

Heat Pumps in Renovation | Update 2022



The most flexible technology when renovating any kind of building





EHPA is a Brussels based industry association which aims at promoting awareness and proper deployment of heat pump technology in the European market place for residential, commercial and industrial applications. EHPA provides technical and economic input to European, national and local authorities in legislative, regulatory and energy efficiency matters.

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Editorial



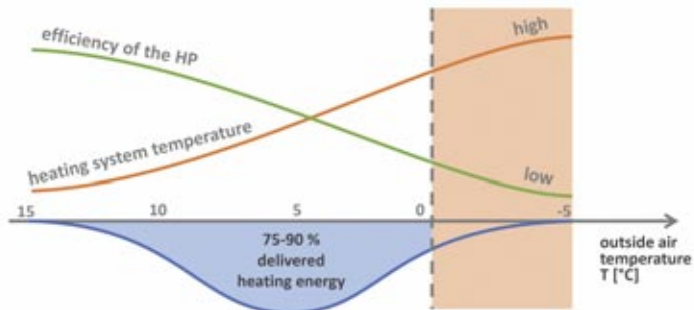
Dear readers,

There are several reasons suggested as to why heat pumps should be used in residential buildings.

First and foremost, they provide heating, domestic hot water and cooling in an ecologically friendly as well as economical way. Moreover, a wide range of studies consider heat pumps as a key technology on the way to energy system transition and targeted CO₂ neutrality. Therefore, in the future CO₂ reduced energy system, heat pumps are set to play a major role in providing the heat for space heating and domestic hot water in the residential sector. Furthermore, the implementation in new residential buildings is particularly straightforward, typically equipped with a low-temperature underfloor heating system. In fact, in several European countries, heat pumps are already the predominant heating technology in the newly built houses and this trend continues to rise.

The real challenge concerning reaching the goals related to climate change and higher energy efficiency, however, is to secure heating in existing residential buildings. Despite the fact that there are several technological solutions that allow the implementation of heat pumps in existing buildings, the number of end consumers choosing heat pumps when replacing an old heating system is still low.

In the current discussion regarding the applicability of heat pumps in existing buildings, there are two main arguments against. The first one is the assumed high heating supply temperature that allegedly leads to the poor performance of heat pumps and consequently to exclusion criteria. The second one, related to the first, is the need for a comprehensive energetical retrofitting of the building before the installation of the heat pump.



Nowadays, there are plenty of examples of efficient heat pumps work in not-retrofitted or only partly retrofitted houses.

For example, the German Fraunhofer ISE Institute examined sixty air-to-water and ground source heat pumps under real operation conditions in existing buildings in their newest field test. Their extensive measurement setting and high frequency data acquisition system allowed for detailed analyses of the efficiency of the systems, including the temperatures of the heating system.

The two main outcomes from this investigation were:

- The average efficiency of the systems is quite high; coincidentally the efficiency results mirrored the results from the project in newly-built residential houses conducted 10 years before.

This indicates the positive development of the technology and the installations processes.

- Measured average heating system temperature for space heating in examined houses is lower than generally expected. The majority of heat for space heating is not delivered in the days with the lowest outside-air temperatures. This explains the relatively low average heating systems temperatures and high average efficiency of the systems (see graph). In other words, the highest supply temperatures and the relatively low efficiency during lowest outside-air temperatures play only a minor role for the average seasonal efficiency.

Additionally, the real maximal supply temperature was lower than the designed heating system temperature. That fact might be explained by milder than normative weather conditions

19th century residence in Berlin
with ground source heat pump.
© Axel Schmidt

during the year the study was carried on, general oversizing of the radiators in older buildings and a lower energy demand thanks to renovation measures applied to the house envelope.

Concerning the ecological assessment of heat pumps, it can be stated that heat pumps or their efficiency may be judged in various ways depending on the CO₂ electricity intensity in a particular country or region. The same rule equally applies to economic evaluation.

Taking the efficiency reached during the field test performed in the last 15 years in Germany as a basis for the evaluation, it is clear that heat pumps perform very well under real operation conditions and that in most cases they ensure significant CO₂ savings compared to natural gas boilers for both new and old buildings. All in all, heat pumps do their job to satisfy thousands of users in

European residential buildings while contributing to a less CO₂ future. And yes, also in the renovation sector!

Dear Reader, in this brochure you will discover several examples of successful heat pumps installations in the renovation sector. For me, they are all very inspiring, albeit they are not the ultimate proof of the applicability of heat pumps in existing buildings. The real evidence is the thousands and thousands of heat pumps running in all over Europe every day. They may not be as spectacular as the examples before you, but each day they save the CO₂ emissions and make their users happy at their homes.

Dr.-Ing. Marek Miara

Coordinator Heat Pumps
Fraunhofer-Institut für Solare Energiesysteme ISE



Making Challenger a positive energy building with triple BREEAM-LEED-HQE certification

LG and Bouygues Construction partner to increase energy performance, environmental sustainability and employees' satisfaction

Challenger, the Bouygues Construction head office, is located in Guyancourt (30 hectares field property in West of Paris). Its 6 buildings were constructed in 1988. These represent approximately 67,000m² in total area and offer working space for 3,200 employees. Renovation started in 2010 and was completed in 2012. 150 million Euros have been invested in increasing energy performance, environmental sustainability and employees' satisfaction.

Mr. Martin Bouygues, CEO of Bouygues Construction mandated a total renovation of the total area of 67,000 m² of the company's HQ called Bouygues Challenger. This was in order to be recognized both on a national and international level by receiving 3 certificates related to energy and environment, namely: the French Thermal Efficiency HQE, the USA Green Building LEED Certification and

the UK BREEAM Environmental Certification. Success in renovation depended on preserving the original infrastructure and increasing user comfort.

At that time, LG was the only supplier who was prepared to develop MULTI V Water Variable Flow and other innovative solutions. Partnership with Bouygues allowed LG to test validation on-site in order to prove Bouygues LG's capability and responsiveness for this project.

