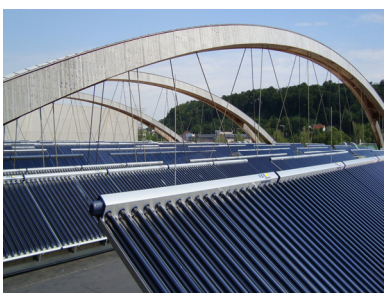
SDH

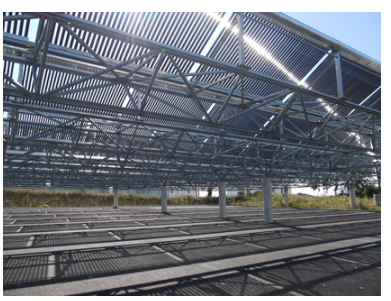
solar district heating

Supplying

Renewable



Zero-emission



Heat

Intelligent Energy Europe Programme
of the European Union

Foreword & Introduction

Paul Voss
Director of Euroheat&Power

For those of us who care about and believe in the emergence of a more sustainable model of heating and cooling in the EU, these are exciting times! Long the ‘poor cousin’ of the energy debate, the question of how we should heat and cool Europe’s buildings in the years and decades to come has risen swiftly up the political agenda in Brussels and is now firmly established as a mainstream issue which policy-makers and the wider stakeholder community simply must address.

The facts are clear. Heating and cooling account for roughly half of European energy consumption, and this need is currently met primarily through the direct combustion of fossil fuels, increasing share of which need to be imported, in individual boilers. The wider objectives of the EU energy transition - preventing climate change, ensuring supply security and preserving economic competitiveness - cannot be achieved unless this situation is entirely reimagined.

Solar district heating, a technology which combines efficiency, renewable energy and reliance on freely available local resources, is literally a shining example of how this new approach can and should work. In this sense, the SDH initiative is a welcome and valuable step towards a brighter future and an energy system that is sustainable in the broad sense of the term.

I hope you find it as inspiring as I do!

Success Factors in Solar District Heating

District heating and solar heating can play an important role in the energy transition of the heat sector in Europe. District heating is one major approach to increase the overall energy efficiency in urban areas, either by refurbishment of existing systems or by the introduction of new systems in existing or new building establishments, and solar heat is available in principle anywhere all over Europe.

Historically, solar district heating plants were introduced in the late 1970's by the interest to develop solar heating plants with seasonal storage. Sweden, The Netherlands and Denmark had a leading role in the early demonstrations, followed in the 1990's by Germany and Austria. Up to today 216 plants with more than 350 kW_{th} nominal power were put in operation in Europe. Out of these, 82 plants have a nominal power of more than 1 MW_{th}. The total installed capacity amounts to 550 MW_{th} and the yearly increase is presently over 30%.

More than twenty years of operational experience, plant technology and know-how are available and since the middle of the last decade there is an increased interest also in the commercial operation of solar district heating, mainly by utilities but also from local authorities and the housing sector. Beside the real boom of the technology in Denmark, further European markets are developing or starting. One common success factor is the early involvement of all project partners and their cooperation towards the development of an optimal concept and the realization of new solar district heating plants.

This brochure presents many examples and relevant aspects of solar district heating projects.

The SDH projects

The Intelligent Energy Europe SDH projects aim at fostering the changeover of district heating to solar energy. Over the last six years, 23 European partner organizations worked together to support the market roll-out. Some of the main achievements are:

- Availability of reliable information on the market conditions, barriers and opportunities for SDH.
- Creation of tools, like state-of-the-art guidelines for SDH activities recognized and used by the European market actors of the DH and solar thermal sectors.
- Development of new opportunities for solar district heating: business models and marketing strategies for market actors, recommendations for policy makers.
- Transfer of the knowledge and practical know-how to market actors in at least 12 European countries, including countries with a new market.

