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Current developments and examples of sustainable energy technologies

klima+ energie fonds

Federal Ministry
Republic of Austria
Climate Action, Environment, Energy, Mobility, Innovation and Technology

# Renewable Heating and Cooling

## Innovative technologies and concepts for sustainable heating and cooling

The heating sector is of extreme importance for the energy transition as approximately half of the final energy consumption in Austria can be attributed to the generation of heat. 40 % of this consists of space heating and domestic hot water generation. The efficient cooling of buildings is also becoming an increasingly important topic. There is high potential in the building sector to improve energy efficiency by utilising new technologies and switching to renewable energy sources for heating purposes.

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# Climate-neutral heat supply

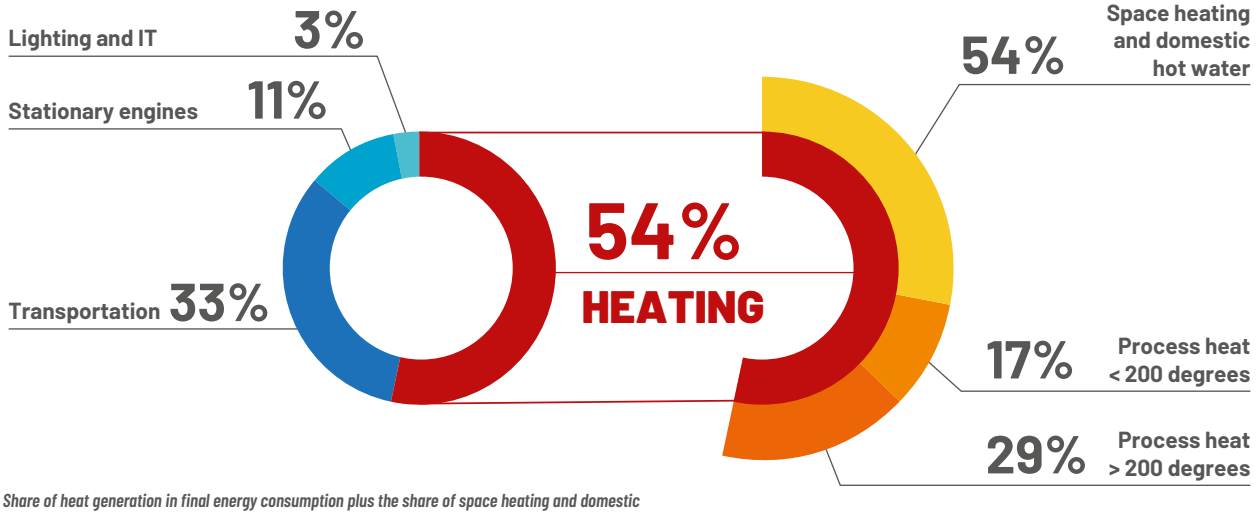
## The key to the energy transition

The impacts of the climate crises and the current geopolitical and energy policy challenges clearly show that the decarbonisation of all sectors of the economy must be accomplished as rapidly as possible. Achieving climate neutrality and a sustainable energy supply requires reduced energy consumption across all economic sectors, significant improvements in energy efficiency and a transition to an energy system based on renewable energy sources. The heating sector is of tremendous importance for the energy transition. The generation of heat accounts for roughly 54% of final energy consumption in Austria. This is largely split between households and industrial production at 40% each, with the service and agricultural sector accounting for the remaining consumption.

The share of space heating and domestic hot water generation in the heating market also makes up around 54%. While low temperatures are required in these applications, many forms of industrial production feature a high demand for process heat at several hundred degrees Celsius. Collectively across all sectors, one third of heat is generated with natural gas, followed by 29 % with renewable energy sources. At 14%, electricity accounts for only a small portion of the heating sector. However, the share of natural gas in heating supply varies significantly between the individual sectors (industry 49 % and households 24 % in 2019).[1]