LG Solutions, namely, MULTI V Water AC SMART Premium and Modbus Interface allowed Ferro engineers to reach more than the initial target of renovation for Bouygues Challenger. The original installation was designed for 1,200 m³/h of water flow rate. After commissioning and starting up, water flow dropped to rates





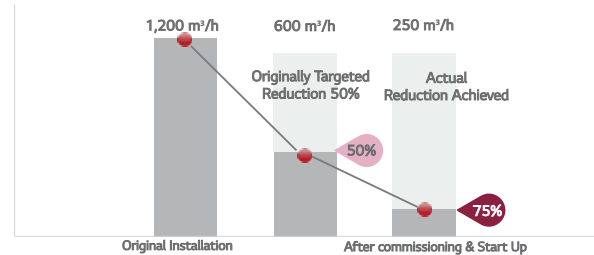
“Thanks to the partnership of Bouygues and LG, the total energy consumption of the building has dropped to 21 kWh/m² per year. I appreciate the outstanding performance by LG which exceeded our expectations,” says Philippe Metges, Managing Director of Bouygues.

between 200 m³/h and 300 m³/h. Bouygues claimed that auxiliaries have reduced up to 75%, as opposed to the originally targeted rate of 50%.

Initial renovation target was 31kWh/m²/year, but the actual result after the renovation reached near zero, thanks to AC SMART and BMS that stopped our ducted units. Thanks to the effort of all stakeholders and LG, Challenger project was highly successful.

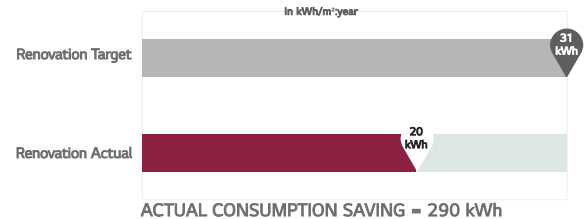
Thanks to work led by LG and R&D, LG was awarded as the Innovative Supplier in 2014. Variable Water Flow allowed us to achieve beyond what had been planned for Bouygues Challenger and made it the first positive energy site in Europe. The system caused a reduction in energy consumption and is partly responsible for making Challenger a positive energy building.

SAVINGS BY VARIABLE WATER FLOW



Drop in water flow

ENERGY CONSUMPTION COMPARISON



Drop in auxiliaries consumption

By



Technical details of the application

Carbon savings: Approx. 420t/yr (-70%)

Heating capacity: 308 x 3 kW +
56 x 6 kW (1,26 MW)

Storage capacity: 364 x 9 kWh
(3,28 MWh)

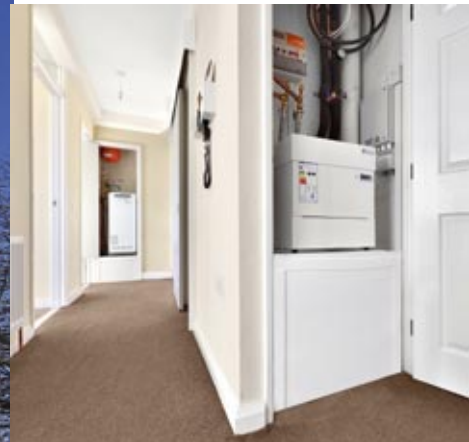
Heating source:

Individual heat pumps (Kensa Shoebox)
and heat batteries (Sunamp UniQ)
connected to a shared open-loop
ground-source system.

Supplied temperature: Space Heating up
to 55°C and Water Heating up to 65°C.

By

Sunamp



Picture 1: The towers in Sunderland

Picture 2: The Sunamp UniQ heat battery
in place

Picture 3: The Kensa Shoebox HP with the
UniQ heat battery in the background

Source: Sunamp

Heat batteries & heat pump system removes gas in high-rise tower blocks

An integrated system design allows the removal of gas combi boilers from 364 space-constrained homes – increasing tenant safety and reducing CO₂-emissions

When faced with the dilemma of how to completely remove the gas supply and replace old gas combi boilers without decanting residents from 364 apartments in a tower block, Gentoo Housing turned to energy services supplier Engie for advice.

To complicate matters, any new system would have to be easy to use and fit into the limited space available in each home, which ruled out installing traditional unvented cylinders and their associated pipework.

The answer was an integrated system combining Sunamp's super compact, phase-change material based UniQ heat batteries and Kensa's Shoebox Heat Pumps, the quietest and smallest ground source heat pumps available in the UK, controlled by a smart, easy to use interface from Switcher.

This fully integrated system is fed communally but managed locally, providing residents with greater individual levels of control and comfort, and lower running costs.

Building safety has improved, as there is no longer any potential risk of gas related explosion, and the risk of carbon monoxide poisoning and legionella disease has been eliminated. Maintenance costs are considerably reduced as there is no longer any need for annual gas safety tests and certification, or cylinder safety checks. Carbon emissions will be reduced by an estimated 420 tonnes, or nearly 70% per year.

The Sunamp / Kensa partnership solution has enabled gas supply to be removed for the first time in an occupied high-rise building in the UK, with minimum disruption. The same system can equally be applied and bring the same advantages to lower density housing, such as a street of terraced homes.

Industrial-scale reductions on heating costs and CO₂ emissions

As part of a large-scale office renovation project, one Austrian company specified Vaillant heat pump technology, transforming both energy usage and carbon emissions.

Greibich Installations GmbH is a specialist building services company based in Amstetten, Austria. In 2017, the business took the decision to refurbish its 800 m² premises, comprising 400 m² office space and 400 m² cooled warehouse, home to thirty staff in total.

Far more than a cosmetic exercise, management took the opportunity to totally re-think the way the building functioned, including looking afresh at heating, cooling and CO₂ emissions.

With this in mind, all the original windows were removed and replaced, along with the entire heating and cooling system, including an old gas boiler and air conditioning units. In their place, ceiling-mounted cooling and ventilation were installed across the premises.

To provide the improved way of heating and cooling for this sizeable building, Greibich specified two Vaillant flexoTHERM 197/4 heat pumps from Vaillant Group Austria, accompanied by 14 m² of solar panels. This state-of-the-art technology now provides pleasant working conditions, regardless of climatic conditions, for those sitting at their desk or moving stock in the warehouse.

Apart from transforming the experience of working at Greibich, the changes have had a considerable impact on the bottom line. Before the refurbishment, the company's annual heating and cooling costs were around € 6.500. This has since been reduced by 60% to € 2.600. On top of this, the new system has reduced CO₂ emissions by an excess of 15 tons.





