SOLARUPDATE

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*Newsletter of the International Energy Agency Solar Heating and Cooling Programme*

#SolarHeat
#SolarThermal
#SolarProcessHeat
#SolarCooling
#SolarDistrictHeating

## In This Issue



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# Solar Energy Buildings Around the World

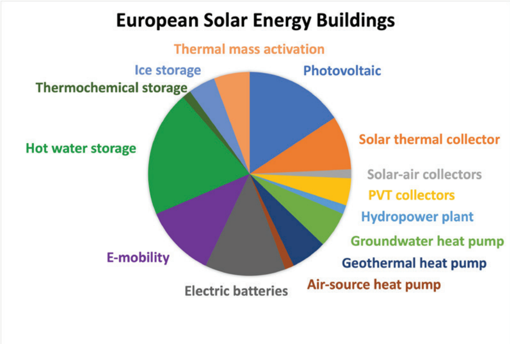
▲ **Single-family houses in Freiberg, Germany, in continental climate.** Photo: Lukas Oppelt, TU Bergakademie Freiberg.

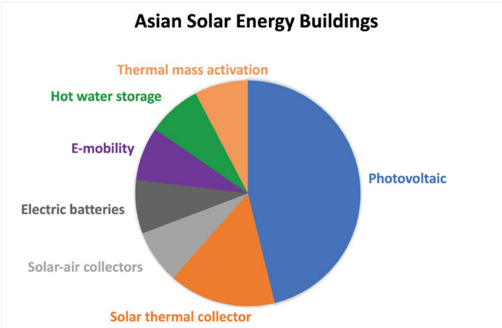
*The analysis of 20 Solar Energy Buildings demonstration cases is wrapping up in IEA SHC Task 66 on Solar Energy Buildings. In this article, you will preview some of the high-solar fraction buildings in this collection.*

The case studies include single- and multi-family homes and commercial buildings in different climate zones and inside and outside district heating areas. All the buildings, except one in India, are connected to the electric grid. The selected buildings aim for high self-sufficiency in heating, cooling, and electricity. The degree of self-sufficiency is defined as renewable energy consumption divided by total energy consumption. The Solar Energy Building demonstration cases are distributed across Europe (13), Asia (6), and Australia (1). The European demonstration cases are in Austria (4), Germany (6), Poland (1), Portugal (1), and Denmark (1), and the Asian are in China (1) and India (5).

The technologies used in the IEA SHC Task 66 Solar Energy Building cases in Europe and Asia are shown in Figure 1.

It is noticeable that the variability of technologies is more significant in Europe than in Asia. On average, the 13 European cases use five different technologies to reach a high degree of self-sufficiency, while the Australian case uses six different technologies. In contrast, the Asian average is




◄ **Figure 1. Technologies used in the IEA SHC Task 66 demonstration cases in Europe and Asia.**

*continued on page 2*

## SHC Members

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only three, influenced partly by the fact that most Asian solar energy buildings do not require space heating.

Photovoltaic (PV) panels play an essential role in solar energy buildings. In Europe, they are more often combined with batteries than in Asia. Solar thermal systems also play an important role. In Europe, alongside traditional flat plate and evacuated tube solar thermal collectors, photovoltaic-thermal (PVT) collectors are used, while solar air collectors are used primarily for melting ice-storages. In Asia, traditional solar thermal collectors are used. In one notable case, in the high mountain region of the Himalayas, a solar air collector is used for space heating and domestic hot water production.

Heat pumps are very popular in Europe, and different types of heat pumps are used in more than 60% of the European Solar Energy Building cases. In contrast, no heat pumps are used in the demonstration cases in Asia.

▲ **Multi-family building in Reidberg, Germany, in continental climate.** Photo: Constantin Meyer, SIZ energieplus.

### Demonstration Buildings

The following buildings are a few examples of the demonstration cases showcasing different energy supply systems. These buildings illustrate the high degree of flexibility and possibilities for combining different technologies within the energy system for heating, cooling, electricity, and even e-mobility. The complete report describing all 20 demonstration cases will be published in 2024 on the IEA SHC Task 66 homepage: https://task66.iea-shc.org/.

#### *Multi-family building in Reidberg, Germany*

Based on measurements, this five-story multi-family building in Reidberg, Germany, built in 2015, reaches 26% self-sufficiency for heating, 100% for cooling, and 42% for electricity. The building has seventeen apartments and a heated area of 1,600 m$^2$. A brine-water heat pump (50 kWth) uses a solar ambient air absorber on the roof (85 m$^2$, located under the PV modules) and an ice-storage (100 m$^3$) as the source for floor heating and domestic hot water. Central mechanical ventilation with heat recovery reduces heat loss in winter and increases indoor comfort. After the heating period, the ice storage regeneration is carried out through the solar ambient air absorbers. Photovoltaic modules are installed on the roof (84 kWp) and the building's façade (15 kWp). To improve the system's flexibility, a battery storage of 59.4 kWh is integrated. The surplus energy is used on-site and charges electric cars and e-bikes in the building's underground car park, which the tenants share.

