heat pump project elected online by the audience

HPCY 2023 Winner - Award Ceremony 2023 - Photo by Vivian Hertz

Apply now!

Download your application form at hpa.ehpa.org

Fill it in with all the information and resources (e.g. photos) required, indicate in which category you want to submit your project (max 1), and use the PowerPoint presentation as a way to showcase and underline the relevance of the work done and the results of your project

You must select one of the following categories to apply:

1. Heat Pump City of the Year
2. Decarbuilding
3. Decarbindustry
4. Lighthouse Heat Pump

Fill in the form on the right with :

- your name
- your email
- objective: HPA2024 Application - title of your project
- attach the filled-in PowerPoint template (max 10MB)
- click ‘submit project’

About EHPA

Our mission

In a fully decarbonised Europe, heat pump technologies are the number one heating and cooling solution, being a core enabler for a renewable, sustainable and smart energy system. They integrate multiple energy sources, bridging the electric and thermal sectors on a local and regional level (microgrids, DHC). Heat pumps are easy to install and widely used in all thermal applications (buildings, transport, white goods) and industrial processes.
Refrigerants and other components are available in sufficient quantities.
The technology is recognised for its merits in legislation and existing energy models.

Our vision

EHPA will be a forward-looking association aiming at putting heat pumps at the centre of the energy system by communicating the benefits of heat pumps, providing relevant information and being a reference point and integrator to all stakeholders.

Awarded projects

Heat Pump City of the Year Award

The world’s first CO_2-based energy network

Description

ExerGo, in collaboration with a consortium of industrial and research partners, has successfully built and demonstrated **the world's first carbon dioxide (R744) based district heating and cooling network** in Sion, Switzerland.

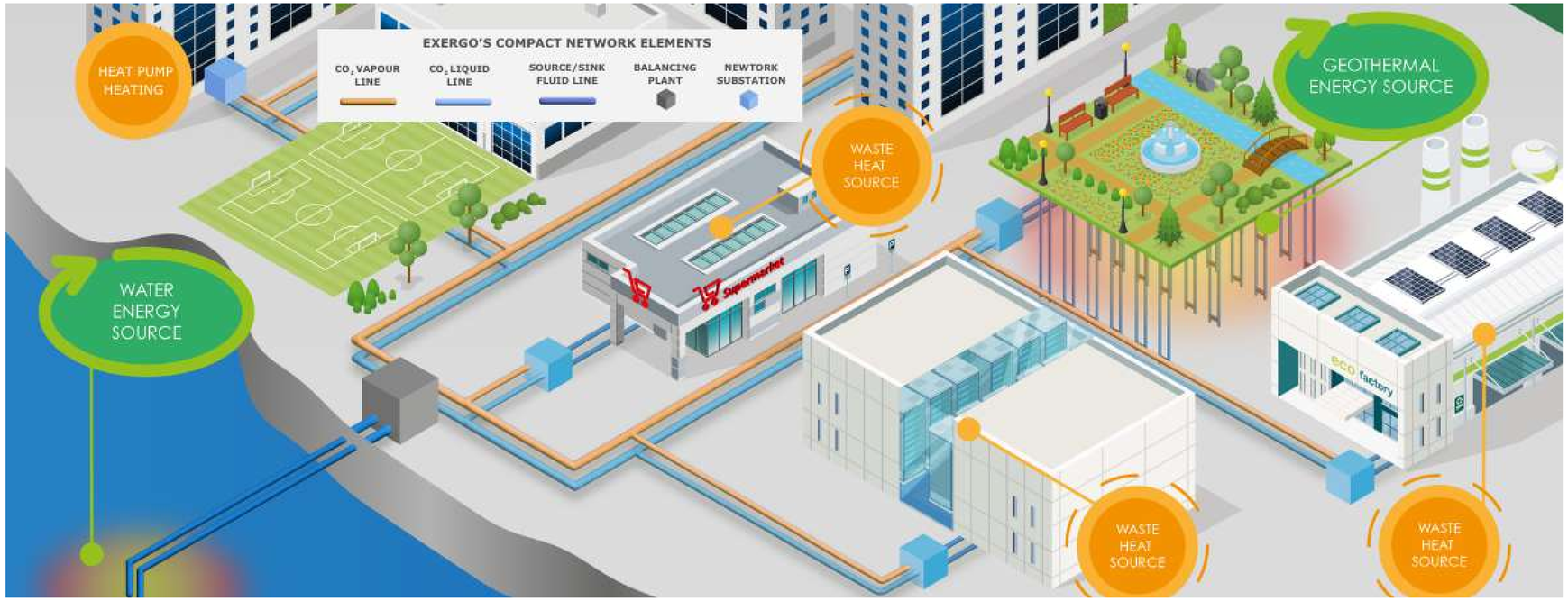
The technological innovation developed by ExerGo uses **CO2** as a heat transfer fluid within a closed loop, facilitating the **efficient exchange of low-temperature energy** between the environment, waste heat emitters, and heating/cooling machines.