„This project illustrates the great potential savings when a building of this size changes from an old to a modern heating system,“ commented Thomas Hanke, manager for market development and communication at Vaillant, Austria

Facts & Figures

Kind of object:	Office and warehouse
Heating System:	2 Vaillant brine-water heat pumps flexo-THERM 197/4
Heating area:	800 m ²
Cooling area:	400 m ²
Energy costs saving:	€ 3.900 p.a.
CO ₂ savings:	15,18 tons
Year of installation:	2017

By



Simon Lacey, Regional Managing Director for ENGIE's Places & Communities division, comments:

“One of the key reasons this project has been a resounding success is that all parties have a shared vision which centres on improving lives, and we have worked collaboratively to achieve this goal for the residents of Enfield. We're delighted to have been recognised for taking a proactive approach in tackling fuel poverty and hope to replicate this model across the country, so more people can live in sustainable homes without breaking the bank.”

Technical details of the application

Installed heating capacity: approximately 1.2 MW

Ground Source Heat Pumps installed:

Kensa 3kW and 6kW Shoebox

SCOP: approximately 3.0

Refrigerant: R134a

Heating Source: Closed-loop boreholes to a total depth: 20 700 metres (100 boreholes drilled to depths of over 200 m)

Supplied temperature: 50 °C to space heating (radiators) and > 60 °C achieved in a domestic hot water tank using GSHP only

By



Industry Oscar Winner – Enfield Council, Tower Blocks Project

A low-carbon renewable energy scheme: England's largest most innovative district ground source heat pump system

Completed in October 2018 the UK's pioneer of domestic district ground source heat pump systems, Kensa Contracting, delivered England's largest shared ground loop array heat pump system with ENGIE.

400 flats over eight tower blocks in the London borough of Enfield were retrofitted with individual Shoebox heat pumps manufactured by Kensa Contracting's sister company Kensa



Heat Pumps and connected to the largest collection of 'district' arrays of its kind.

The Shared Ground Loop Array System is sub-divided into 16 "micro-districts" consisting of clusters of seven boreholes, supplying half a tower block each.

Delivered in under a year all work was achieved while tenants remained in situ. This system architecture allows residents to select their own energy supplier to access the best available electricity tariff. The resulting heating upgrade led to a significant reduction in residents' energy bills, (falling by 30–50%) with an estimated 773t CO₂ saving per annum.

The shared nature of the ground array design also reduces drilling costs, ordinarily the most cost-prohibitive aspect of a ground source heat pump installation. Ensuring funding through the Energy Company Obligations (ECO)

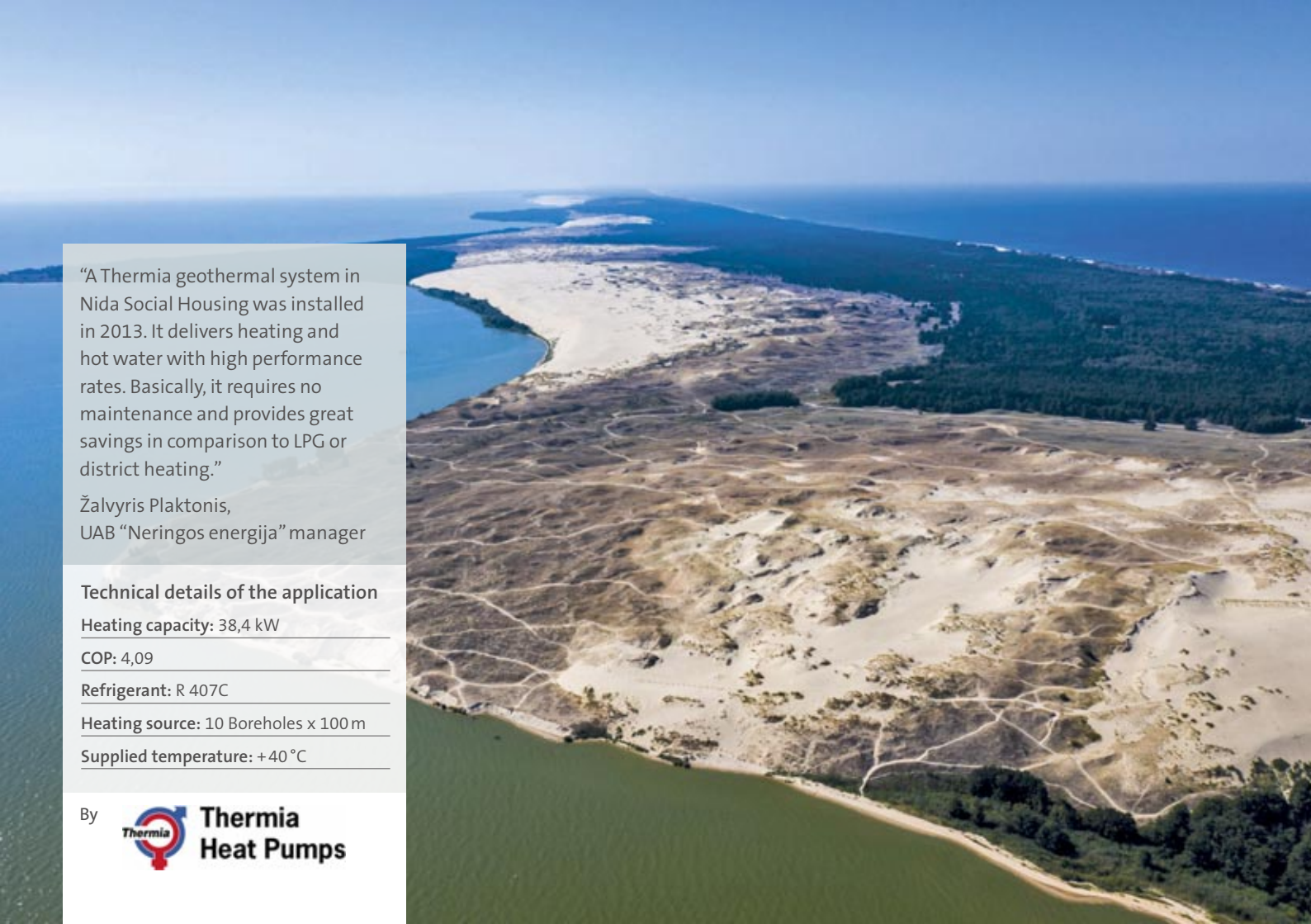
Scheme and the Government's Non-Domestic Renewable Heat Incentive (RHI) and securing Enfield Council quarterly payments for 20 years.