▼ **Office building in Beijing, China, in continental climate.** Photo: Xinyu Zhang, China Academy of Building Research.

#### *Single-family houses in Freiburg, Germany*

(see photo on page 1)

These two single-family houses in Freiberg, Germany, built in 2013, reach 70% self-sufficiency on the thermal side and 94% on the electricity side – based on measured data. One of the buildings serves as a residential building (206 m$^2$), the other as an office building (162 m$^2$). The energy system consists of solar thermal collectors (46 m$^2$) and photovoltaic panels (8.4 kWp) on the roof, heat storage (9.1 m$^3$), a backup heating stove (25 kW), battery storage (58 kWh), and a geothermal collector system for cooling. An electric vehicle is used to increase the self-consumption share of the residential building.

#### *Office building in Beijing, China*

The office building in the China Academy of Building Research office park was refurbished in

*continued on page 3*

**Solar Energy Buildings** *from page 2*

2021. The building reaches 31% self-sufficiency on the electricity side – based on measurements. The two-story office building has an area of 3,000 m². The building is cooled by a split air conditioner in summer and heated by district heating in winter. Domestic hot water is prepared in an electric-heated hot water tank. Three types of photovoltaic panels are used on the roof and façade and in the window glass: Monocrystalline silicon 569 m² (115 kWp), Thin film 849 m² (118 kWp), and transparent thin film 51.6 m² (2.2 kWp).

### *Guest house in Ladakh, India*

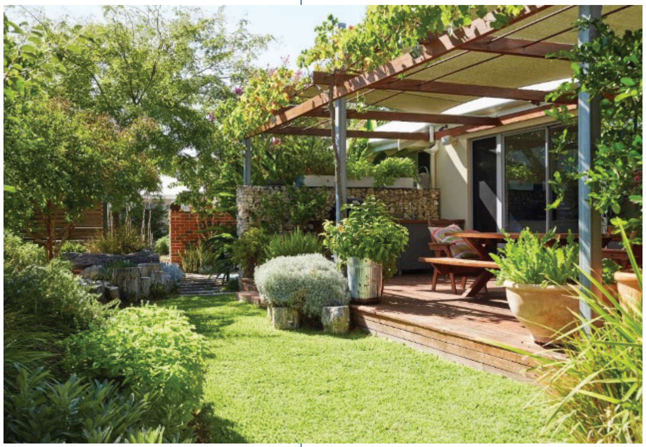
This guest house in Ladakh, Himalaya, India, reaches 94% self-sufficiency for heating – based on measurements. A solar air collector system on the roof completely heats the guesthouse, including the domestic hot water tank. The solar heated air flows through a pebble-bed storage below the ground floor of the building and a heat exchanger connected to the hot water tank. Building mass activation ensures room heating even for one to two days without sun. Photovoltaic panels (2 x 60 Wp) drive the ventilators. The high share of self-sufficiency is achieved due to the cold but sunny winters, which you find in many other locations worldwide. Gas is used for cooking (2 gas bottles of 12 kg per year), which is why the self-sufficiency is 94 % and not 100 %.


▲ **Guest house in Ladakh, India, in subarctic climate.** Photo: Christoph Müller, Simply Solar GbR.

### *Single-family house in Hilton, Australia*

A solar electric single-family home in Hilton, Australia, built in 2013, reaches 89% self-sufficiency - based on measurements. The building energy system comprises an electrical-driven heat pump, photovoltaic panels (6.4 kWp), battery storage (10 kWh), a solar hot water system, and a charging station for an electric vehicle. The building collects and recycles most of its water, and landscaping includes food production, wildlife habitat, and play spaces.

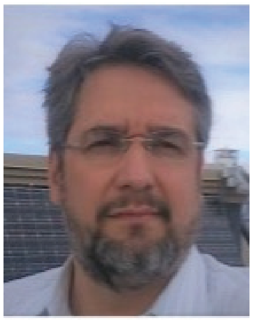
*This article was contributed by Elsabet Nielsen, Senior Researcher at the Department of Civil and Mechanical Engineering, Technical University of Denmark, and leader of the SHC Task 66 Subtask C on New and Existing Building Block/Communities.*



▲ **Single-family house in Hilton, Australia, in Mediterranean climate.** Photo: Rebecca Yang, RMIT University, Australia.