All products of these projects can be found on the international SDH platform:

www.solar-district-heating.eu

Solar District Heating

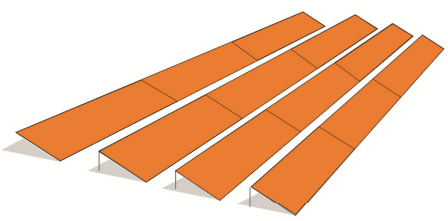
Solar District Heating (SDH) plants consist of large fields of solar thermal collectors feeding their produced solar heat into district heating networks. The solar collector fields are either installed on free ground or integrated into building roofs. Today, the plant capacities range up to 100 MW_{th} for the largest systems installed. Typical shares of solar thermal production are up to 20% of the total heat supplied by the district heating system. With large heat storages, used also for CHP optimization or power-to-heat applications, solar thermal shares of up to 50% can be reached.

Emission-free

Zero emissions and 100 % renewable energy lead to a maximum sustainability in heat supply.

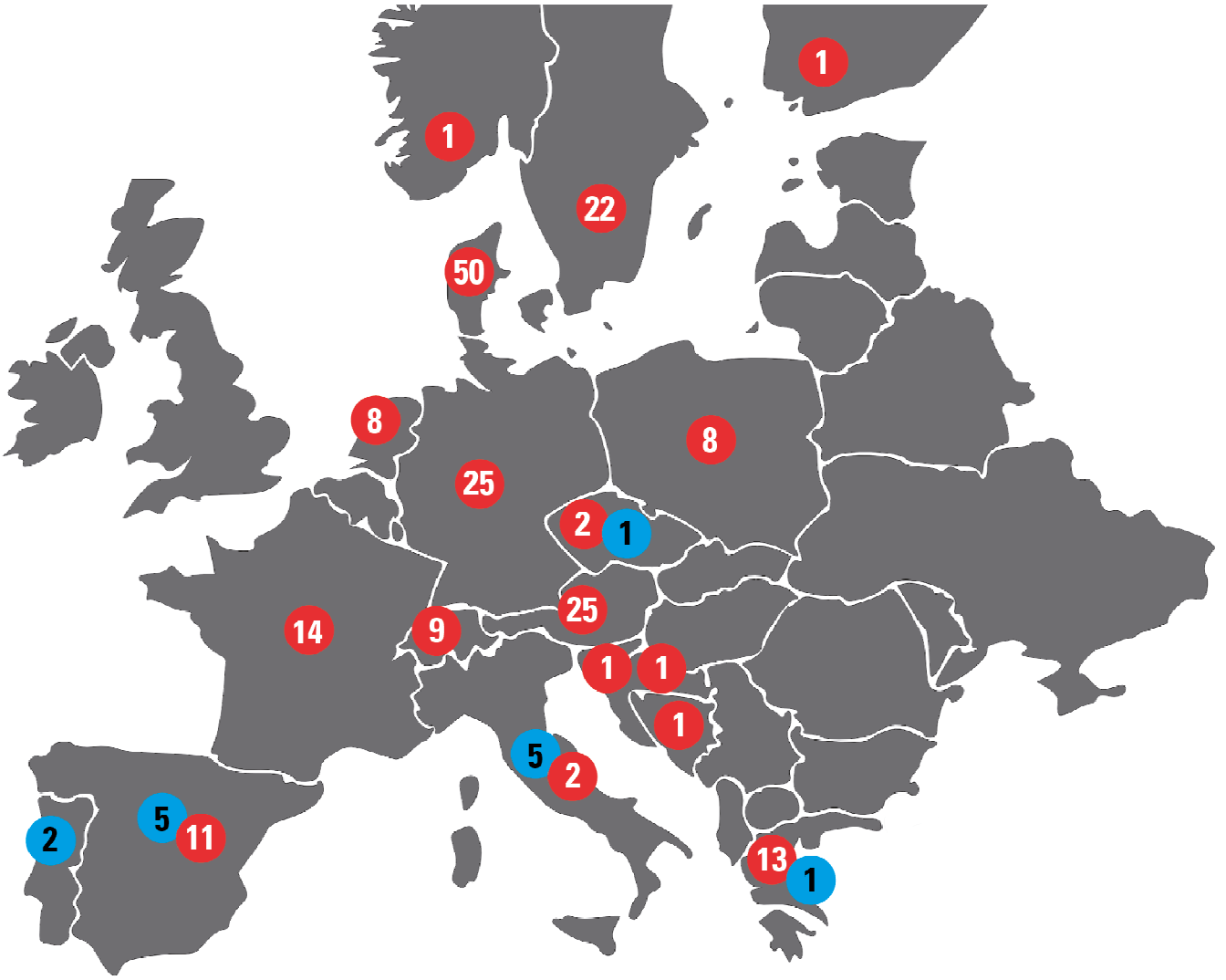
Available everywhere

Solar energy is unlimited and can be used in principle at any location in Europe.



