

# Solar Thermal 2023 TRENDS

*As 2022 comes to an end and 2023 begins, our team of SHC Task Managers wants to share trends they see coming in their fields of expertise. We hope that by taking the time to stop and think about where solar thermal is headed, we can stay one step ahead of the technological advances and market changes.*

## TECHNOLOGY

### Solar Cooling

The energy demand for air-conditioning is growing faster than any other energy use in buildings. The main share of the projected growth for space cooling comes from emerging economies – more than tripling by 2050 to 6,000 TWh per year globally. One of the main trends for 2023 will be the emergence of more and more **hybrid cooling system solutions** (combinations of absorption or adsorption chillers with compression chillers using natural refrigerants). Even in the small to the medium cooling capacity range, they simultaneously offer high CO<sub>2</sub> savings with sound economics.

In the field of **medium-temperature systems** (solar collector temperatures around 160-180 °C) and commercial double-effect and new SE/DL absorption chillers (e.g., SunBeltChiller concept), there will be solutions with better efficiency and economy using smaller solar fields and with heat dissipation capacities to achieve an **investment advantage of up to 40% over traditional solar cooling systems.**

A newly developed **GIS tool** within the German project SunBeltChiller shows excellent potential to identify new markets for solar cooling based on specific geographic data on solar irradiation, population density, GDP, industrial areas, or water availability. Two filters are crucial here. The level of GDP is a measure of the market volume of building air conditioning because homeowners need a certain income to buy solar cooling systems. On the other hand, industrial areas indicate the market size of industrial cooling demand.

### Solar Water Heating

Natural gas and oil prices will continue to be volatile in 2023. In fact, the gas supply will be limited or restricted in several parts of the world into 2023, accelerating the roll-out of solar-driven heating and cooling technologies. For Solar Water Heating, this means:

- Gas water heaters will start to be phased out in some regions. Despite a gradual decline in new solar thermal hot water collector installations (on a year-on-year basis), the **overall share of solar energy supplied to hot water systems is set to GROW by diverting solar electricity (from photovoltaics) to water heating applications.**
- Low-income economies will choose to 'skip' expensive centralized fossil fuel infrastructure with volatile fuel prices (e.g., gas water heaters) in favor of **distributed energy systems such as PV2Heat hot water systems and thermosyphon water heaters.**
- High-income economies will see a rapid increase in the number of **heat pumps used for space and water heating** in the market, **powered increasingly by local rooftop solar** and a higher share of solar electricity at the grid level. The design and control of these heat pumps to operate with local PV will be key for energy savings and maintaining grid power quality.
- With rising energy prices, many new products will come to market in 2023 to help residential and business consumers manage their energy bills by scheduling energy consumption and storing energy as thermal energy (e.g., in hot water tanks and by pre-heating/cooling spaces). These emerging **'smart' products** have the potential to provide a triple win by creating value for manufacturers, consumers, and grid operators.

### Compact Thermal Energy Storage (CTES)

With the sharp increase in energy costs, the distance to market for a number of compact thermal energy

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storage applications has significantly shortened. We will see this for **industrial applications of Phase Change Materials (PCM)** at medium temperatures and **heat storage and transportation using sorption materials**.

In the coming year, there will be more CTES technology **demonstration projects** and probably the birth of more **start-up companies** in this field. However, policymakers must enable this development by creating the proper **R&D and market introduction measures**.

## BUILT ENVIRONMENT

### Solar Neighborhoods

Due to security aspects and pressure on energy supplies, high on national agendas is how to plan for increasing the local energy supply together with energy-efficiency measures to reduce the energy need. The growth of PV installations on buildings and in urban areas combined with more large-scale solar fields outside cities due to the demand for local and secure energy supply – the push will be even greater to develop **supportive planning methods and tools, identify business models**, and suggest **strategies for how to increase solar access** and use not just active solar energy, but passive solar energy and daylight.

## INDUSTRY

### Solar District Heating

Five trends in the coming year stand out. The first is that **large-scale solar thermal systems** using the economy of scale will be competitive with gas and oil prices. Second, new **innovative solar thermal technologies and collectors** will more efficiently provide solar heat, even at higher temperatures. Third, **long-term seasonal storages** used for solar thermal and other technologies will significantly contribute to the efficient operation of different sector coupling technologies, for example, Combined Heat and Power (CHP) systems, since they allow for maximizing the heat use and, in turn, overall performance. Fourth, the **combination of technologies, solar thermal with other technologies** (e.g., heat pumps), will increase the efficiency of both. And lastly, the push to reach the next step regarding **digitalization** will allow for the application of new algorithms and methods, resulting in a more efficient, robust, and cost-reduced operation.

### Nexus Water-Energy-Industry

In addition to solar thermal energy for supplying wastewater treatment technologies, **direct UV radiation** in solar water decontamination and disinfection systems is becoming increasingly important. **New industrial applications** are needed in combination with overcoming the technical, economic, and political barriers to new decontamination and disinfection systems to increase the number of installations. Another trend is the development of new solar reactors that aim to process wastewater efficiently into **hydrogen (H<sub>2</sub>) through photocatalytic or photo-electrochemical processes** by directly utilizing solar radiation. Using a multidisciplinary approach, disciplines from solar collector development, efficient reactor systems, photo-electrochemical materials research, wastewater chemistry, and the innovative production of alternative fuels, such as H<sub>2</sub>, will need to be combined.

### Solar Process Heat

We will see more **large-scale solar thermal plants** for district heating and industrial process heat. Financing mechanisms by ESCOs are well-known in other technology fields. And as solar thermal technologies increasingly become attractive investments, we will see more projects financed by third parties based on **contracting models**. Especially in combination with large thermal storages, solar thermal plants can reliably deliver a substantial share of industrial heat demand and thus help to hedge energy costs and CO<sub>2</sub> emissions. Therefore, we will see more projects with **large storages** and a **combination of solar thermal with other renewable technologies** (heat pumps, biomass) to aim at a 100% CO<sub>2</sub>-free heat supply.