OPINION

# Reflections from the Chair



In our 93rd Executive Committee meeting back in June, I was elected chair of our Programme. First, I would like to personally thank the leadership of our last chair, Tomas Olejniczak. Tomas showed great dedication to our TCP in the challenging times we all faced during the pandemic.

Second, I would like to say that being elected chair is both an honor and a significant challenge. Our Technology Collaboration Programme (TCP) has delivered amazing results throughout the years. From its beginning in 1977, the Programme has strived to bring together researchers, engineers, and key stakeholders to advance state-of-the-art solar heating & cooling technologies and daylighting. The Solar Heating and Cooling Programme (SHC TCP) has supported the development of new collector technologies, small and large energy storage systems, better and broader standards and certification schemes, and enhanced systems integration, to name just a few accomplishments. However, we need to do even more, and our Programme has identified key areas and actions for strategic development:

**Analyze**
Provide authoritative and impartial analysis on solar heating and cooling and daylighting technologies, markets, and barriers.

**Research**
Demonstrate the effectiveness of solar heating and cooling technologies and designs through increased performance and reduced costs, facilitating their market competitiveness in heating and cooling applications.

**Connect**
Cooperate with stakeholders, including international organizations, local, regional, and national governments, potential users, energy and urban planners, and industry.

**Communicate**
Raise awareness and understanding of the potential and value of solar heating and cooling systems.

More than ever, we need broader participation and stronger partnerships to deliver results in the key areas listed above. And deliver results we must. Because deployment has been slow, and it is undeniable that solar heating and cooling still lacks strong policy support in many countries, despite our urgent need for decarbonization and the fact that the technology is sustainable, cost-effective, and locally manufactured using common commodity metals.

Our sector continues to be very fragmented, with an industry marked by small and medium-sized companies with limited advocacy power. The widespread policy focus on electrification has brought new challenges. More and more, the market focus in OECD countries has shifted to larger solar thermal systems and new market segments such as commercial solar water heating, solar district heating, and industrial processes. Despite market limitations in some countries, our *Solar Heat Worldwide* data shows strong growth in many other countries and market segments.

Solar thermal can and should deliver a strong contribution to our decarbonized future. It's clean, reliable, shovel-ready, and, in many cases, locally manufactured. It is also cost-effective in many instances, particularly in cases where there is a level field with other energy sources.

Policies come and go. Any predictions regarding energy technologies carry a significant uncertainty, as we have seen many times. So, let's focus on what we can do and work together to help fulfill the potential of solar heating and cooling technology on our way to a more sustainable planet!

Lucio Mesquita
*SHC Executive Committee Chair*

# ISES and IEA SHC International Conference on Sustainable and Solar Energy for Buildings and Industry

# EuroSun2024

26 - 30 August 2024
Limassol, Cyprus

ISES and IEA SHC and the local organizers, the Technical University of Cyprus and ISES Cyprus, look forward to you and your colleagues participating in the conference and submitting papers.

As with past conferences, EuroSun is THE solar conference to attend, whether you are from academia, industry, or another solar profession. The role of PV, solar cooling, storage and grid integration is especially crucial for isolated sunny islands, like Cyprus. Join us to share, learn and network!

The 2024 conference themes are:

- Energy Efficient Buildings
- Sustainable Heating and Cooling Systems for Buildings
- Solar and Efficient Districts
- Sustainable Process Heat for Industry
- Sustainable Energy Infrastructure and Electrification
- Thermal Energy Storage
- Solar Thermal and PVT Collectors and Solar Loop Components
- Solar Air Conditioning and Refrigeration
- Sustainable and Solar Energy Transition
- Solar Resources and Energy Meteorology

Don't forget, this is an international conference, so join us this coming August in Cyprus to network and learn from attendees and presenters from around the world.

The Call for Papers will be in early 2024, so visit the IEA SHC and ISES websites.

**Conference of**

ISES International Solar Energy Society

SHC SOLAR HEATING & COOLING PROGRAMME INTERNATIONAL ENERGY AGENCY

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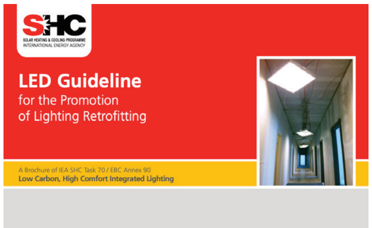
ΔΟΗΕ - Κύπρου - 1990