With typically two-thirds of the heating sourced from the ground, the borehole installations will provide an infrastructure which will deliver an affordable heat and hot water solution for the Enfield tower blocks for generations.

One of the great strengths of this system is its flexibility and scalability. Shared ground loop systems can feature in developments of just two properties (micro-district) while this project clearly demonstrates how the concept can be scaled up to much larger systems.

Project Accolades

- District Heating Project of the Year (H&V News Awards 2019)
- Featured in the Mayor of London's Climate Action Week program 2019



“A Thermia geothermal system in Nida Social Housing was installed in 2013. It delivers heating and hot water with high performance rates. Basically, it requires no maintenance and provides great savings in comparison to LPG or district heating.”

Žalvyris Plaktonis,
UAB “Neringos energija” manager

Technical details of the application

Heating capacity: 38,4 kW

COP: 4,09

Refrigerant: R 407C

Heating source: 10 Boreholes x 100 m

Supplied temperature: +40 °C

By



Thermia
Heat Pumps

Nida Social Housing benefits from a Thermia heat pump

Powered by green technology



Curonian Spit is a 97 km long and 0.4–4 km wide strip of land between the Baltic Sea and the Curonian Lagoon, which was formed more than 5000 years ago by sea waves and currents, sand and wind. The exceptional landscape of the Curonian Spit is the sloping sand dunes.

The flora of the Curonian Spit National Park consists of about 900 species of plants; there are about 40 species of mammals and 300 species of birds. It is a permanent habitat for woodpeckers, thrushes, skylarks, flycatchers. The most impressive bird species are grey herons, sea eagles and great cormorants.

Nida Social Housing is located in Nida, the administrative centre of the municipality, which is the westernmost point of Lithuania and has about 1200 permanent residents.

It is a complex of 5 houses with 25 family apartments. 4 of the apartments are for civil servants and the rest are for those Nida residents who are in need of social housing. The total heating area is 1250 m².

The choice to use Thermia ground-source heat pump to provide all the heating and hot water via geothermal energy was made and funded by the local municipality. The installer of the system is the local distributor of Thermia, UAB “Naujos Idejos”.

The use of heat pumps is an innovative and creative way of thinking green and will contribute to reducing CO₂ emissions in the years to come, achieving large cost savings.

Nida Social Housing project is a small example of how environment-friendly solutions can be used for heating in such a fragile environment. Nida belongs to UNESCO and its survival to the present date has been made possible only as a result of human efforts to combat the erosion of the Spit. The maximum goal would be to shift to renewable energy heating in all of the Peninsula.

Greater Manchester smart community demonstration project

The Greater Manchester Smart Community Demonstration Project was a collaborative project developed by the Greater Manchester Combined Authority (GMCA) and Japan's New Energy and Industrial Technology Development Organisation ("NEDO"), in collaboration with a range of partners, including three Greater Manchester Housing Associations, Hitachi Ltd, Daikin Industries Ltd, Mizuho Bank, Electricity Northwest and central Government (BEIS) – an example of a

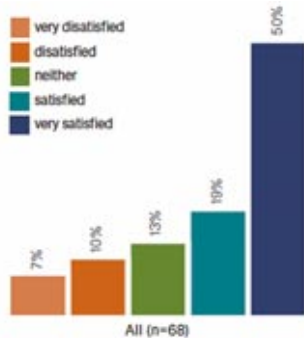
multi-national partnership project between government, industry and academia.

The rationale for the project was to develop and deliver a pilot within the social housing sector across Greater Manchester to trial the implementation and use of Air Source Heat Pumps (HP) at scale and test the effectiveness of Demand Response (DR)* in the social housing sector. The energy demand shift from one heat pump would have a

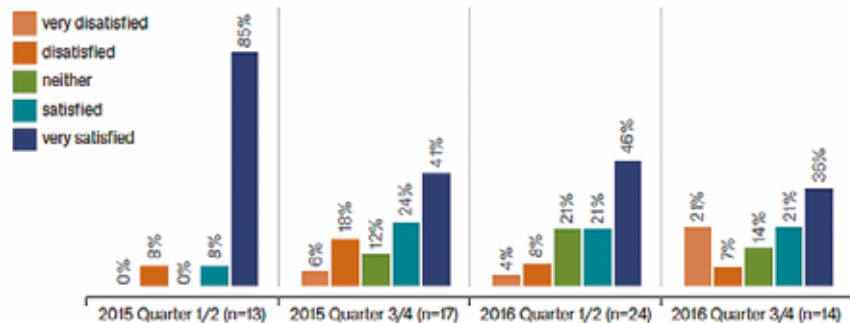
negligible impact on the energy system, compared to the impact of aggregating demand shift across multiple properties.

The demonstration comprised a large-scale field trial, replacing old inefficient heating systems in 550 social housing properties across Wigan, Bury and Manchester with a range of cutting-edge electrical and hybrid air-source heat pumps (HPs); developing an energy aggregation system and ICT platform

Reported overall satisfaction level with new heating system



Reported overall satisfaction vs date of installation



* Demand Response (DR) is about shifting consumer demand for electricity in real-time, through various methods, including financial incentives and behavioural change.

to control and coordinate the electricity usage of the HPs collectively; reducing electricity usage during peak periods, and testing the effectiveness of this reduction as a system to potentially trade in the electricity market. We believe that this project represents the largest field trial of aggregation of demand shift using heat pumps in Europe.

The project successfully demonstrated that a significant amount of energy could be saved through collective DR across a large number of social housing properties. Each DR activation resulted in accumulated energy demand reduction of between 50 kW and 320 kW depending primarily on the external temperature during the activation and the number of properties involved in each DR event. There is currently little evidence of heat pumps as a large scale retrofit DR solution. This demonstration project enabled the development of a further understanding of the challenges these systems present and some solutions to those challenges.



“I wanted my house to be always warm so I wasn’t prepared to sacrifice comfort for cost. I was shocked how much I have saved. I knew nothing about renewables or HP beforehand. Now I can tell all my neighbours, friends and family about them and their benefits.”

Technical details of the application

Number of heat pumps by Daikin: 540
117 Hybrids (5 kW, 8 kW – 32 kW boiler)
253 Splits (4 kW, 6 kW, 8 kW)
170 Monoblocs (5 kW, 7 kW)
Demand Response (DR) target: 200 kW

By



The Meridian Cove | Vancouver

Decentralized air-to-air heat pump without outdoor unit



Constructed in 1991, the Meridian Cove is an 11-store, 125 unit, concrete frame residential building in Vancouver's Fairview neighbourhood. Like many condos, the south and west facing units in particular require cooling during the summer; by contrast, the north and east facing units are hard to keep warm in the winter.