Cost stable

Heat generation costs are stable and known on the first day of operation for the next 25 years.



216 solar thermal plants for the generation of heat and cold each with more than 500 m² collector area / 350 kW_{th} nominal capacity.

Market Situation in Europe

Since the introduction of solar district heating plants in the 1970's about 216 plants with more than 350 kW_{th} nominal power were put in operation in Europe, especially in Sweden, The Netherlands, Denmark, Germany and Austria. The total installed capacity amounts to 550 MW_{th} and the yearly increase is presently over 30%. In recent years newcomer countries are following this trend.

Competitive heat prices below 50 €/MWh are reached and result in good market perspectives for the next years. On the long term, the potential of solar district heating is assessed to up to 15% of Europe's district heating and cooling supply.

Solar district heating for different overall concepts

SDH for districts

In cases of renovation or new construction of urban quarters, local heating networks are a valid option for heat supply. Depending on the building type and equipment such networks can be operated at low temperatures, which are favorable for integrating solar thermal plants.

Vallda Heberg, Sweden

This new building area inaugurated in 2013 is centrally supplied by a district heating system combining biomass and 680 m² of solar thermal collectors. The solar fraction of such systems is up to 20 %.

Munich Ackermannbogen, Germany

By integrating long-term seasonal storages, the solar contribution to the total heat supply can reach up to 50%. Since1996, 11 large-scale solar thermal plants with long-term seasonal heat storage were built in Germany.

SDH for small cities, villages and communities

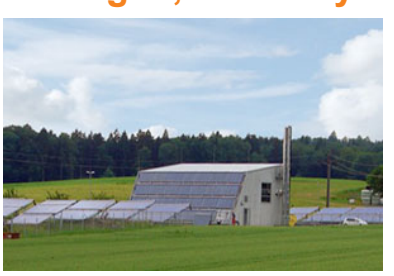
In Denmark, Sweden, Austria and Germany, district heating systems are frequently used to supply heat to small cities and communities in rural areas. There, the combination of a large-scale solar thermal plant and a biomass heating plant is an economically interesting concept to supply local nets with renewable heat, but also combined with CHP.

In such projects, the involvement and participation of citizens are essential success factors. High rates of acceptance as well as high connection rates are essential for operating a district heating net economically. In Denmark for example, district heating operators are mostly organized in cooperatives. Their goal is not profit maximization but to achieve a long-term favorable price using renewable energies for heating.

Marstal, Denmark

In Marstal on the island of Aerö, the 33 400 m² solar collectors combined with a 75 000 m³ storage provide 55% of the yearly heat demand. Here the district heating company is citizen-owned.

Büsingen, Germany



In Büsingen, Germany the 1 090 m² large-scale evacuated tube collectors provide all the heat supplied by the district heating net in summer. More and more ‘energy villages’ with citizen participation are developing in Germany.

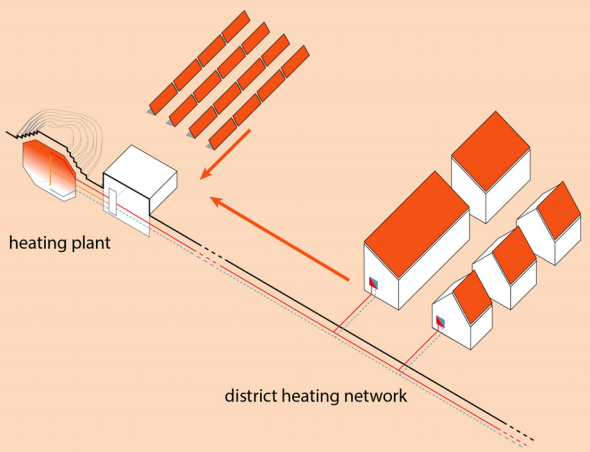
SDH for urban areas and cities

Large urban district heating systems are usually operated with heat from combined heat and power plants, heating plants or industrial waste heat. Fuels are often natural gas, coal, waste or biomass. The decentral integration of large-scale solar thermal plants is one possibility to increase the share of renewable energy sources in such district heating systems.