# Making the right decisions, now!
## A new guideline on lighting retrofits



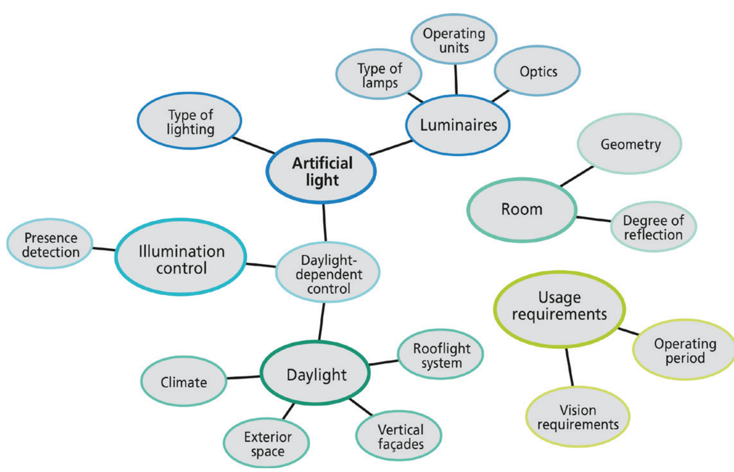

*The new IEA SHC LED Guideline for the Promotion of Lighting Retrofitting provides suggestions for accelerating the replacement of old lighting systems, harvesting the "low hanging fruits," and managing daylight. With lighting being responsible for about 15% of electricity consumption and about 5% of global $CO_2$ emissions, it needs to be brought up to date with climate protection, energy sovereignty, and economic efficiency while ensuring user comfort at the same time.*

In new buildings, almost only LED systems are being designed. However, in existing buildings, many have not yet been converted to LED technology despite offering great and often easy-to-develop climate protection potential — so-called "Low Hanging Fruits."

With the conversion forced by the phasing out of fluorescent lamps (e.g., by 2023 in the EU), the main question is whether "transitional solutions" in the form of LED replacement lamps make sense or whether it would be better to switch to more powerful LED lights right away. When answering this question, the focus should not be solely on the high efficiency of the LEDs but also on new control options and the most sustainable light source, daylight.

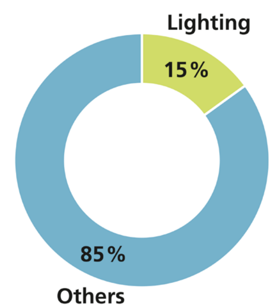
Download the LED Guideline for the Promotion of Lighting Retrofitting for free here.

*For more information, contact Jan de Boer, the Task Manager of SHC Task 70: Low Carbon, High Comfort Integrated Lighting.*




▲ **Factors influencing lighting and associated energy consumption.** [© Fraunhofer IBP]

**Global Electricity Energy Consumption**




"Solar use includes daylighting of buildings as well. With appropriate architecture and façade design, we can significantly cut down lighting's energy demands and carbon emissions. What can we do? Make sure to support legislative efforts that promote appropriate daylight use in the built environment. Specifically, make daylight-dependent lighting controls and facades with good over-the-year daylight vs. solar gain ratios mandatory."

JAN DE BOER
*IEA SHC Task Manager*

SOLAR ACADEMY SHC
FOR HEATING & COOLING IN BUILDINGS & INDUSTRY

# ECREEE Hosts Solar Training in Cape Verde

*The IEA Solar Heating and Cooling Programme (IEA SHC) has been working for a number of years to expand its membership beyond the OECD countries, as we believe that the challenges posed by the transition to a sustainable energy supply based on renewable energy can only be met in cooperation with all global players.*


▲ **Participants in the Solar Academy training.**

To better engage the Global South in our activities, IEA SHC cooperates with the Global Network of Regional Sustainable Energy Centers (GN-SEC) initiated by UNIDO. GN-SEC is an innovative south-south and triangular multi-stakeholder partnership to accelerate the energy and climate transformation in developing countries. To date, eight centers exist, each representing 10 to 15 countries.

In addition to SACREEE (responsible for Southern Africa) and RCREEE (responsible for North Africa and the MENA region), with which strong cooperation has existed for several years, the cooperation with the ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE) is now also being intensified. As a first step, on-site training for 27 West African experts was conducted within the IEA SHC Solar Academy framework on October 10-12, 2023, in Cape Verde.

▲ **Dr. Uli Jakob training on solar cooling.**

Since ECREEE had expressed particular interest in large-scale solar thermal systems for hospitals and tourism as well as solar cooling, the training focused on these topics. ECREEE was also interested in these topics because it is preparing a project for 15 West African countries to equip 150 hospitals with solar thermal systems. This training was a first step towards building this expertise.

By the end of this two-day training, the participants had a good overview of the possibilities of using solar thermal systems for heating and cooling, the dimensioning of these systems, and last but not least, the costs of such systems.