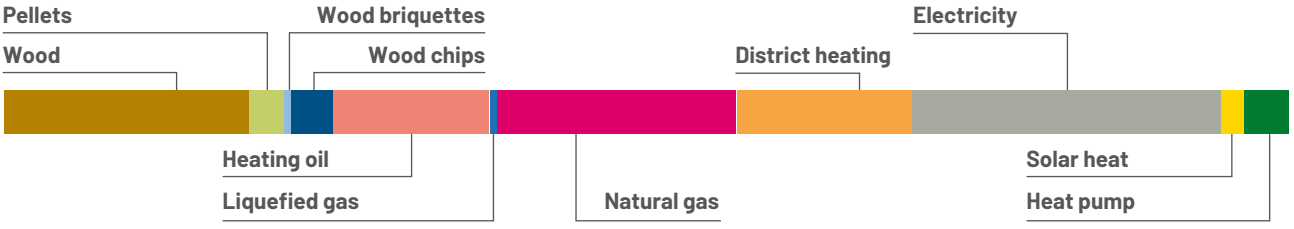
Decarbonisation of industrial production is a major challenge. This calls for entirely new processes, some of which are only just being developed. New technologies are available for climate-neutral heating of buildings based on renewable energy sources. These must be implemented as rapidly as possible in combination with measures to reduce energy consumption and increase energy efficiency.

The total energy use of Austrian households in 2019/2020 amounted to 284,871 TJ, of which space heating accounts for 200,314 TJ and electricity consumption for 69,211 TJ.[2] Just 34 % of the energy used for space heating and domestic hot water generation comes from renewable sources.[3]




*Share of heat generation in final energy consumption plus the share of space heating and domestic hot water, process heat > 200 degrees, process heat < 200 degrees, graphic: Waldhör KG, data source: Statistics Austria, useful energy analysis*

*All photos: stock.adobe.com*




*Energy consumption of households and energy sources 2019/2020 (black coal, brown coal, brown coal briquettes and coke below the depiction threshold), graphic: Waldhör KG, data source: Statistics Austria*

## CLIMATE-FRIENDLY BUILDINGS

With new builds or the renovation of existing buildings, it is necessary to further reduce energy consumption for heating and cooling with suitable measures while at the same time switching to climate-friendly energy supply based on the use of new, clean technologies for heating, hot water and cooling. With rising temperatures energy-efficient air conditioning of buildings will have an increasingly important role to play.

Coupled with a corresponding reduction in energy consumption, switching to renewable energy sources for heating buildings with biomass technologies, direct use of solar energy, geothermal energy and ambient heat offers a path to a sustainable, climate-neutral heating sector.

One key aspect – especially in urban areas – is the expansion of district heating. Here the goal is to rapidly increase the share of renewable energy carriers, which is currently at around 50% for local and district heating in Austria, and to integrate new heat sources such as waste heat, heat pumps, geothermal energy, solar heat and biomass.[4]

The heating transition must be understood as part of the transformation of the entire energy system. It is not about merely replacing individual technologies – the entire structure of energy supply must be transformed, by means of digitalisation, decentralisation and democratisation. The fluctuating availability of energy from renewable sources and the large number of small, distributed energy producers require a more flexible energy system. The changes, however, will not be limited to infrastructure and technology, but will also affect the way buildings are used. Furthermore, users will also play a vital role in the future by actively participating in the energy system with new, digital applications.

In this edition, we present national research and development projects that are bringing us closer to achieving a sustainable heating supply. We also report on Austria's participation in the activities of the International Energy Agency (IEA) on this topic (see page 9).

[1] Figures for the Austrian heating market, Austrian Energy Agency, 2021
positionen.wienenergie.at/wp-content/uploads/2022/03/20210118_AEA_Erneuerbare_Waerme_Lechner.pdf

[2] Statistics Austria, energy consumption of households by energy carriers and by purpose and useful energy analysis
statistik.at/en/statistics/energy-and-environment/energy/energy-consumption-of-households,
statistik.at/en/statistics/energy-and-environment/energy/useful-energy-analysis

[3] Energy in Austria, figures, data, facts, BMK, 2021
nachhaltigwirtschaften.at/resources/nw_pdf/Energie_in_OE2021_UA.pdf

[4] bmk.gv.at/themen/energie/energieversorgung/fernwaerme.html

# THERMAFLEX

## Flagship project for more flexible heating networks

*Large solar thermal plant in Mürzzuschlag, photo: SOLID Solar Energy Systems GmbH*

*Absorption heat pump in Hallein, photo: Climate and Energy Fund/Krobath*

District heating systems are an environmentally friendly and convenient way to provide energy for heating and hot water. They also play a central role in Austria's energy supply. Currently, 27 % of Austrian households are heated with district heating, and this figure is predicted to increase further. The total pipe length of the district heating networks of Austria's heating supply companies increased from 4,100 km in 2010 to roughly 5,600 km in 2020. A network length of 6,500 km is forecast for 2030.[1]

To quickly increase the share of renewable energy in the supply of district heating from the current level of roughly 50 %, it is necessary to make use of various local and sustainable heat sources. Alongside biomass, other new heat sources to be used include waste heat, deep geothermal energy, large heat pumps, solar thermal energy and power-to-heat.