By utilising CO2 and its phase change between liquid and vapour states, the ExerGo solution increases the energy transportation potential per unit of volume flow up to 10 times compared to water-based heating and cooling loops.

The high latent heat of vaporisation associated to a unit of CO2 volumetric flow enables the use of smaller, flexible pipes, helping to accelerate thermal network deployment in densely populated urban areas.

The resulting **reduction in infrastructure investment cost** makes ExerGo's solution particularly attractive in multiple applications.

The CO2 network installed at the **Energypolis Campus of the HES-SO University of Applied Sciences**, distributes the low-temperature energy from underground water, providing energy between **5°C and 12°C all year round** to three buildings.
In each building, the network supplies **decentralised heat pumps and cooling heat exchangers**. These units, consisting of standard HVAC equipment, convert the energy supplied by the network into heating, hot water or cooling for the building. The distribution of these energy services within each building is realised with traditional hot/cold water or air circulation.
In one of the HES-SO buildings, ExerGo's technology extends its services by efficiently recovering waste heat from a liquid-cooled server. This energy is made available to heat pumps in the neighbourhood, reducing the use of the underground water source.
ExerGo's visionary 'thermal smart grid' is emerging as a comprehensive solution that **maximises the synergies between heating, cooling and hot water energy needs within a district**.



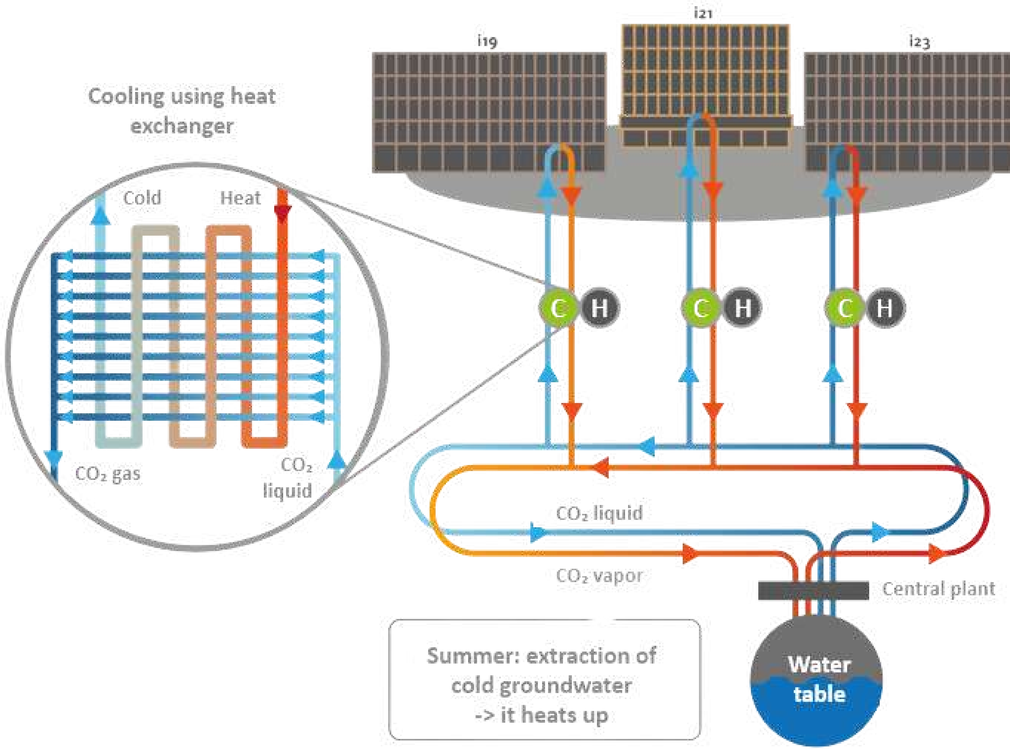
Ecodistrict Infographic - Copyright ExerGo