For this project, the ..2.0 was chosen; a combined air conditioning and heat pump unit that can cool rooms in the summer, heat them in the winter, and dehumidify all year round. The heat pump air conditioners are a unique through the wall product that functions without the need of an outdoor compressor unit, thereby saving money on installation costs. Mounted on an exterior wall, the INNOVA ..2.0 simply requires two duct holes of 162 mm each (6.4 in). To minimize their aesthetic appearance, the duct holes are disguised by vent covers that are

available in many different styles and colours to fit the building exterior.

For this type of installation, the following models have been chosen:

- ..2.0 + FCU with integrated fancoil
- ..2.0 Elec with integrated electric heater
- ..3.0 condensation vaporizer

The option ..2.0+FCU integrates into one single body both an air-conditioning system for summer cooling and winter heating, and a fancoil for winter heating with hot plant water. The option ..2.0 Elec includes an integrated electrical heater for colder climates or in applications where the floor area exceeds 700 m². In this version, the heat pump is integrated with a 1 kW electric resistance heater that intervenes automatically when outdoor temperatures are low.

THE PRODUCT

SIMPLE

No outdoor unit.

It can be easily installed even by inexperienced operators

SAFE

It uses low refrigerant quantity in an airtight circuit

EFFICIENT

DC Inverter compressor. It modulates the power to the real comfort needs, increasing the energy efficiency



QUIET OPERATION

Super silent speed 27dB(A)



EASY CONTROL

Touch screen display
Remote hand set
WIFI



With ..3.0 condensation vaporizer the water condensate is atomized by an innovative system using piezoelectric cells, and afterwards expelled by a microfan.

“The INNOVA equipment is certainly worth it. It is quiet and you can run it in cooling mode only, without using the compressor. Removing excess humidity from the air is another big advantage. There are few other options available that are so efficient and look good.”
Meridian Cove resident

Waterside holiday home is transformed by air-to-water upgrade

Re-thinking the heating in a sixteen-year-old German holiday cottage made it as thermally efficient as the most up-to-date new residential property



When Heiner Wockel got the rare opportunity to make a permanent residence in what was a holiday cottage in a quiet lakeside idyll, he was quickly reminded of the difference between the kind of home people tolerate while on vacation and a place people live in permanently.

The house, with commanding and uninterrupted views of the Lister Dam, needed major refurbishment to bring it up to the standard of a modern building. Wockel invested in new windows, floors, staircase and a brand new electrical system. But perhaps the most fundamental change was to the heating and hot water system.

Like many holiday properties, this one used out-dated and energy-guzzling electric storage heaters and vintage air conditioning. Switching to oil or gas was an option but would have meant not only unattractive boilers and pipes, but also sacrificing space in the garden for ugly fuel tanks.

The chosen solution was a very compact 7kW Vaillant aroTHERM Split air-to-



water heat pump, which provides 75% of the cottage's energy from the ambient air.

Outside the pump operates, even at full load, at a whisper-quiet 47 dB when measured 3 m away, which is no louder than a standard refrigerator. Inside, the indoor unit is fitted comfortably into a small 2 m² utility room, leaving space for a washing machine. Underfloor heating circuitry was milled into the existing floor and not only ensures an even distribution of heat but also doubles as a passive cooling system, eliminating the need for air conditioning.

Wockel calculates that the heat pump was no more expensive than a new oil or gas-fired condensing boiler.



“The ecological benefit of this heat source is priceless,” according to Heiner Wockel. “We obtain 75 percent of our energy from the ambient air, and only need to supply a quarter in the form of electricity as drive energy. And for this we will later install a photovoltaic system on the roof.”

Facts & Figures

Kind of object: One-family house

Heating System: 1 aroTHERM Split 7 kW
Wall-hung module MEH

Heating & cooling area: 140 m²

By



Single-family house renovation

Renovation with expansion of single-family house built in 1972 in Castelli Calepio (BG). Traditional structure of reinforced concrete and brick.

The building:

Originally a single apartment with 250 m² of ground floor and 200 m² of only partially livable garret. Since the requalification with enlargement, the owner has obtained two apartments with a gross area of 250 m² on the ground floor and of 225 m² on the first floor.

Insulation:

Wooden roof with 10 cm of wood insulation, and 10 cm of wood fiber insulation. Walls in porous brick with 12 cm of Polyurethane 120 foam coat. Aluminium frames with thermal break double glazed windows, with low emissivity film and sound film.

System:

The old boiler was replaced with a complete system that guarantees not only heating and hot domestic water production, but also cooling, summer dehumidification, air renewal and purification. The heat pump provides heating and hot domestic water production to the ground floor apartment, where radiators were maintained and an old air conditioning system was already present. On the first floor, the heat pump provides heating and cooling with radiant floor. The plant on the first floor is completed by Clivet's heat pump unit for air renewal and purification and summer dehumidification with thermodynamic heat recovery and electronic filtration. The entire system of the two apartments is managed by Clivet's management and control system.

By





Picture 1 & 2: Single-family house before and after requalification




Picture 3 & 4: Clivet heat pump installed in the technical room instead of old boiler and tank



Picture 5 & 6: Clivet air renewal and purification unit in false ceiling + supply air grille in the living area

Source: Clivet

A large, multi-story red brick building with a prominent corner tower and a balcony. The building features arched windows and a mix of red brick and light-colored stone or plaster. Two flags, the St. George's Cross and the Union Jack, are flying from the balcony. A person is walking on the sidewalk in front of the building, and a dark car is parked on the street. The sky is clear and blue.

„We are very satisfied with the Innova 2.0 units, both for their aesthetics, for their performance, and for their ease of control: in fact, thanks to the integrated touch screen controls, the air conditioners can be easily programmed by our guests.“

David Munson – director of the Whittlebury Hall Conference, Training Center and Hotel

By

 **innova**
renewing energies

Whittlebury Hall Hotel – Silverstone



Located near Silverstone, the prestigious Whittlebury Hall Conference, Training Center and Hotel offers its guest, in addition to 5 “Executive” suites, 50 “Club” rooms and 159 “Standard” rooms, ample space for leisure and a wide range of modern facilities for catering and for the management of corporate events, conferences, exhibitions and training courses.