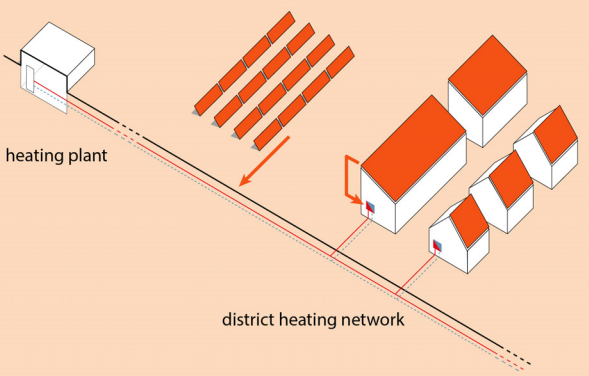
Wels and Graz, Austria

In Wels a 3 400 m² collector plant built on the trade fair center feeds into the district heating net of the city, which has a yearly heat demand of approximately 173 GWh. The solar fraction is about 50% of the summer heat demand. Already three plants of this type had been realized in Austria before Wels, feeding in the district heating net of Graz, operated by a contractor.

Technical concepts



Central SDH plant: the solar collectors deliver heat to a main heating plant. Large heat stores enable also higher solar contributions to the total heat demand.



Decentral SDH plant: the solar collectors are placed at suitable locations and connected directly to the DH primary circuit on site. Often these plants use the district heating network as storage.

Collector integration

Simple and convenient if suitable areas are available.

More adapted to urban context, these solutions present more technical complexity and aesthetical requirements, but have the advantage of using existing areas and infrastructures.

Storage

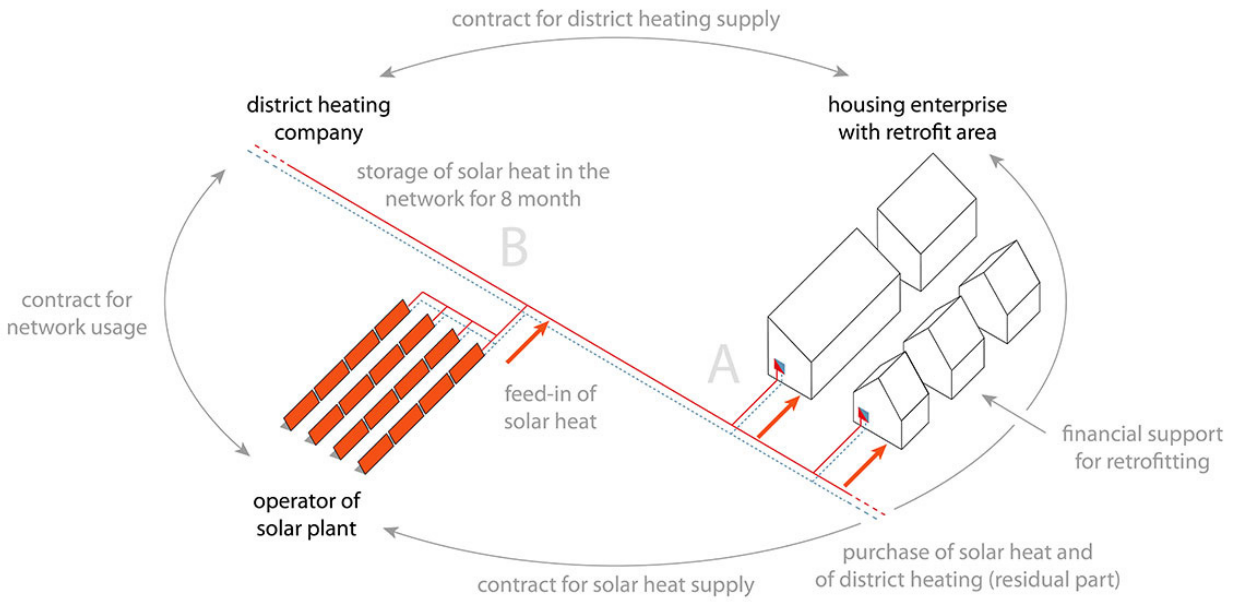
For large solar thermal plants, storages with several hundred m³ are usually needed.