Sion Substation - Copyright ExerGo

Technical details

The ExerGo system facilitates the transfer of low-temperature energy, which is used by decentralised heat pumps to provide heating and hot water energy services to buildings. Within the CO_2 network, each individual substation is equipped with a heat pump - either water-to-water or CO_2-to-water.
The technology works as follows:

- In winter (net heating mode), the network extracts energy from the environment/waste heat sources and distributes it to decentralised heat pump units where the extracted energy is delivered by condensing gaseous CO_2 in thermal exchange with the heat pump working fluid. The liquid CO_2 produced is returned to the central plant where it is evaporated again before the cycle is repeated.
- In summer (net cooling mode) the central plant rejects the excess heat from the cooling loads via the central plant to the energy sink. In such situations, the network delivers liquid CO2 to decentralised heat exchangers where liquid evaporation provides the cooling or heat recovery effect. The gaseous CO_2 produced is then sent to the central plant, where the liquid CO_2 is condensed again before the cycle is repeated. For demonstration purposes, the central plant at **the pilot site in Sion** includes a chiller that simulates different source temperatures such as rivers, groundwater or lakes.



Sion Infographic, Cooling Mode, Translated by ExerGO - Copyright HES-SO

- When there are synergies between simultaneous heating and cooling demands, the system is able to internally circulate the gas produced by the cooling users and make it available to the heating users, thus minimising (and in some cases avoiding) the use of the central plant.

Efficiency

The system provides an **efficient and economically attractive solution for heating and cooling several buildings**. In Sion, the CO2 network powers decentralised heat pumps and heat exchangers with a total capacity of **370 kW heating and 400 kW cooling**.

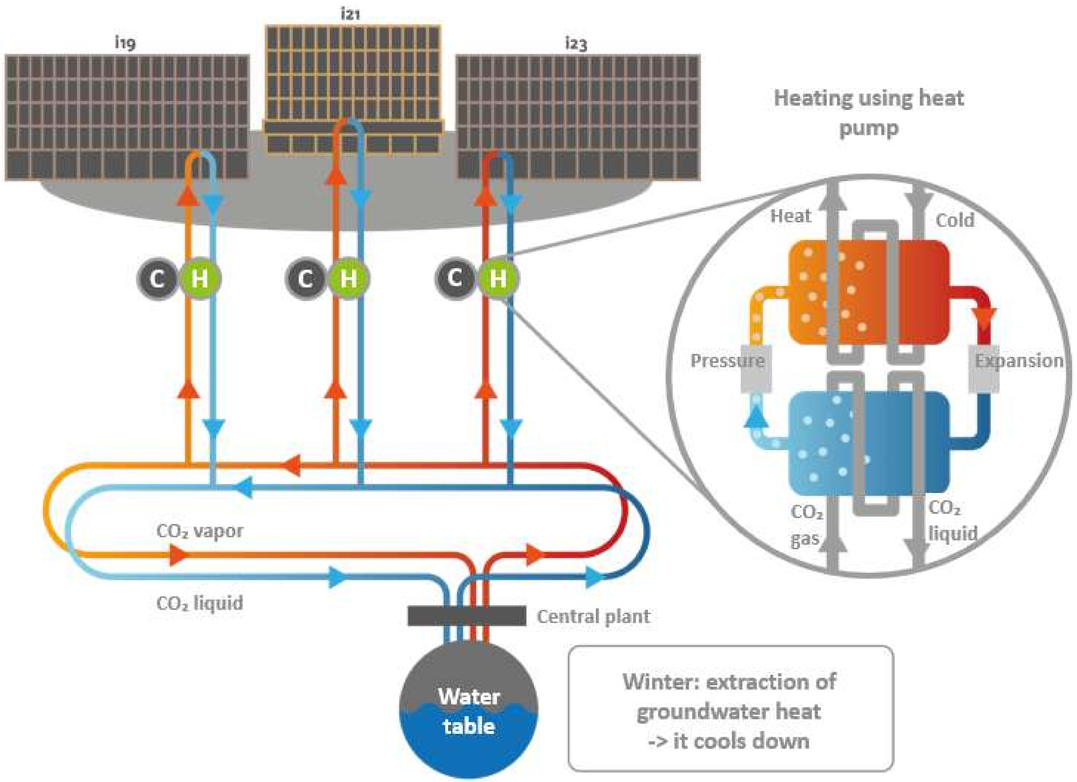
Since its first commissioning in March 2022, the CO2 network has successfully delivered **900 MWh of combined heating and cooling per year**, operating efficiently all year round.