On the occasion of its recent renovation, the design team chose to replace the heating system of the existing rooms with heat pump air conditioners without external unit ..2.0 of INNOVA. The heat pump air conditioners have been chosen for their great potential in upgrading the energy efficiency of existing buildings thanks to their simplicity of installation, the safety of the hermetic refrigeration circuit, the high energy savings, the significant improvement in real and perceived comfort and the integrated dehumidification and summer cooling functions. INNOVA 2.0, which brings together in one body (inside) the evaporating part and the condensing part, usually divided into two distinct units (one internal and one

external), is connected to the outside exclusively through two discrete holes of 162 mm in diameter. This way, it is allowed to fully comply with all the architectural and aesthetic requirements indicated by the Whittlebury Hall, such as the perfect cleaning of the facades, made possible also by the possibility of painting the external grids of the same dark red colour as the exposed bricks.

The INNOVA heat pump air conditioners without outdoor unit ..2.0 have proved to be very fast to install. This feature has allowed the installation of air conditioners during the day in the absence of guests, proving decisive to avoid inevitable “room down” that they would cause severe economic and image damage to the structure.

The Wi-Fi integrated in every single machine has allowed both to connect all the units without communication cables (ideal situation in such a complex redevelopment), and to manage all the machines directly from the reception thanks to a software developed by Innova specifically for the hotel industry.

Turning a family home into an energy-neutral home with Panasonic air-to-water

Sinne Technyk, installer, opts for Aquarea T-CAP heat pump combined with HIT KURO photovoltaic panels. With this combination, the household enjoys energy-neutral and free heating, as well as domestic hot water.

Technical details of the application

Heating capacity: 12 kW

COP: 4.74

Heating source: air-to-water

By

Panasonic

Sinne Technyk recently installed Panasonic heat pump and photovoltaic panels in a house in Oudemirdum in Friesland, the Netherlands. Due to this combination, the owners now have an energy-neutral home and benefit from a more comfortable indoor climate.

The house has a surface of 14 by 10 meters with an annual gas consumption of 1800 to 2200 cubic meters per year. “The owners of this house have asked us to make it more sustainable. The aim was to realize an energy-neutral home and reduce the usage of gas to zero,” explains Leo van der Molen of Sinne Technyk. “That makes a heat pump an interesting option.”

With the comfort of the customers and neighbours in mind, a silent Aquarea T-CAP heat pump was chosen. “The Aquarea T-CAP is a very quiet unit by itself. The heat pump is equipped with three silent modes, with which the noise production can be further reduced during the night, for example.

Another important argument is the ease of use. Due to a touchscreen, the Panasonic heat pumps are very user-friendly,” says Van der Molen.

The Aquarea T-CAP is powered by solar panels. A total of 24 Panasonic HIT KURO solar panels of 325Wp each were installed in combination with a SolarEdge inverter equipped with optimizers. “We believe that these are the best quality solar panels currently available on the market. Thanks to their high efficiency per m², the panels provide the largest amount of power and also have a long lifespan.”

Just like in this case, we have advised Panasonic products. “Our experience is that the customer likes to opt for quality and prefers to pay a bit more for a high-quality solar panel or heat pump,” says Van der Molen. “The products of Panasonic are high end but offer a higher quality than other solutions. The price-quality ratio is, therefore, considerably better.”

Picture 1: Sinne Technyk installed Panasonic solar panels and heat pump in a house in Oudemirdum in Friesland, the Netherlands.


Picture 2: The Aquarea T-CAP indoor unit. (Picture at the bottom)

Picture 3: The Aquarea T-CAP outdoor unit (Picture on the top)

Source: Panasonic, Sinne Technyk

“The aim was to realize an energy-neutral home and reduce the usage of gas to zero.”
Leo van der Molen, Sinne Technyk





“By opting for a total solution, we can achieve low energy consumption. In this project, we opted for an LG R32 Monobloc. Besides, LG’s Monobloc has interesting subsidy benefits for the end-user of the building,”
Martin van der Voort,
Key Account Manager
at Centercon

By



“All-in-one” solution for heating, cooling and hot water in BREEAM certified new office buildings in the port of Amsterdam



Picture 1 (left): Charging area in the warehouse, subject to temperature control

Picture 2 (above): Roof of the office space equipped with the LG air to water heat pump and LG PV panels

Source: LG

The upgrade of heating and cooling systems has been identified as a top priority to achieve the European climate and energy goals. It also offers a major opportunity to improve the indoor air quality in buildings which has a major impact on the well-being and the productivity of people living and working in buildings. The BREEAM certification is one of the leading sustainability assessment methods for master-planning projects, infrastructure and buildings. It recognises and reflects the value in higher performing assets across the built environment's lifecycle, including the measurable energy consumption in the building.

SUSTAINABLE COOLING SOLUTION:

- Four business units of offices spread over three floors in the distribution centre DCAM Amsterdam Park in the Port of Amsterdam.
- Full integration of cooling and heating with a monobloc air to water heat pump running with R-32 refrigerant and indoor climate systems in the form of underfloor heating and fan coils units. Coupled with a heat recovery system to recover the heat from the cooling system to provide hot water.

- Controlled by the Center Smart Energy Controller, a building automation system that allows for remote monitoring of temperature and power and gives the user insight into energy consumption.

BENEFITS:

- The combination of system integration and energy-saving sustainable solutions ultimately led to the BREEAM certification, recognizing the building's climate-friendly performance.
- The “all-in-one” solution providing heating, cooling and hot water makes sure that the big heating and cooling loads in the building are met under all circumstances with minimal energy consumption.
- The air to water heat pump technology used for cooling, heating and hot water supply benefits from the Dutch government's subsidy for energy-efficient heating and cooling technologies. The end-user, therefore, sees the total cost of ownership reduced right from the start and throughout the system's lifecycle thanks to reduced energy bills.

Renovation of the historical palace in Chorzów with heat pumps – Heat4Cool project

Integrating advanced technologies for heating and cooling at building and district level

The EU funded Heat4Cool project proposes innovative, efficient and cost-effective heating and cooling solutions to optimize the integration of six technologies (adsorption heat pump, PCM storage batteries, SCI-BEMS, Solar PV, Solar thermal, heat recovery from sewage water) at building and district level, to meet net-zero energy standards.