The flagship project ThermaFLEX, led by AEE INTEC in cooperation with an interdisciplinary team of 28 project partners[2], is working on exactly this. The project focuses on developing and demonstrating how heating networks can be made more flexible and efficient in order to cope with not using fossil fuels in the future. Demonstration projects with scientific support are being implemented at various locations in Austria for this purpose.

### HIGHER FLEXIBILITY IN THE DISTRICT HEATING SECTOR

District heating networks are currently supplied centrally by just a few generation plants. The switch to renewable, locally available energy sources will require a more distributed approach with many generating facilities and higher system complexity. To ensure a reliable energy supply, the fluctuating availability of energy from renewable sources must be integrated into the system as a whole, and the fluctuations must be balanced out. This requires flexible options and an intelligent interplay of technical and non-technical elements. Topics of great importance here include energy storage systems, the coupling of different energy sectors, intelligent regulation and control concepts as well as the inclusion of users and relevant stakeholders. Integrated planning, implementation and operational management processes are required in parallel with these efforts, such as new approaches to spatial energy planning or life-cycle analysis.

### THERMAFLEX SUPPORTS THE TRANSFORMATION PROCESS

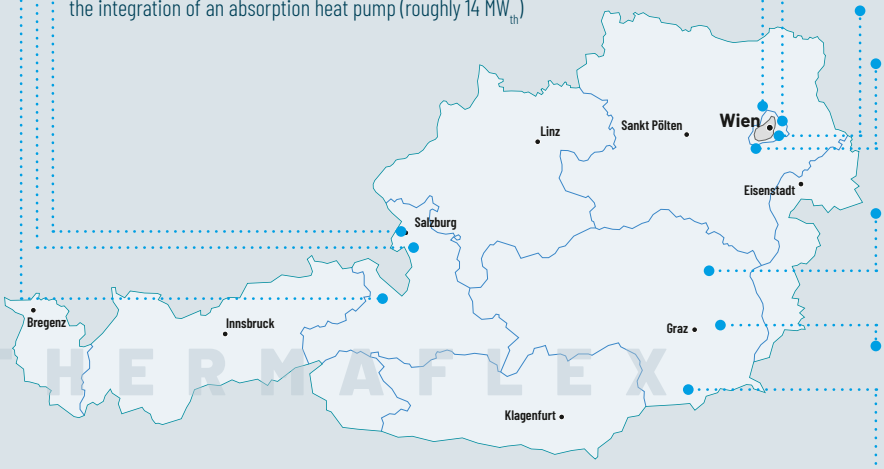
As part of the flagship project, technical, non-technical and systemic measures to make heating networks more flexible are considered in combination and implemented in demonstration projects. The focus was placed on 10 locations in small, medium and large district heating supply regions across Styria, Salzburg and Vienna, which all make use of a wide range of different measures, heat sources and flexibility approaches. The project results show that large-scale technical implementations are possible even within a relatively short time.

[1] bmk.gv.at/themen/energie/energieversorgung/fernwaerme.html, gaswaerme.at/media/medialibrary/2021/09/zasp21_hi.pdf

**Modernisation concept and heat pump integration in Saalfelden**
(see p. 7)

**Use of industrial waste heat in Hallein and the Salzburg eco-energy park**
Concept development for absorption heat pumps (HP) at industrial scale

**Large solar thermal plant in Salzburg (Big Solar Salzburg)**
Concept for a large solar thermal installation (roughly 30,000 $m^2$ of collector area), a large water-based thermal storage system (roughly 20,000 $m^3$) and the integration of an absorption heat pump (roughly 14 $MW_{th}$)




**High-temperature heat pump at Wien-Spittelau**
Use of waste heat from flue gas condensation at the waste incineration plant as a heat source for a high-temperature heat pump (16 $MW_{th}$)

**Renewable heating and cooling from waste water – Wien Kanal**
Energetic use of waste water for heating and cooling, with an innovative heat exchanger and heat pump system