Using heat pumps, the system skilfully extracts low temperature heat from the network and delivers energy to customers at their optimum temperature.

The energy efficiency ratio (EER) of the system is strongly influenced by

- the source temperature and its variations throughout the year
- the load and temperature demand profiles of the heating and cooling consumers
- the specific EER of the decentralised heat pumps

The average EER recorded in Sion between June 2022 and April 2023 was 5.49.



Sion Infographic, Heating Mode, Translated by ExerGO - Copyright HES-SO

The liquid form of CO_2 is subsequently sent back to the substation, completing the waste heat recovery loop. **This comprehensive heat recovery system ensures that every bit of energy is utilized**, aligning with principles of clean and circular economy practices within the industry.

From June 2022 to April 2023, the total heating and cooling demand amounted to **1,955,601 kWh**, with the CO_2 network covering an impressive **34% (656,579 kWh)** of this demand. It is important to note that the Sion project, being a pilot plant, currently addresses a fraction of the total capacity of the connected buildings. This pioneering CO_2-based network serves as a demonstrator, validating the working principles and system performance in effectively transporting low-temperature energy.

Innovative Edge

The project stands out as an unparalleled innovation, introducing the world's first district heating and cooling network utilizing carbon dioxide (R744) as an energy carrier.

Notably, this groundbreaking system integrates a flexible CO_2 composite pipe system with **Heating, Ventilation, and Air Conditioning (HVAC) equipment**, delivering a comprehensive range of services, including heating, cooling, refrigeration, and free cooling energy to buildings and processes.

The demonstration in Sion highlights the system's ability to distribute energy from the environment and effectively reuse heat discarded by IT infrastructure, underscoring ExerGo's commitment to maximising energy recovery and the system's adaptability to fluctuating environmental conditions and intermittent waste heat sources.

The **compactness** of the ExerGo solution stands out as a key requirement for decarbonising heating and cooling energy services in dense urban areas and developing district energy infrastructure in confined spaces where the transition from fossil fuels to renewable solutions may not be cost-effective. The system's compactness makes it the only solution in some applications to efficiently transition to clean, affordable and efficient energy services.

The rapid deployment potential of this disruptive energy infrastructure technology lies in the **strategic integration of existing industrial and HVAC equipment**, making it a readily deployable solution. Utilising both the evaporation and condensation of CO2, this technology is **versatile** and can be applied in different climates and applications, from city centres to industrial and commercial buildings.

Flexible Pipes - Copyright ExerGO

Location: Sion, Switzerland

Project start date: June 2020

Funding of the project: Public and private

For more info:

Sion, Aerial view - Copyright ExerGo

DecarBuilding Award

Water-Loop Heat Pump for heating systems retrofit in existing buildings

Description

This project focuses on the global shift towards electricity in the context of decarbonization, with a specific emphasis on **improving energy efficiency in existing buildings**. It utilizes Water-Loop Heat Pump (WLHP) air conditioning systems, where the primary Heat Pump (HP) plays a key role in generating water at suitable temperatures for conventional radiators. The system operates quietly, replacing high-temperature terminals with WLHP water/air heat pumps, ensuring a **consistent temperature range** throughout the year. The innovative aspect involves **minimal disruption**, as it allows the reuse of existing piping systems, ensuring continuity in residential occupancy during implementation.