A bonus for the participants was the onsite solar thermal cooling system, which gave them a hands-on opportunity to see how a system works. CERMI (Center for Renewable Energy and Industrial Maintenance) installed the system with its 70 kW cooling capacity in 2013. The system, supported by a compression chiller, cools a conference room and other rooms in the building with chilled water. The collector field consists of flat plate collectors with CPC mirrors inside (PCP Power ST1), a model from the former Portuguese company MCG, and a 1,000-liter hot water tank and 500-liter cold water tank are used for energy management of the system.

▲ **Participants see first hand a solar cooling system at work.**

In addition to the technical training, participants discussed the possibilities for participating in IEA SHC Tasks. There was great interest in this because it is seen as an opportunity to build up knowledge through international cooperation and then implement this new knowledge in actual projects and buildings.

The IEA SHC trainers, Uli Jakob and Werner Weiss, see the training as an excellent first step in intensifying the cooperation between ECREEE and IEA SHC. Since the training, the first significant outcome is the submission of a concept note for a three-year project to the Steering Committee Meeting of the GN-SEC and presented to UNIDO in Vienna on November 8. If approved, the project will create a strong foundation for collaboration between ECREEE member countries and IEA SHC in the upcoming years.

*Article contributed by Werner Weiss, Austrian IEA SHC Executive Committee member and Chair of the SHC Solar Academy and Uli Jakob, Task Manager of IEA SHC Task 65: Solar Cooling for the Sunbelt Regions.*

Task 65

# Sunbelt Chiller – An Innovative Solar Cooling Adaption

## Technical Features and Life-Cycle Cost-Benefit-Analyses in Comparison to Double Effect Absorption Chiller

*In 2016, air conditioning accounted for nearly 20% of the total electricity demand in buildings worldwide and is growing faster than any other energy consumption in buildings. The main share of the projected growth in energy use for air conditioning comes from emerging economies. Recognizing this developing market, in July 2020, IEA SHC Task 65 on Solar Cooling for the Sunbelt Regions began its work on innovations for affordable, safe and reliable solar cooling systems for the Sunbelt region. The "innovation" is the adaptation of existing concepts/technologies to the Sunbelt regions using solar energy.*

Solar thermal-driven cooling systems can play an important role in decarbonizing cooling demand worldwide. Especially if, besides cooling demand, there is a demand for heating. One of the most widely used solar thermal cooling systems are two-stage absorption chillers (Double-Effect) powered by concentrating solar collectors. However, in regions like the SunBelt, with high ambient temperatures regularly above 30°C, these systems require a wet cooling tower. Often, in these regions, the availability of water is limited; therefore, wet re-cooling systems cannot be used (for regulatory or economic reasons).

To solve this problem, the Sunbelt Chiller (SBC) was developed within the research project "Solar thermal energy system for cooling and process heating in the Sunbelt region – SunBeltChiller (SBC)" (for more details, refer to SHC Task 65 report, Climatic Conditions and Applications.

The SBC is a modified Double-Effect (DE) absorption chiller. During the daytime, it can be re-cooled in the first stage at high temperatures of up to 90°C with a COP of 0.35 when ambient temperatures are high. The waste heat produced is stored in a hot water energy storage. In the second step, this heat is reused to run the SunBelt Chiller with a COP of 0.75 when ambient temperatures are lower (especially during nighttime) so that a dry cooling tower can be used. Depending on the application, using a cold storage is suitable to cover the cooling demand as required. In summary, this results in the following advantages of the SunBelt Chiller:

- No wet cooling tower needed.
- Reliable operation even at high ambient temperatures.
- High efficiency with an overall COP of up to 1.35.
- High solar cooling coverage reachable.