For higher solar fractions up to 50 %, larger long-term thermal energy storages are needed (up to 100 000 m³). They can also be realized underground in urban areas.

Business models and market opportunities

Business models

District heating systems are a cost effective and flexible way for supplying efficiently produced and renewable heat and cold to cities. A main barrier for renewable energy sources in district heating is the still limited use of district heating itself in many countries. Smart business models e.g. based on the idea of open heat platforms and the modern image and high end user acceptance of solar thermal can be a door opener for district heating in general. Innovative marketing, market extension and business models for solar district heating are opportunities for increasing the use of district heating.



Solar heat prosumers – an example from Sweden

In Gothenburg, Sweden owners of district heating connected buildings have expressed their interest to install large solar thermal plants. If the solar heat production exceeds the total heat demand of one building, it can be distributed to other buildings via the main district heating circuit. A net-metering contract between the building or plant owner and the district heating operator regulates the selling and buying of regularly consumed and produced excess solar heat. The district heating system works as storage for the solar heat.

The neighborhood of Gårdsten, in the Swedish town of Gothenburg was built in the seventies, and refurbished in 1996 according to a global concept for improving the quality of life and the energy efficiency in the neighborhood. One of the projects, a 150 m² high-temperature flat-plate collectors plant on the roof of a renovated building feeds into the large urban district heating net of Gothenburg through a prefabricated substation.

SDH in urban and heat planning

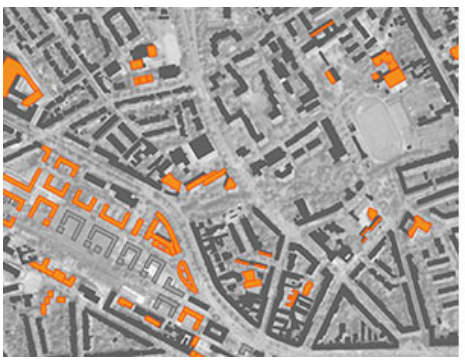
Jan-Olof Dalenbäck, Chalmers University

'The potential use of solar district heating is strongly influenced by the availability of suitable areas for solar collectors, either on land or on roofs. Therefore, investigation and planning of suitable areas for solar collectors should be a mandatory part of planning in cities and other dense building areas within EU.'

Position paper 'Solar District Heating is ready to support EU targets', 2012

The heating and cooling demand usually amounts to more than the half of the total end energy consumption of urban centers. Therefore local administrations and in particular urban planners have to closely connect urban and heat planning for any urban development project.

Areas for solar thermal collectors can be found on building roofs, infrastructure areas or free land areas. The integration of solar thermal in the development plan cannot be prescribed, in most of the cases. However, it can be enabled or supported through requirements e.g. on building orientation or roof shapes or through suitable land utilization plans.



'Solar radiation is available everywhere and solar heat has about 50 times higher area specific thermal yield as biomass. Therefore, it should be mandatory to include the use of solar heat in feasibility studies for new and the upgrade of existing district heating schemes within EU.'

Areas are rare and costly in Europe's densely populated regions. The comparison of areas needed for a 100% renewable heat supply of a village with solar thermal or with biomass evidences the high specific area yield of solar thermal collectors. The incident solar radiation is transformed to useful heat with an efficiency of up to 85%.

International cooperation

The SDH network provides a unique platform for know-how exchange and common learning between experienced and newcomer market players.