Service delivered

There are many benefits to the final user:

- **Does not require any external unit for individual homes**;
- Use of existing piping and **limited internal work**: the heat pump connects to the connection points of existing radiators;
- Heating, cooling and dehumidification with the same system;
- **Constant heat output** independent of the external temperature;
- Very **high efficiency**;
- Complete **autonomy of operation room by room**;
- Optimal **comfort**;
- Reduction of distribution losses in the plant;
- Use of renewable energy;
- A **highly flexible and versatile** solution, with minimally invasive interventions;
- Significant **reduction in energy consumption and operating costs**;
- **Housing continuity**;

Technical details

Efficiency

This project offers a versatile heating and cooling system available in **three sizes**, with thermal power ranging **from 1.1 to 3.05 kW**. Operating on a **water loop system**, the secondary heat pump uses water to air, while the primary heat pump employs air to water, ground to water, or water to water for temperature control. The system demonstrates exceptional efficiency with a Coefficient of Performance **(COP) of 5.88** and an Energy Efficiency Ratio **(EER) of 4.87**. It maintains a neutral temperature efficiently in the first stage, utilizing a centralized heat pump that exchanges energy with an external source. **On-site photovoltaic systems** supplement electricity for heat pump operation, enhancing sustainability. The system utilizes the existing **low-temperature loop** for various thermal balancing solutions, including thermal solar panels for winter water heating, evaporative towers for summer water cooling, and integration with low-temperature district heating networks. Options like **geothermal probes and groundwater wells** further enhance the system's flexibility and efficiency.

External aesthetics water loop heat pump unit - Copyright INNOVA SRL

The system acknowledges the pivotal role of **decarbonizing building heat loads** to meet energy and climate goals, aligning with the expected evolution of the European building stock. With new constructions potentially plateauing, the focus shifts to renovations and replacements, which are anticipated to dominate at an 80 to 20 ratio. The emphasis is on **extending the use of heat pumps to existing buildings**, particularly those with centralized systems like condominiums, multi-family buildings, the tertiary sector, and heritage structures. However, technical challenges hinder direct heat pump implementation in existing multi-apartment buildings, such as adapting to high-temperature pipes, meeting sanitary system requirements, and addressing issues in poorly insulated or deteriorated distribution networks. Overcoming these challenges is crucial for the widespread adoption of heat pump technologies in existing building contexts.

Innovative Edge

- System upgrades existing centralized systems while maintaining the plant system.
- Water-air HP distributed in rooms has a modern design, compact dimensions, and low thickness (14 cm deep).
- Uses propane gas (R290) in refrigerant circuit with a minimized charge for acoustic comfort.
- Equipped with DC inverter compressor and tangential inverter fan for ideal temperature and maximum silence.
- Smart touch control on the machine or wall, with APP, WIFI, or ModBus connection for remote management.
- Allows zone and environment control, different operating scenarios, daily/weekly programming, and consumption monitoring.
- Electronic accounting system for monitoring consumption, and facilitating expense division in condominium areas.
- Optional condensate injection kit for cases where draining condensate in the existing building is impossible.

Waterloop Heat pump unit: internal view - Copyright INNOVA SRL

The proposed system involves upgrading existing heating systems by incorporating heat pumps on a water loop kept at a neutral temperature. This innovation reduces energy consumption and operating costs significantly. In traditional systems, distribution losses due to high water temperatures and poorly insulated pipes can reach 30-50%. By maintaining a neutral temperature, **heat loss is reduced by up to 9 times**, enhancing overall energy efficiency and cost savings. Additionally, individual water/water heat pumps in each apartment, connected to the same loop system, replace existing sanitary columns, reducing indirect consumption and minimizing thermal losses in domestic hot water production. During summer, waste heat from room cooling is utilized for hot water preparation, **balancing energy consumption**. The use of heat pumps is deemed crucial for the ongoing energy transition. The solution is **simple**, **cost-effective**, and **adaptable**, aligning with the goals of the "Renovation Wave" strategy to double retrofit rates. With potential for mass production and lower costs, the water loop system is expected to contribute to the international growth of this technology, especially with future measures promoting heat pumps.