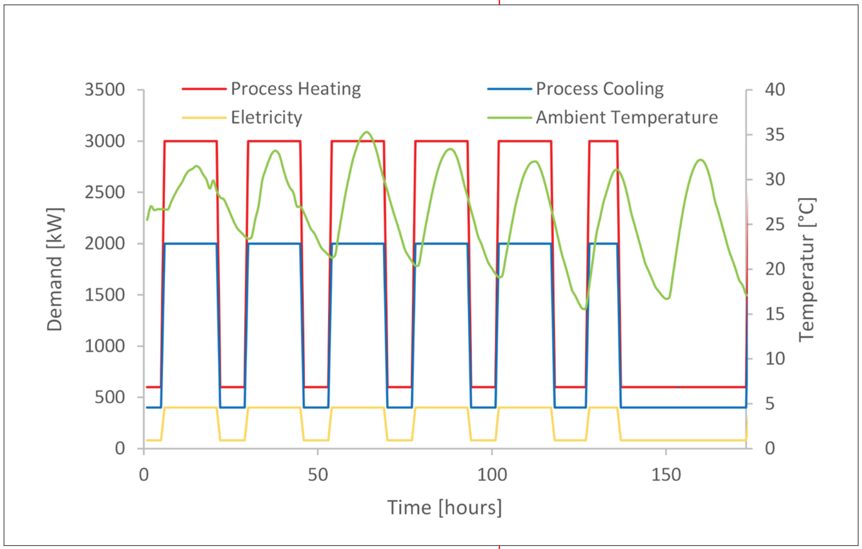
| | Fresnel Collector + DE Chiller | Fresnel Collector + SBC |
|---|---|---|
| **Energy demand** | | |
| Cooling demand | 10.955 MWh/year | |
| Heating demand | 16.433 MWh/year | |
| Electrical demand | 2.191 MWh/year | |
| **Technical parameters** | | |
| Fresnel peak power | 1.500 kW | |
| Nominal cooling power DE/SBC | 3.000 kW | |
| Cold storage size | - | 1.000 m³ |
| Hot storage size | - | 1.800 m³ |
| **Results** | | |
| Solar heating energy provided | 8.098 MWh/year | |
| Solar heating coverage | 49% | |
| Solar cooling energy provided | 1.701 MWh/year | 4.522 MWh/year |
| Electrical energy demand savings | 338 MWh/year | 864 MWh/year |
| Solar cooling coverage | 16% | **41%** |
| Reduction $CO_2$ emissions for cooling | 142 tons/year | 363 tons/year |
| Reduction electrical energy demand for cooling / Reduction $CO_2$ emissions for cooling | 13% | **34%** |

▲ **Table 1. Energy demand of the considered industrial applications, technical parameters of the DE and SBC, and results of the comparative study.**

*continued on page 9*

- Highly efficient heat supply at up to 90°C.
- Components are available on the market.

Within the research project, the SBC was evaluated using a comparative study between SBC and DE chiller (each equipped with a dry re-cooler) to assess the economic and ecological advantages. Both systems use concentrated solar collectors (Fresnel collectors) as a heat source to cover the heat requirements of the process and the chillers. To map the energy requirement, load curves for process heating (at 160°C), process cooling (at 6°C) and electricity, the example of an industrial process plant in Windhoek, Namibia, with a typical production cycle (two shifts during the week, rest day on Sunday) was used. The two solar cooling systems have the same installed collector peak power and nominal cooling capacity, but the SBC has hot and cold water storage. Key properties are summarized in Table 1.

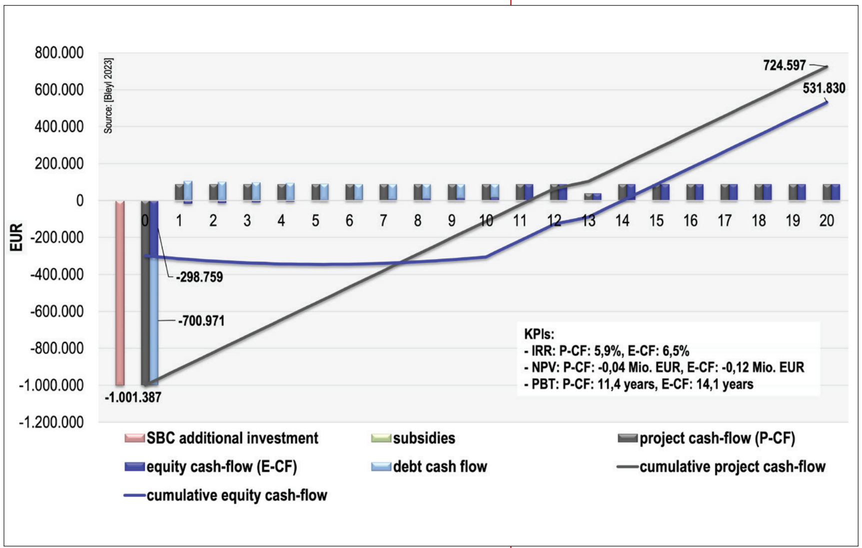



▲ **Figure 1. Plot of energy requirements of the industrial application and the ambient temperature over a week in Windhoek, Namibia.**

As shown in Table 1, both systems are reaching a high solar heating coverage of nearly 50%. However, the DE-Chiller can provide a solar cooling coverage of only 16% due to the limitation of the dry cooling tower operating at high ambient temperatures. SBC, on the other hand, achieves a solar cooling coverage of 41%, thus significantly reducing $CO_2$ emissions, 221 tons per year.