**Use of waste heat by Therme Wien** (see p. 6)

**Heat from waste water at Wien-Liesing**
Use of waste water directly from the sewer as a heat source for a 2 $MW_{th}$ heat pump and feeding into the secondary district heating network of Vienna

**Large solar thermal plant in Mürzzuschlag**
Integration of a roughly 5,000 $m^2$ solar thermal installation into the heating network in combination with a 180 $m^3$ storage system

**Virtual heating plant Gleisdorf**
Coupling of district heating with the municipal waste water treatment plant and use of a new control concept (virtual heating plant)

**100% renewable district heating for Leibnitz**
Use of fluctuating waste heat (maximum of 4 $MW_{th}$) from a industrial plant and bidirectional coupling of two district heating networks

The entire process from problem identification, concept development and detailed planning to implementation, data monitoring and optimisation efforts was accompanied by detailed scientific analysis. Holistic system analysis and life-cycle analysis techniques that take the entire value chain into consideration were used to evaluate the results. Roll-out scenarios were developed in order to demonstrate the potential for scalability and widespread implementation. Many new insights were gained in the process, which can be put to use in all areas of the district heating supply sector. Important future research topics include long-term storage systems, the phasing out of large gas-powered combined heat and power plants and further digitalisation.

thermaflex.greenenergylab.at

*Biomass heating plant in Saalfelden, photo: Climate and Energy Fund/Krobath*

*Photo: Salzburg AG*

**“Salzburg AG is committed to decarbonisation and ensuring that our district heating plants are ready for the future – aspects that are now receiving increased attention. The questions investigated within the ThermaFLEX project are key factors for achieving this goal. The concepts and know-how from ThermaFLEX will allow us to transfer the results to our district heating systems in order to guarantee a safe, sustainable and cost-efficient heat supply for our private and industrial customers.”**

THOMAS HERBST, HEAD OF DISTRICT HEATING AND ENERGY SYSTEMS
SALZBURG AG FÜR ENERGIE, VERKEHR UND TELEKOMMUNIKATION

[2] **PROJECT PARTNERS:**
Research institutions:
AEE INTEC (project management), AIT Austrian Institute of Technology GmbH, BEST - Bioenergy and Sustainable Technologies GmbH, FH Joanneum Gesellschaft mbH, JOANNEUM RESEARCH Forschungsgesellschaft mbH, SIR Salzburger Institute for Regional Planning and Housing, StadtLABOR - Innovationen für urbane Lebensqualität GmbH, TU Wien/Energy Economics Group, TU Graz/Institute of Thermal Engineering

Energy suppliers & infrastructure operators:
Abwasserverband Gleisdorfer Becken, Energie Steiermark AG, Feistritzwerke-STEWEAG-GmbH, Haselbacher Nahwärme, Salzburg AG für Energie, Verkehr und Telekommunikation, Stadtwerke Gleisdorf GmbH, Wien Energie GmbH

Know-how and technology providers:
ALOIS HASELBACHER GmbH Haustechnik, ENAS Energietechnik und Anlagenbau GmbH, FRIGOPOL Kälteanlagen GmbH, Green Tech Cluster Styria GmbH, GREENoneTEC Solarindustrie GmbH, Horn Consult, Pink GmbH, Rabmer GreenTech GmbH, ROTREAT Abwasserreinigung GmbH, Schneid Gesellschaft m.b.H., STM Schweißtechnik Meitz e.U., SOLID Solar Energy Systems GmbH

**The lead project ThermaFLEX is being carried out under the “Green Energy Lab” research initiative as part of the innovation offensive "Vorzeigeregion Energie". www.greenenergylab.at**

# Heat from the thermal baths
## Use of waste heat in Vienna's district heating network

**Over 440,000 households and 7,800 business customers in Vienna are currently connected to the district heating network. In the future, Wien Energie would like to supply 56 % of all Vienna's households with district heating. By 2040, all heat generated should be climate neutral. This can only be accomplished by making use of new sources of heat. In addition to tapping into deep geothermal energy, more heat should be generated in future using large heat pumps and local use of waste heat like at Therme Wien.**


*Heat pump at Therme Wien, photo: Wien Energie/Max Kropitz*

*Photo: Therme Wien*

## THERMAFLEX DEMO PROJECT

The integration of local waste heat from various sources can make an important contribution to the decarbonisation of heating networks. In future, Wien Energie would like to utilise the thermal water from Therme Wien to supply heat to roughly 1,900 households in Vienna. Waste heat energy from the thermal water, which has previously been discharged into the canal unutilised, will become an environmentally friendly source of heat for Vienna's Oberlaa district. This will mean a saving of about 2,600 tonnes of $CO_2$ per year.