Location: Tione di Trento, Italy

Project start date: 2021

Funding of the project: Private and EU funds

For more info:

innova

Lighthouse HP Award

Heat the streets

Description

Heat the Streets is a pioneering initiative in the UK, supported by the European Regional Development Fund, focusing on **high-density ground source heat pump (GSHP) technology**. Implemented in Cornwall, the project successfully demonstrated the retrofitting of GSHPs onto existing domestic properties at scale, challenging traditional 'fabric-first' methods. Notably, this retrofitting approach eliminates upfront financial burdens on customers, offering a **practical pathway to adoption**. Heat the Streets exemplifies how GSHPs can be integrated into a wide range of existing structures, **revolutionizing domestic heating practices**. The project adopted a **coordinated street-by-street deployment strategy** and achieved a significant milestone with **the world's first in-road retrofit of a shared ground array**. **Over 100 properties**, including new builds and retrofits in private and social housing sectors, were equipped with GSHPs, showcasing the initiative's substantial impact and versatility.

The Kensa Shoebox heat pump, roughly the size of a microwave
- Copyright Kensa Utilities

Clients benefit from an environmentally friendly heating option with ground-source heat pumps (GSHPs), offering **lower initial costs** compared to air-source heat pumps and ongoing operational savings. This transition is especially advantageous for those moving away from oil, LPG, or night-storage heaters, resulting in **significant reductions in heating expenses**.
The GSHPs require **minimal maintenance**, have a **lifespan of about 25 years**, and **the ground array infrastructure is owned and maintained by Kensa Utilities Ltd**.

Participants in the Heat the Streets Project, particularly private homeowners, are covered by the **Heat Trust scheme**, ensuring a **high standard of customer service and support for vulnerable customers**.

Jackie proudly next to her Evo heat pump, giving her 70%+ CO2 savings and monthly bill savings - Copyright Kensa Utilities

Technical details

Efficiency

The project successfully implemented **Kensa Evo & Shoebox** heat pumps with **high efficiencies (SCOP values exceeding 4.0)**, resulting in **significant bill savings for residents (30-50% compared to night storage heating)**. The initiative may also explore converting residents' photovoltaic panels into photovoltaic-thermal panels for enhanced efficiency. The project garnered substantial interest, being oversubscribed by five times, with **over 500 residents expressing interest**, showcasing the success of a community-led model and strategic consumer engagement through Heat the Streets. The positive response indicates the potential for large-scale community conversions with careful planning and outreach efforts. For detailed technical information, scan this code:

Innovative Edge

Heat the Streets, initiated by Kensa Utilities Ltd (KUL), introduces an **innovative business model** for ground source heat pump (GSHP) systems. Unlike traditional models, KUL **retains ownership of ground array infrastructure**, charging consumers for access similar to gas network agreements. This **reduces upfront costs and disruption associated with installations**, making it economically viable for both private and social housing. The approach, backed by low-cost pension funding, **minimizes reliance on subsidies**. The model is **well-suited for densely populated urban areas**, offering a gradual transition for entire streets or towns. The project has influenced the networked heat pump sector in the UK and has international implications, resembling the 21st-century evolution of the gas network in heating infrastructure.

Borehole drilling, one of 102 drilled (total depth of 11,319m, double the height of Mount Kilimanjaro!), and one of the world's first drilled in public roads - Copyright Kensa Utilities

Kensa Utilities has successfully implemented Heat the Streets, showcasing the large-scale retrofitting of Ground Source Heat Pumps (GSHPs) in Cornwall's housing, addressing the decarbonization challenge in flats and terraced streets. This model provides a **groundbreaking solution for areas where district heating is not dense enough, but individual heat pumps are too dispersed. About 50% of the UK's housing stock falls into this category**. Heat the Streets serves as **a pioneering example**, inspiring businesses like Scottish Power and global trials in the US Northeast, Denmark, and Europe.

Hendra Close - Copyright Kensa Utilities

The business model has gained significant media attention, with outlets like the Financial Times, BBC, and ITV highlighting the innovative approach of treating ground array infrastructure as a utility service, displacing the traditional gas network and reducing upfront costs for low-carbon heating and cooling. The installation of ground source heat pumps in new-build homes within Heat the Streets developments offers advantages such as **lower operational costs, reduced maintenance expenses, and decreased carbon emissions compared to alternative technologies**.

