INTERVIEW

Large-Scale Solar Thermal District Heating and Cooling

One on One with Sabine Putz

The SHC Programme wrapped up its third project on large solar systems (Task 55) in December 2020. To learn how the Task impacted this market sector, we've asked Sabine Putz, the Austrian Task Operating Agent, to share some of her thoughts on this 4-year project.

Why was a project like this needed?

Solar thermal district heating has developed rapidly in recent years, and today, it's a technology ripe for delivering heat on a large-scale to district heating networks. In combination with large-scale heat storage, solar heat can become an important part of the energy mix for heating cities or districts. Several studies have proven that solar heat could hold a significant share of existing and new district heating networks all over the world.

What is the current status of the technology?

The first large-scale solar heat networks started to be deployed in the USA and Europe around the 1970s.

In Europe, the first solar heat networks were installed in Sweden around 1979; they were connected to newly built residential areas at Ingelstad, outside the city of Växjö, and at Lambohov, outside the city of Linköping. By 2007, there were around 119 solar heat networks installed across Europe.

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The first solar heat network in Denmark, the current worldwide leading solar district heating country, was put into operation in the spring/summer of 1985 at Vester Nebel. It consisted of 296 m2 of flat plate collectors installed on the field in front of the district heating substation (straw and oil) and heated approximately 100 houses.

Today, Denmark is the leading country in solar thermal district heating and a good example of a mature and commercial solar district heating market, but other markets are catching up, especially China. In several other countries, smaller niche markets exist, such as in Austria, where 29 systems >500 m^2 are installed to feed into district heating networks, smaller microgrids in urban quarters, or local biomass heating networks supply heat to large residential, commercial, and public buildings. Other countries to note are Germany with 46 large-scale systems (some of these with seasonal storage), Sweden 25 systems, France 18 systems, Poland 15 systems, Greece 13 systems, and Switzerland 17 systems. Although Germany is currently considered a niche market, relative to Denmark, accelerated market growth is observable.

Is there one result/outcome that surprised you?

Yes, industry participation was very high. More than 60% of the Task experts came from industry, such as collector producers and solar thermal system installers. The cooperation of participants, even when from competing industries, was driven by the common goal – faster market development through awareness building of the technology and its reliability.

Do you have a Task success story from an end-user or industry to share?

At the first Task Meeting in 2016, two industry experts (a Danish and Chinese system installer) met for the first time. They discussed a potential solar district heating plant in China, which was finally built in 2018. This installation of 22,000 m^2 flat plate collectors, a 15,000 m^3 seasonal pit storage, and new district heating pipes was installed at an altitude of more than 4,000 meters in Tibet and was entirely financed by the Chinese Government.

Another success story is the Task's investor brochure, which explains solar district heating technologies, their advantages, and market developments. The brochure includes business models, best practice examples, infographics, and statements by investors. You can download it from the Task 55 webpage.

How has the Task's work supported capacity and skill building?

The cooperation of solar thermal industry partners and the information shared by experienced turnkey installers no doubt contributed to a faster-growing number of installations. For example, a French solar thermal installer decided to step into solar district heating while before he only wanted to install solar process heat plants.

Furthermore, four big events were held – two IEA SHC Solar Academy trainings to build awareness in the U.K. and China, an SHC Solar Academy Webinar, and a technology transfer workshop at the end of the Task. So, I would definitely say that the Task´s work supported capacity and skill building.

What is the future of the technology – new developments, markets, policies, etc.?

Today, the energy cost of solar thermal for district heating is just under 40–60€/MWh for district heating (depending on location/country conditions/fossil price). This price needs to come down to 30€/MWh to compete with conventional fuels. It is estimated that this is achievable with investment aid. In the long run, a price of 20–25€/MWh is realistic. The path to profitability is calculated with a relatively low-price elasticity where the energy price of solar heat is halved in the event of a 20 times increase in sales volume. This is because certain costs such as laying pipes in soil and construction work are well-established techniques with fewer volume effects.

What is needed to bring down heat costs?

- The bigger, the better – the larger a solar district heating system is, the lower the heat generation costs and heat price (in case of selling the heat instead of the installation)
- Large components, like solar thermal collectors, need to cost less
- Standards for design and construction of seasonal storages
- Support by decision-makers and funding bodies to convince utilities to switch to renewable district heating

What were the benefits of running this as an IEA SHC Task?

Better cooperation between research and industry. The research experts got first-hand information about what the industry really needs – bring down costs and help facilitate the uptake of new technologies, such as concentrating solar thermal systems for district heating.

Will we see more work in this area in the IEA SHC Programme?

Yes, a follow-up Task is already on the way. The first Task Definition Meeting was held, and there is even more interest by stakeholders and utilities in joining this project. The focus is on taking the next steps to reduce solar district heating system costs, the use of medium and high-temperature collectors, as well as digitalization measures to increase data quality and use.