How does this translate into monetary terms? More precisely,

- What are the economic and financial implications of the additional investment for the SBC?
- How do the additional electricity savings calculated at 150 EUR/MWh impact the SBC business case?
- What would be the effect of an assumed carbon pricing at 90 EUR/ton $CO_2$?
- Does the project cash flow (CF) support debt service for a 70% loan at a 5% interest rate?




▲ **Figure 2. Investment project and equity cash flows (annual and cumulative), including carbon pricing at 90 EUR/ton $CO_2$.**

Life-cycle costs and benefits of the SBC business case are modeled over a 20-year project cycle, taking the standard Double-Effect solution as a reference case (baseline). The net CF accounts for revenues from electricity savings and all life-cycle costs (CAPEX, fixed and variable OPEX, as well as 5% re-investment budgets in year 13).

Based on the additional SBC investment cost of 1 million EUR, the project CF reveals a

*continued on page 10*

cumulative net surplus of 325,000 EUR after 20 years. Its internal rate of return (IRR) stands at 2.9% and has a dynamic payback period of 15.4 years, which would require very low expectations on the investor's side.

If carbon pricing at 90 EUR/ton $CO_2$ is included, the cumulative net surplus increases to 725,000 EUR with an IRR of 5.9% and a payback of 11.4 years, as depicted in Figure 2.

Regarding financing, the debt service for the 700,000 EUR loan can be covered from the net savings. After the 10-year loan repayment, the net surpluses accrue to the equity investor and amount to a surplus of 532,000 EUR with an IRR of the equity CF of 6.5%.

In conclusion, the SBC is one of only a few solar thermal cooling systems equipped with a dry re-cooling tower that can reach significant solar cooling coverage and $CO_2$ emissions savings despite high ambient temperatures. $CO_2$ savings are almost three times higher than a similar solar cooling system with a DE chiller.

Economically, the SBC investment still requires a long-term business case. Feasibility is greatly increased by a remuneration for avoided $CO_2$ emissions (and other 'Multiple Benefits' of reduced fossil fuel consumption).

It is also interesting to note that the SBC payback period is just 6 months longer than a standard DE solution (compared to a conventional compression chiller + natural gas heating solution). In any case, the availability of long-term and reasonably cheap (WACC (Weighted Average Cost of Capital) ≤ 6.5%) financing options is a key pre-requisite (as for many renewable, decarbonized supply options).

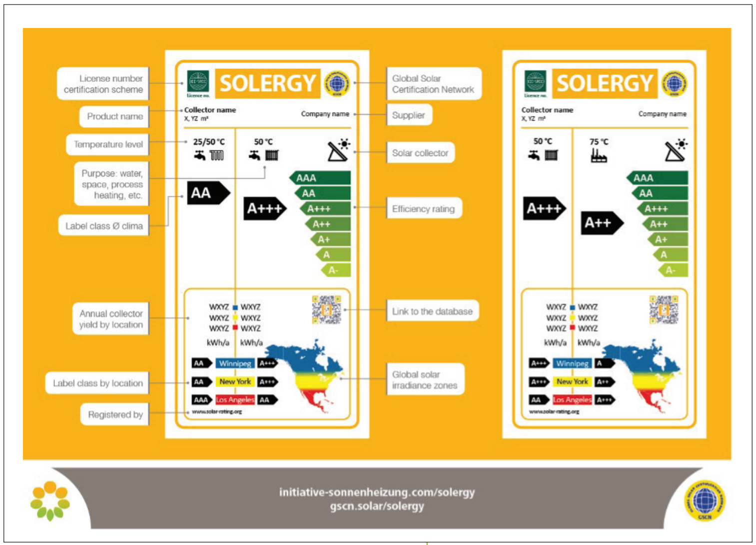
More technical design features and findings on the economic and financial life-cycle cost-benefit comparison of different electricity heating and cooling supply options will be published in an upcoming SHC Task 65 report (planned for January 2024). And, ZAE Bayern is currently setting up a laboratory system with a cooling capacity of approximately 50 kW to demonstrate the SBC. The next step will be a proof of concept at a larger scale (> 500 kW) under actual operating conditions.