### INNOVATIVE CONCEPT

After the thermal water has been used internally by Therme Wien, the remaining heat present in the water (at a temperature level of about 30 °C) will serve as a new heat source for Vienna's district heating network. For this purpose, Wien Energie installed two identical water-cooled compact heat pumps in the technical room at the thermal baths. These are designed to feed about 2.2 MW of heat into the local district heating network year-round.

As part of the ThermaFLEX lead project, the energy system at Therme Wien was analysed with extensive investigation of specific aspects of the heat source, such as availability, temperature level and chemical properties.

Due to fluctuations in temperature and mass flow of the heat source, hydraulic switches were integrated into the concept on the cold side of the large heat pumps. Plate heat exchangers made of titanium were used due to the corrosive properties of the thermal water.

The heat pumps are designed for a maximum output temperature of 82 °C. An additional power-to-heat plant with 375 $kW_{th}$ thermal output raises the temperature to 90 °C when the outside temperature is below -5 °C.

The project serves as an example for similar configurations to make use of new sources of waste heat. System monitoring will also be carried out over the remaining term of the ThermaFLEX project to generate valuable insights for future projects.

thermaflex.greenenergylab.at/e4a_demonstrator/waste-heat-utilisation-spa-vienna/?lang=en

**DATA:** Output: around 2 megawatts
Annual heat production: 11 gigawatt-hours of heat
Environmentally friendly district heating for roughly 1,900 households in Oberlaa
$CO_2$ savings: 2,600 tonnes per year
Investment: EUR 3 million

THERMAFLEX DEMO PROJECT

*Biomass heating plant in Saalfelden, photo: Climate and Energy Fund/Krobath*

# District heating in Saalfelden
## Modernisation of the biomass heating plant

**The modernisation led to an increase in the energy efficiency of the biomass boiler system and a significant reduction of fossil fuels in the energy mix. The share of fossil gas was reduced from an annual average of 11.3 % in 2019 to 3.7 % in 2021. This means a substitution of roughly 920 MWh of gas and $CO_2$ savings of around 230 tonnes. At the same time, the heat production was increased by more than 1.8 GWh.**

Biomass-based district heating networks are an important part of a sustainable heat supply. Around 2,400 biomass heating plants are currently operating in Austria[1]. However, many heating networks of the first and second generation now require upgrading or modernisation in order to comply with future technical, economic and regulatory requirements. A 2-stage modernisation process was developed within the framework of ThemaFLEX for the Saalfelden biomass heating network operated by Salzburg AG. The 5.3 km long district heating network supplied roughly 50 consumers in the year 2019 (prior to modernisation), and the annual heat production was around 13.1 GWh. The heat is primarily generated by a biomass boiler with a rated output of 2.5 MW plus an economiser (0.3 MW). For peak loads and as a reserve in case of outages, the system includes a gas boiler (5 MW), a power-to-heat system and another remote gas boiler system at the local primary school.

### TECHNICAL REFURBISHMENT

The goal of the project was to increase the share of renewable energy sources used in the heating network, while also improving the efficiency of the existing systems. This was accomplished by implementing various technical optimisations at the heating plant. These included modifications of the biomass boiler system and hydraulics, installing flue gas recovery systems, implementing a flue gas cleaning system (e-filter) as well as increasing the output of the flue gas condensation (from 300 kW to 550 kW), replacing the control systems and implementing a thermal storage system with a volume of 150 $m^3$.

### INTEGRATION OF NEW HEAT SOURCES

The potential for integrating alternative heat sources and making use of waste heat from low-temperature sources was also investigated, and a technical concept was developed for the integration of a heat pump. Alongside the dimensioning of the heat pump, the hydraulic integration also plays an important role. Two different variants were evaluated: integration of the heat pump into the thermal storage as well as integration into the biomass boiler return line. The second variant was recommended for the detailed planning.

The simulations and calculations show that the integration of the heat pump results in a further increase in output and efficiency. The additional output capacity for the network expansion lies in the range of 1.5 – 2 MW, and a further reduction of fossil energy for covering peak loads would be possible. The concept is currently being validated in detail.