The project will showcase four different retrofitting solutions, three of them will be focusing on residential buildings where the new innovative systems will be monitored and controlled through the SCI-BEMS (self-correcting intelligent building energy

management system). The SCI-BEMS will take into account weather forecast, energy demand and will be able to interact with the end-user allowing him/her to identify and maintain the best comfort conditions, as well as remotely control the HVAC system.

One of the case studies is the historic residential pilot site in Chorzow (Poland), composed of 12 apartments. The main sources of heat for space heating and DHW are the natural gas boilers, while space cooling is not required.

As part of the retrofitting project, a direct current driven heat pump with 30 kW

heating capacity and integrating a 36 kWh PCM storage, 8 PCM storage batteries for a total thermal storage of 96 kWh, (four new boilers, 41 radiators all connected to the new heating system) and 43 solar PV modules for a total peak capacity of 14.19 kWp have been installed and integrated into the heating system.



The Project has received funding from the European Union's Horizon 2020 program for energy efficiency and innovation action under agreement No. 723925.



Picture 1 (above):
Historical façade of the Polish demo site

Picture 2 (below):
DC heat pump installed in Chorzow

Picture 3 (right): PV modules installed on the roof
Source: Heat4Cool project



Technical details of the application

Heating capacity: 30 kW

COP: 4,34 at A7 W35

Refrigerant: R134a

Heating source: air to water

Supplied temperature: 55 °C

By



Technical details of the application

Heating capacity: up to 50 kW

Cooling capacity: up to 40 kW

COP: hot 3,3 – cold 2,7 – combined 6

Refrigerant: CO₂ (R744)

Heating source: Electricity

Supplied temperature: up to 150 °C

By



Single house refurbishment with heat pumps and solar thermal – Sunhorizon project

Sun coupled innovative heat pumps, efficient solutions for residential and tertiary buildings

The EU funded SunHorizon project aims to develop heat pump solutions (thermal compression, adsorption, reversible) that will act properly coupled with advanced solar panels (PV, thermal, hybrid) providing heating and cooling for residential and tertiary buildings. During the project five technology packages (TP) will be designed and demonstrated in eight different demos across EU climates (Germany, Spain, Belgium, Latvia) in small and large scale buildings. Moreover, a cloud-based monitoring platform will be realized for the development of data driven algorithms and tools for predictive maintenance and optimize the TP's management.

One of the demo sites is situated in Berlin. It is a residential building with two apartments located in the town center. Currently, the heat demand of the building is covered by standard gas boilers for the DHW and trough radiators for the space heating.



Picture 1: Façade of demo site.

Picture 2: BoostHeat thermal compression heat pump

Picture 3: TVP Solar vacuum solar thermal panels

Source: SunHorizon project

During SunHorizon project, a technology package composed by 20 kW thermal compression heat pump and 14 m² high vacuum solar thermal panels, properly connected with a 2 m³ stratified thermal storage, will be installed to cover the whole heating demand with an estimated primary energy savings of 70%. The main schematics highlights are:

- Parallel operation of solar panels and heat pump.
- Possible direct use of solar heat at high temperature on the cold return line from the radiator space heating circuit.
- DHW solar preheating from accumulated solar heat in the thermal storage.
- Use of only one outdoor fan coil (instead of two) to operate the heat pump unit during the heating season and to dissipate excess heat from the solar collector.

At this stage no results are available. The TP will be tested firstly in laboratory and then installed in September 2021 for one-year monitoring.



This Project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement N. 818329

Energy from the River Elbe

Two German musicians rely on a unique energy system from Buderus that extracts thermal energy from the river for their houseboat.



Fynn Kliemann is a very well-known German musician, web designer, YouTube do-it-yourselfer and all-round talent with many ideas. In 2018, Kliemann had the idea to buy a former GDR workers' boat together with singer-songwriter Olli Schulz from Berlin. The old houseboat once belonged to the late German singer Gunter Gabriel and had to be modernised from scratch – an 18-month project that has been documented in a Netflix series.

The old oil boilers of the workers' boat had to make way for the new Logatherm WPS 8-1 brine/water heat pump. Normally, brine/water heat pumps extract environmental

energy from the ground. Via the heat pump's refrigerant circuit, the heating system of the houseboat is energetically connected to the River Elbe as a heat source. This individually projected brine/water heat exchanger is located directly in the Elbe stream. The ingenious system can generate thermal energy for the heating system of the houseboat even from cold river water.

A well-insulated buffer storage tank stores the heat and transfers it to the underfloor heating system when required. Additional benefit for the environment: the brine/water heat pump uses, among other things, the electricity generated by the photovoltaic

system of the houseboat for its operation. The two artists use their boat as a creative studio for music recordings. During the planning phase, the focus was on making the best possible use of the available space. The owners benefit from the small footprint of the heat pump. The biggest challenge on Kliemann and Schulz's houseboat is that it has a sound-conducting steel construction. The Logatherm WPS 8-1 is, however, optimally sound-decoupled from the ground. Thanks to Buderus' modern heat pump technology and system expertise, the artists are no longer reliant on fossil fuels such as oil and can expect excellent efficiency values and maximum carbon savings.



Picture 1: The modernised houseboat in Hamburg-Harburg harbour, Germany.
Picture 2: The efficient Logatherm WPS 8-1 brine/water heat pump from Buderus.
Picture 3: View into the stylish studio that is pleasantly warmed by underfloor heating.
Picture 4: The heart of the houseboat's energy technology: the heat exchanger during installation on the dry dock.
Source: Buderus

Facts & Figures

Kind of object: Houseboat

Heating System: Logatherm WPS 8-1 brine/water heat pump that extracts thermal energy from the river water.

Heating capacity: 10.4 kW

Year of installation: 2020

COP: 4.7

Refrigerant: 410A

Heating source: River water

Supplied temperature: Max. 62 °C

Measurements: 180 x 60 x 64.5 cm

By



Hybrid heating today, benefit tomorrow

In Germany, the Nitschke family has opted for a hybrid heating system consisting of an oil condensing boiler and an air/water heat pump from Buderus.

“The emission-free and efficient operation of this heat pump convinced me, as it was my goal to have a modernised heating system which reduces the use of fossil fuels. In retrospect, the relation between the investment cost and the benefit of our new hybrid system is excellent. It represents the state of the art, is efficient and environmentally friendly.”