Italy

Fabio Fidanza, Varese Risorse

'Leading the Varese project was a great challenge in the Italian framework. A fundamental impulse to the project was undoubtedly given by SDH team initiatives which made available the knowledge of the specific techniques applied in other European countries, getting rid of all the remaining doubts and resistances about the SDH potential in Italy, the 'sunny country' by definition. I look forward to seeing Italian utilities projecting and building SDH plants even larger than the Varese installation in order to bridge the gap with northern European countries. This first Italian plant surely represents an important milestone.'

Denmark

Per Kristensen, Danish District Heating Association

'In view of the increasing international focus on conversion from fossil fuels to renewable energy, it is only natural that the interest in the use of district heating technology has increased significantly. Large-scale solar heating plants combined with heat stores will develop to become one of the main energy production technologies for district heating. To ensure this development on a global scale, international cooperation is necessary. In fact, it is quite in the spirit of the EU that the member states should set measurable objectives and that national players help and support each other to achieve the targets.
In Denmark, over 60% of all buildings are supplied with district heating and more than 500 000 m^2 solar heating have been established in combination with district heating. Therefore, it is only natural that the relevant Danish players in this field enter into international alliances with colleagues and other interested parties.'

Varese Risorse, the local utility in the city of Varese, inaugurated in 2015 a 990 m^2 solar thermal plant integrating thermal energy into their district heating grid. Thanks to the support of the SDH team, first calculations were made and the feasibility of a plant installed on the ground, in an area close to the main district heating production unit, was demonstrated, also thanks to the available incentives for solar thermal in Italy.

Solar District Heating is ready to support EU targets

Heating accounts for 50% of the primary energy demand in Europe, and measures on heating are necessary to achieve EU's climate goals.

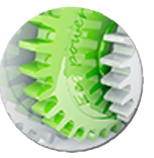
Solar Thermal + District Heating

Full consideration of heat in energy

Shift focus from electricity and transport to a full-scale approach creating strategies for the decarbonisation of heat

Balancing supply and demand

Combine supply-side and demand-side measures based on a joint calculation of cost-effectivity and efficiency for maximum impact



Application of a holistic, system-oriented approach

Assess supply opportunities, demand measures and synergies on a district level

Supply of renewable heat to urban

Support feasibility studies for and the development/extension of district heating and cooling grids in urban areas

Integration and consideration of full potential of solar heat

Include the use of solar heat in feasibility studies for new and extended DHC schemes in the EU

Create awareness and support development of modern business models

Support awareness-raising measures and create a framework favourable for the development of SDH and modern business models

Proper planning on local and system

Investigation and integration of suitable areas for solar collectors as well as storage solutions should be mandatory in city planning efforts in urban Europe

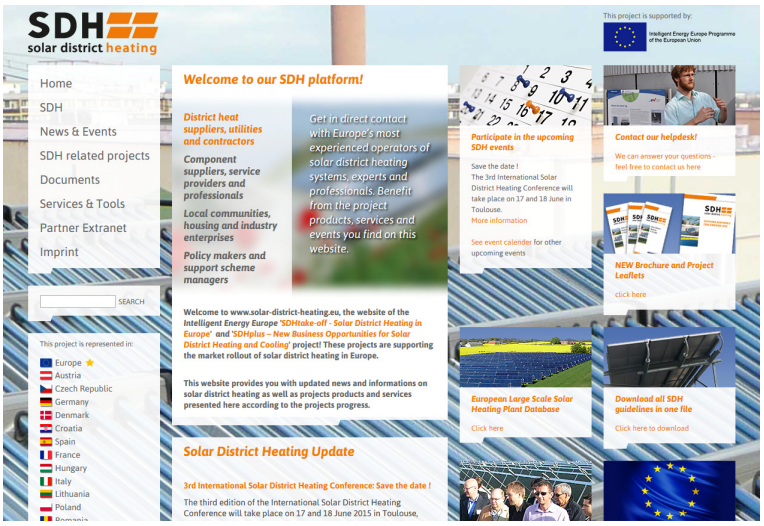
www.solar-district-heating.eu

Take a look at the materials, take part in the activities, become a frontrunner!

Don’t hesitate to get in touch with us to benefit from the strong international network of experts and market actors.

Our web platform provides you with supporting documents and tools and updated news on solar district heating.

Experience in SDH projects is available to support you in your own solar district heating plans!



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