Overall, the optimisation concepts for the biomass heating plant have high multiplication potential and can be transferred to many district heating systems in Austria and Europe.

thermaflex.greenenergylab.at/e4a_demonstrator/retrofit-and-heat-pump-integration-saalfelden/?lang=en

[1] Basic Bioenergy Data 2021, Austrian Biomass Association, Vienna 2021

*Absorber mats, Smart Block Geblergasse, photo: Katharina Zwiauer*

# Sol4City

## Integrated solar supply concept for climate-neutral buildings in the city

The switch to renewable energy sources in the supply of heat and electricity is driving the decentralisation of the energy system. It will be necessary to integrate many new actors and many new components in the future. Coupling together all local, volatile energy producers, the heat and electricity consumers, the storage systems (building masses, heat and electricity storage systems) and the supply networks represent a complex task. There are currently no standardised solutions for an integrated energy supply system. Appropriately adapted solutions are needed for all applications, whether for individual buildings, whole neighbourhoods or renewable energy communities. Sector integration in the area of power-to-heat plays an important role here, offering tremendous potential for greater flexibility in the power and heat sector.

### TRANSNATIONAL COOPERATION

The project Sol4City aims at covering a large share of the heat and electricity demand of multi-storey residential buildings from renewable energy sources through the intelligent coupling of various technologies. The first phase involved bilateral bundling of Austrian and German competences from research and industry[1].

The innovative concepts combine technologies that are already available (e.g. activation of thermal masses, PV and battery technologies, heat pumps, etc.) with new components such as PVT hybrid collectors, sorption collectors, vacuum thermal insulation and ice storage systems. Economical solutions are being developed for climate-neutral multi-storey residential buildings in urban environments. The goal is to enable high solar coverage levels in new and renovated buildings utilising components integrated in the building envelope. One central aspect of the concept is its consideration of the interaction with network infrastructure (electricity and heat).

[1] **AUSTRIAN PROJECT PARTNERS:** AEE INTEC (project management), Institute of Polymeric Materials and Testing Johannes Kepler University Linz, GREENoneTEC Solarindustrie GmbH, SONNENKRAFT GmbH, KIOTO Photovoltaics GmbH, Kreisel Electric GmbH&CoKG
**GERMAN PROJECT PARTNERS:** IGTE University of Stuttgart, Viessmann Werke GmbH & Co KG

### CURRENT RESEARCH TOPICS

- Optimising the design and dimensions of all individual technologies with regard to security of supply and system integration
- Maximising the renewable energy production for covering heat and electricity demand (including e-mobility)
- Actively relieving the supply networks by utilising flexibility options inherent in buildings and systems
- Integrating model predictive control approaches and operational forecasting tools
- Definition of KPIs based on technical, economic and environmental criteria

The results of the bilateral project are also entering into international cooperation on the topic of climate-neutral buildings and city districts as part of the technology programme "Solar Heating and Cooling" (Task 66) of the International Energy Agency (see p. 9).

nachhaltigwirtschaften.at/de/sdz/projekte/sol4city.php

*"In the bilateral project Sol4City, our product development work is supported by a large number of experts from universities and private research institutions across Austria and Germany. We welcome this bilateral collaboration, since it brings together the best research and development capabilities. Solar thermal energy already makes a considerable contribution to securing a sustainable heating supply. To further expand and improve this contribution, we are working on new and innovative concepts, such as combining PV and solar thermal in the form of a PVT hybrid collector as well as other technologies like sorption collectors. Renewable energy sources are indispensable in the current situation and show the way to a largely independent energy supply."*

***HARALD POSCHARNIG,***
***HEAD OF RESEARCH AND DEVELOPMENT***
***GREENONETEC SOLARINDUSTRIE GMBH***

## IEA SOLAR HEATING AND COOLING (SHC TCP)

# Solar Energy Buildings

*Photo: stock.adobe.com*

Supplying buildings with renewable energy in a climate-neutral way requires integrated system concepts. Intelligently combining innovative technologies, sector integration and measures to increase flexibility will make it possible to achieve high levels of coverage with renewable energy. The "Solar Energy Buildings" project (IEA SHC Task 66) aims at developing economical energy supply concepts that enable solar solutions for covering at least 85 % of the heating demand, 100 % of the cooling demand and 60 % of the power demand for households as well as e-mobility in multi-storey residential buildings and neighbourhoods. Complete systems are being developed for new buildings as well as for comprehensive renovation of existing buildings. One important focus lies on a synergetic approach to interactions with network infrastructure (electricity and heat) in the sense of bidirectional flexibility.