Heat the Streets not only demonstrates the feasibility of placing ground array infrastructure in the public highway but also emphasizes the replicability of this approach, **aligning with the UK's 2050 Net Zero targets**. Kensa has developed legal agreements and documents strategically positioned within existing infrastructure for future projects.

Location: Stithians, United Kingdom

Project start date: June 2021

Funding of the project: Private Housebuilder and Social Housing Provider contributions and European Regional Development Funds (ERDF)

Project website:

Kensa Utilities
A KENSA GROUP COMPANY

Aerial view of Collins Parc (the ring road) in Stithians, in which the world's first in-road borehole network is deployed - Copyright Kensa Utilities

DecarbIndustry Award

How Bosch transformed the Eisenach plant into a pioneer in energy efficiency

Description

The Bosch Eisenach plant underwent a significant sustainability and efficiency transformation by decarbonizing its heating supply. The project integrated compressed air waste heat reuse and a heat pump, resulting in a **nearly carbon-neutral heating and cooling generation process**. This initiative, prompted by increased demand and the construction of a new building, led to **remarkable environmental and economic benefits**. The plant now annually saves **2,400 tons of CO2 emissions**, reduces gas consumption by **over 90 percent**, and realizes cost savings of approximately **600,000 euros**. Overall, the modernization marks a substantial step towards sustainable and eco-friendly practices at the facility.

Service delivered

The Bosch Eisenach plant has **optimized its energy usage** by tapping into waste heat from refrigeration. This involves adjusting network temperatures and critical consumers, along with implementing return temperature optimization. The key element is **a large heat pump utilizing cold water as a heat source**, achieving a remarkable Coefficient of Performance **(COP) of 7.6**. **In summer, the system transforms into a chiller using compressed air waste heat**. It operates with **minimal electrical energy from green sources**, and continuous monitoring allows real-time oversight and efficiency fine-tuning.

Copyright Bosch Building Technologies

Technical details

Efficiency

- Heat Pump: Engie Quantum Water, **refrigerant R515B**
- Heat source **cold water** (combined generation of heating and cooling)
- Winter operation (heating & cooling): Heating capacity **1.400 kW** / cold water capacity **1.070 kW**, combined **COP=7,6**
- Summer operation (only cooling): Cold water capacity **1.000 kW, EER=5,7**
- Baseload heat is supplied by **compressed air waste heat reuse (600 kW)**
- Peakload heat is supplied by **new high-efficient gas boilers (2x1.500 kW, share in total heat supply <10%)**
- Peakload cold water demand is supplied by the formerly existing chillers
- **CO2-neutral green electricity** (produced partly from photovoltaics and purchased) is used for the heat pump operation
- **Integration of heat pump into an existing plant**
- Combination of heat pump installation with adaption of the heating network temperatures

Innovative Edge

This project is a successful example of **industrial sustainability**, showcasing the integration of a heat pump to decarbonize the heat supply of an existing industrial plant. It demonstrates the feasibility of this approach and highlights the economic benefits of combining heating and cooling generation. The achievement of **nearly CO2-free heating and cooling**, along with **significant reductions in gas consumption and energy costs**, makes it a compelling and financially prudent solution. The project's success is evident within Bosch, where plans for similar initiatives across various sites are underway, and its replicability offers a model for decarbonizing industrial plants with simultaneous heat and cold water demands.

Location: Eisenach, Germany

Project start date: 2018

Funding of the project: Private

For more info:

BOSCH
Invented for life

People’s Choice Award

AHT Rottenmann - Decarbonization Project: Gas Boiler Replacement

Description

This project entails the **implementation of a heat pump cascade system** designed to meet the heating requirements of a production facility, office building, and domestic hot water demand. The total installed heating capacity of the cascade system is **1,200 kW**.

The primary energy source for this system consists of **four air-cooled Daikin heat pumps (EWYT350BXRA2) utilizing refrigerant R32**. These air-cooled heat pumps serve as the energy input for **two Water-Water Heat pumps (EWWH525VZXSA1) employing refrigerant R1234ze**.