Dirk Nitschke, system operator

When a new heating system is to be installed in a house, the question is which energy source to use – fossil or renewable? Combining several heat generators, hybrid systems offer the benefits of different technologies – they are comfortable, energy-efficient, forward-looking, and eligible for subsidies. These qualities convinced the Nitschke family from Krefeld, a German city on the River Rhine. A hybrid system consisting of the existing oil condensing boiler and a new, modern air/water heat pump from Buderus reliably heats their 120-year-old multi-generational home.

In 2015, Dirk Nitschke added a 120-square-metre bungalow designed to meet the needs of the elderly to their multi-storey old building. For environmental and economic reasons, father Dirk Nitschke decided, in 2020, to combine the oil condensing boiler with a Logatherm WLW 196i-8 AR heat pump. The boiler room, which can be accessed by both parties living in the house, is well equipped:

- Modern indoor unit of the Logatherm WLW 196i-8 AR air/water heat pump
- Proven Buderus GB135 oil condensing boiler
- Logalux SM400 buffer storage tank as the ideal component for renewable or hybrid heating systems
- MM100 heating circuit module for convenient system expansion
- RC310 system operating unit centrally manages all parts of the hybrid heating system and coordinates heat generator, heating circuits, hot water and circulation.

The German government is also increasingly focusing on renewable energy sources and supports the installation of efficient heat pumps. This way, hybrid heating modernisation pays off not only environmentally but also financially. The Nitschkes applied for a subsidy even before the renovation work began and thus had 35 percent of the costs subsidised. Thanks to system technology from Buderus, the Nitschke family consumes only the amount of energy that is needed, leaving young and old with a good feeling regarding sustainability.



Picture 1: The Nitschke family lives on a plot of about 1400 square metres with a terrace and garden in the German city of Krefeld.

Picture 2: Well planned and even better equipped: The boiler room with (from left) hot water tank, oil condensing boiler, buffer storage tank, system controller and air/water heat pump from Buderus

Picture 3: The outdoor unit of the WLW 196i-8 in Dirk Nitschke's garden

Source: Buderus

Facts & Figures

Kind of object: Extended multi-generational house

Heating System: Hybrid system consisting of existing Buderus GB135 oil condensing boiler and new Logatherm WLW 196i-8 AR air/water heat pump.

Heating area: 230 square metres (2 residential units)

Heating capacity: 10.7 kW

Sound power level, outdoors: 53 dB(A)

Year of installation: 2020

COP: 4.29

Refrigerant: 410A

Heating source: Ambient air

Supplied temperature: Max. 62 °C



By



Facts & Figures

Kind of building: Lodge (Hotel, Guest house)

Heating system: Bosch Supraeco T 480-2, Geothermal heat pumps with 11 boreholes of total 2700meter.

Heating area: 2100 m2 living space + 400m2 storage space

Cooling area: no cooling today because the arctic area means short and warm summers. The Hotel's focus is on winter tourism

Heating capacity: 200kw = 96kw Heat pump capacity + 100kw electrical heating module for peaks and safety reasons.

Energy costs savings: 250 000kwh / yearly savings

CO2 Savings: hard to calculate due to mix in Swedish el nuclear, water based electrical, wind + imported el. Before the Hotel used solid fuel wood + electricity.

Year of installation: 2017

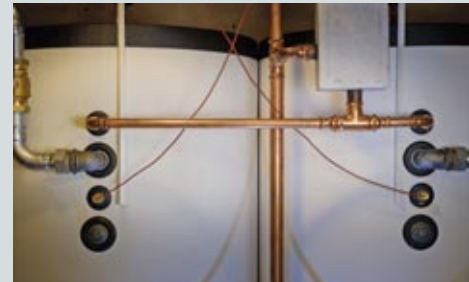
COP: seasonal performance COP 4,5 in the winter SCOP 3,5 - 4,4 depending on year a lot of warm water to the spa

Refrigerant: 410 A

Heating source: Geothermal heat pumps Liquid water heat pump with

Supplied temperature: 55 degrees

By  **BOSCH**



A cosy atmosphere at 40 degrees below zero

Two Supraeco T 480-2 geothermal heat pumps from Bosch cover the complete hot water and heat requirements of a unique holiday resort north of the Arctic Circle.

Picture 1: Two brine heat pumps from Bosch cover the complete hot water and heat requirements of the Arctic River Lodge in Sweden, north of the Arctic Circle, where outside temperatures can be 40 degrees below zero.

Picture 2: A Bosch heating system serves as the new energy source of the Arctic River Lodge. Characterised by a simple, futuristic design, it comprises two cascaded Supraeco T 480-2 geothermal heat pumps.

Picture 3: Two Bosch hot water storage tanks with a capacity of 750 litres each supply all rooms and facilities of the Lodge with sufficient hot water.

Source: Bosch

The refurbishment of a former settlement for forest workers in Tärendö, Sweden, has resulted in a unique holiday resort—the Arctic River Lodge.

People come here to explore the north and enjoy activities like sleigh rides with huskies and watching the northern lights. All this in an area where temperatures can drop as low as 40 degrees below zero. The guests are happy to return to the cosiness and comfort of the Lodge, where two Supraeco T 480-2 geothermal heat pumps from Bosch meet the highest demands in terms of energy efficiency and environmental protection.

For almost 47 years an inefficient and expensive old wood-burning plant was used to heat the settlement's buildings with a total size of 7000 square metres.

Together with Bosch Sales Manager Petter Karlberg, Installer Daniel Kuoppala calculated that two Bosch Supraeco T would be the optimal choice for the basic heat in terms of price, energy efficiency and sustainability at the planned place of installation, which is characterised by very low outside temperatures.

“The system owes its high efficiency to the fact that it operates in accordance with actual requirements. Depending on the time of year, only a single compressor is needed,” emphasises Kuoppala.

The two 48-kW pumps with two scroll compressors each, both being activated depending on actual energy requirements, deliver the energy either straight to the system or to one of the two Bosch hot water storage tanks (750 litres each).

FACTS:

- very low sound levels (52/54 decibels)
- reduced heating costs (from 50 to 80 percent)
- remarkable return on investment now ten years (calculated 12-13 years)
- last year's saving of 248,000 kwh, while consumption totalled 48,000 kwh

Tärendö is a good example of how Sweden is becoming a highly innovative nation. The cooperation with Bosch makes it possible to come up with new ideas and creative solutions in the energy sector – an ideal starting point for technologies for the future and innovative energy concepts.



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