The goal of the international cooperation is to identify relevant stakeholders and their needs as well as to develop a technology portfolio and optimised solutions for integrated energy systems. This involves collecting, analysing and evaluating new approaches and insights from case studies in various countries. The results will serve as the basis for recommendations to policymakers and companies in energy-related industries. Under German leadership, experts from Albania, Australia, Belgium, Denmark, Norway and Austria are collaborating on this project.

nachhaltigwirtschaften.at/en/iea/technologyprogrammes/shc/iea-shc-task-66.php

## IEA DISTRICT HEATING AND COOLING (DHC TCP)

# Integration of renewable energy sources in district heating and cooling systems

*Photo: Climate and Energy Fund/Krobath*

One project within the technology collaboration programme "District Heating and Cooling" (IEA DHC TS5) is concerned with the conversion of district heating and cooling systems to a full supply from renewable energy sources. The transformation of these supply systems is a central element of the heating transition in Austria as well. Important know-how for this transformation process is being produced through participation in the international collaboration.

**Project objectives include:**

- Collecting knowledge of optimised solutions for the integration of renewable energy systems into existing district heating and cooling systems.
- Sharing practical know-how through business cases and technical solutions for stakeholders and market actors
- Preparing innovative demo cases in collaboration with stakeholders (for both technical and organisational solutions)
- Identifying market prospects and non-technical market barriers

Overall, the project should contribute to establishing renewable heat sources as environmentally friendly and emissions-free heat generating technologies for the district heating and cooling sector. The results of the project will strengthen the technical and economic competence of established market players in Austria (e.g. energy supply companies, planners and technology providers).

At the same time, the project will establish simple access to methods and key information concerning the implementation of renewable energy sources in existing and new district heating and cooling, in turn benefiting municipalities and public bodies. The participating countries are Germany (Operating Agent), Denmark, Finland, France, Italy, Canada, Austria and Sweden.

nachhaltigwirtschaften.at/en/iea/technologyprogrammes/dhc/iea-dhc-annex-ts5.php

# HEAT HARVEST

## "Harvesting" solar waste heat in urban environments

The impacts of climate change are especially pronounced in cities, including the urban heat island (UHI) effect. In densely developed urban areas, higher average temperatures are increasingly resulting in heat islands. Heated buildings and infrastructure surfaces (roads, paths, squares) produce excessive heat, posing in combination with air pollution and reduced air circulation a major health risk to residents. Green areas and/or water areas as well as road and building vegetation can help reduce the occurrence of UHIs. These measures are already being implemented in many cities, but they are not possible everywhere or not necessarily to a sufficient degree.

### NEW SOLUTION CONCEPT

An innovative approach to preventing the formation of heat islands is to "harvest" excess solar heat in urban areas from building surfaces, paths, roads and squares by installing flat absorber lines. The collected heat is then fed into a borehole thermal energy storage and can be made available later as a heat source for heating buildings. Due to the high temperature level of urban surfaces, which can be as high as 50 °C, flow temperatures into the storage system of up to 40 °C can be expected.

However, the subsurface temperatures in cities are generally already elevated due to development and use. Precise calculations and simulations are required for storing additional waste heat on a seasonal basis and for integrating heat pumps. This was the focus of the "Heat Harvest" project, led by the AIT Austrian Institute of Technology in cooperation with the Geological Survey of Austria and TERRA Umwelttechnik GmbH.

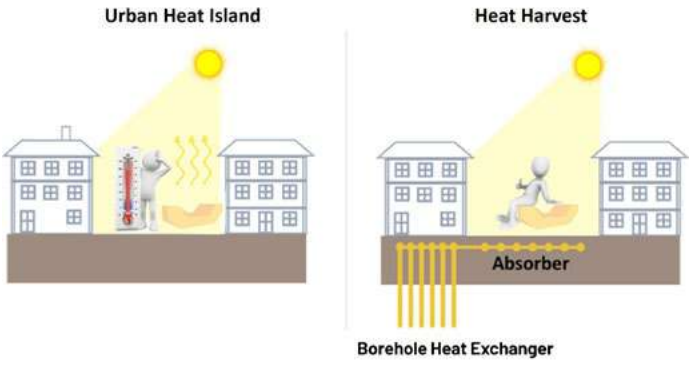
### ANALYSIS OF THERMAL EFFECTS IN THE SUBSURFACE

The project work included a comprehensive investigation of how the thermal behaviour of the subsurface changes when urban solar waste heat is fed into borehole thermal energy storage. The geothermal test field of the Geological Survey of Austria, installed in Vienna in 2019, was used for this purpose.