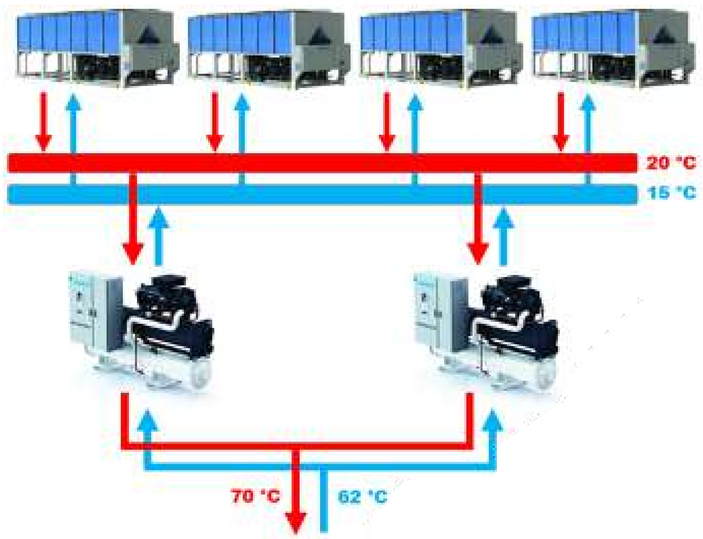
Throughout the entire year, **the system is dedicated to producing hot water at a temperature exceeding 73°C**, operating exclusively for heating purposes. Additionally, the project includes the **integration of a photovoltaic (PV) installation with a capacity of 1,950 kWp**. To enhance energy storage capabilities, **a 50,000-liter hot water tank** is also incorporated into the system.

Service delivered

Delivery and installation of Daikin heat pumps, including supervision throughout the installation process. Additionally, Daikin offers commissioning, test runs, and functional checks for all their heat pumps, along with the option to sign a maintenance contract for ongoing support.

Hydronic installation including de-coupler without insulation - Copyright Daikin Airconditioning Central Europe HandelsgmbH, AHT Cooling Systems GmbH

Technical details



Air-cooled Daikin heat pumps EWYT350BXRA2 (refrigerant R32) and Water-Water Heat pumps EWWH525VZXSA1 - Copyright Daikin Airconditioning Central Europe HandelsgmbH, AHT Cooling Systems GmbH

Efficiency

The final system solution involves the integration of a **heat pump cascade**, comprising a **synergistic arrangement of both air-cooled and water-water heat pumps**. Four air-cooled heat pumps serve as the primary energy source for two water-water heat pumps.

The energy loop maintains a consistent temperature level ranging from **15°C to 20°C** throughout the year, ensuring **optimal efficiency under various operating conditions**. This temperature range is strategically chosen to maximize the system's overall effectiveness.

To address the diverse heat demand of the customer, **two distinct energy sources** are available, contingent upon the operation of photovoltaic (PV) systems and market energy prices for gas and electricity:

1. **Photovoltaic (PV) System**:
   - Installed Capacity: 1,950 kWp
   - Number of Modules: 6,000
   - Total Area: 10,000 m²
   - Expected PV Earnings: 2,000,000 kWh per year
2. **Existing Gas Boiler**:
   - Reserved for Peak Load Coverage
   - Provides an additional energy source to supplement the system's requirements, offering flexibility and reliability during periods of heightened demand.

Innovative Edge

AHT Cooling Systems is strategically renovating its production facilities and offices for a sustainable future, with a focus on decarbonization. The project employs advanced heat pump technology using **low Global Warming Potential refrigerants**, aiming to reduce greenhouse gas emissions, integrate renewable energy, and enhance energy efficiency. The unique combination of air-cooled and water-water heat pumps makes it a **best-practice example for industrial and commercial settings**, demonstrating **flexibility** in meeting diverse heating and cooling demands. The project is commercially viable due to **decarbonization imperatives**, replacing old heat sources, government funding in Austria, and meeting the market demand for low water temperature heating solutions.

50.000 Litre hot water tank - Copyright Daikin Airconditioning Central Europe HandelsgmbH, AHT Cooling Systems GmbH

Location: Rottenmann, Austria

Project start date: November 2022

Funding of the project: Public

Project website:

hpa ehpa frascold® Blue is better