*Drilling the test geothermal probe, photo: Heat Harvest consortium*

*Thermal conductivity measurements on the drilling core, photo: Heat Harvest consortium*

Laboratory experiments and simulations under various conditions were also carried out in parallel at the AIT. The goal was to explore the appropriate conditions for harvesting solar waste heat in urban environments. The tests and analyses laid the technological foundation for implementing the concept.




*Heat Harvest concept, graphic: Heat Harvest consortium*

*Asphalt collectors, photo: Ooms Producten*

## HIGHLY PROMISING RESULTS

The investigations show that – given appropriate geological conditions – higher temperatures can be fed into geothermal probe storage systems without causing negative thermal consequences. The required geology is a clay-silt-dominated system, as is typical for the part of Vienna south of the Danube. Precise knowledge of the subsurface (structure, groundwater, thermal conductivity, thermal capacity, etc.) is essential for correct planning and efficient operation of a borehole thermal energy storage.

Seasonal heat storage in borehole heat exchangers is a space-saving and invisible technology that is particularly appropriate for densely built-up areas. The higher feed-in temperature (up to 40 °C instead of the usual maximum of 30 °C) results in a significant increase in the transmission performance of the probe but does not cause excessive heating of the subsurface. The innovative technology has a high potential for reducing the urban heat island effect. Plus, the concept improves the efficiency of heating operations, thereby contributing to the decarbonisation of the heating sector. The target group for the innovative concept consists of developers, building operators, municipalities and industrial and infrastructure companies with large amounts of usable land area. The harvesting of excess solar heat is also an interesting option for retrofitting in existing buildings (including listed buildings).

nachhaltigwirtschaften.at/de/sdz/projekte/heat-harvest.php

### 100 % RENEWABLE HEATING AND COOLING SUPPLY IN SOCIAL RESIDENTIAL BUILDINGS

An innovative building services concept is currently being developed for a residential construction and demonstration project on Käthe-Dorsch-Gasse in 1140 Vienna based on insights from the "Heat Harvest" project. The large-volume social residential building with about 300 units (built by developer WBV-GPA - Wohnbauvereinigung für Privatangestellte) will implement a 100 % renewable (on-site) heating and cooling supply that will simultaneously offer excellent comfort to residents.[1]

The overall system combines innovative technologies that have never been used before in this combination or at this scale in a social residential building. These include the harvesting of geothermal energy in borehole heat exchanger fields, heating and cooling via thermally activated building systems, free cooling, heat recovery from service water and a PV system to cover a large share of the electricity demand of the building services systems as well as the general electricity demand. The concept calls for the integration of asphalt collectors and roof-mounted (unglazed) flat collectors. Both solar heat and waste heat from cooling of the units will be stored in a borehole heat exchanger field. A performance comparison between the solar and the asphalt collectors is also part of the project.

*Image: RGE-KDG Christoph Lechner & Partner ZT GmbH, Berger+Parkkinen Architekten ZT GmbH, rendering: Isochrom*

nachhaltigwirtschaften.at/de/sdz/projekte/sozial-100-prozent-erneuerbar.php

[1] **PROJECT PARTNERS**: Schöberl und Pöll GmbH (project management), WBV-GPA - Wohnbauvereinigung für Privatangestellte, AIT Austrian Institute of Technology GmbH

You can also visit us at:

www.energy-innovation-austria.at

## INFORMATION

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**Sol4City – Integrated solar supply concept for climate-neutral buildings in the "City of the future"**
AEE INTEC – Institute for Sustainable Technologies
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**Heat Harvest – Harvesting urban solar waste heat from buildings and surfaces to prevent summertime overheating in cities**
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**Sozial100%Erneuerbar:**
**100 % renewable heating and cooling supply in social residential buildings – the Käthe-Dorsch-Gasse demo project**
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