*This article was contributed by SHC Task 65 experts Richard Gurtner, ZAE Bayern, Germany; Jan W. Bleyl, Energetic Solutions, Austria; Uli Jakob, energy research GmbH & Co. KG and IEA SHC Task Manager, Germany. If you are interested in learning more, please contact Uli Jakob, the Task Manager of SHC Task 65: Solar Cooling for the Sunbelt Regions, uli.jakob@drjakobenergyresearch.de, and visit the SHC Task 65 webpage.*

# Solar Thermal Collector Label Now Available in North America

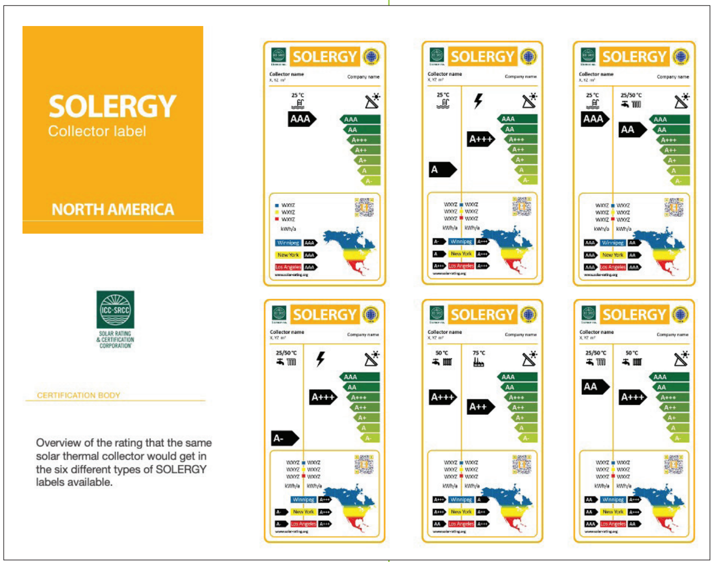
*The Solar Rating Certification Corporation (ICC-SRCC) and DIN CERTCO partnered to expand the SOLERGY label to North America. Since 2016, DIN CERTCO has been the designated certification body responsible for granting the SOLERGY collector label in Europe. The principal requirement to get the optional label is to have a valid Solar KEYMARK certificate. As of this October, 23 manufacturers and distributors of flat plate, evacuated tube, and PVT collectors have obtained and registered the SOLERGY label through DIN CERTCO.*

On September 26, 2023, a major milestone was achieved – the Solar Rating Certification Corporation (ICC-SRCC) of the United States formally announced the successful collaboration with DIN CERTCO to issue the SOLERGY label in North America.




▲ **The SOLERGY label helps consumers choose a sustainable and cost-effective solar thermal collector.**

The SOLERGY label joins the certifications and ratings of solar collectors that ICC-SRCC provides under the OG-100 program. Through the collaboration, manufacturers of solar thermal collectors can now apply to ICC-SRCC to obtain the SOLERGY label for any qualifying liquid-heating collector certified under the OG-100 program. ICC-SRCC then works with DIN CERTCO to develop the SOLERGY standardized performance ratings for North American climate zones and generate the SOLERGY consumer label. The label gives an easy-to-read performance rating ranging from A- to AAA, showing the energy produced per unit area for different climates in North America, including Mexico, the United States of America and Canada. It also references the ICC-SRCC OG-100 certification, which provides additional performance information and compliance with regional minimum durability and safety requirements.




▲ **Summary of the ratings assigned to a single solar thermal collector across the six distinct SOLERGY label categories.**

"We are pleased to be working with DIN CERTCO and the Solar Heating Initiative (SHI) to bring this product label to North America," says Shawn Martin, ICC-SRCC VP of Technical Services. "It can sometimes be difficult for consumers to appreciate the performance benefits that products like solar water heaters can bring. Tools like the SOLERGY label provide manufacturers with another option that works well with existing regional certifications like OG-100."

Ongoing collaboration between leading global solar thermal evaluation and certification bodies, like ICC-SRCC and DIN CERTCO, continues to yield benefits for manufacturers and consumers alike. "We are delighted to have found a great

*continued on page 12*

**SOLERGY** *from page 11*

partner in ICC-SRCC, with whom the label can grow beyond European borders. We are convinced that the label will bring a great benefit to North America," remarks Dr. Ina Förster, Product Manager at DIN CERTCO.

Decarbonization is a paramount concern for various sectors, encompassing multinational corporations, with more than two-thirds of energy consumption in the industrial domain being attributed to heating purposes. "The SOLERGY label serves as an effective instrument for effortlessly showcasing the core function and versatility of solar thermal collectors: supply of clean heat and performance according to climate zone and temperature level," states Marisol Oropeza of the Solar Hearing Initiative (SHI).

Implementing the SOLERGY label in further regions, such as Oceania and Africa, is planned as part of the activities to be performed in alliance with the Global Solar Certification Network (GSCN).

*This article was contributed by Marisol Oropeza, Solar Heating Initiative/Global Solar Certification Network, m.oropeza@solar-heating-initiative.com. For more information on the SOLERGY label, visit www.solar-heating-initiative.com/solergy/. For more information on the Global Solar Certification Network, visit www.gscn.solar.*

# Task 64

# Solar Thermal at Work

## Heineken Showcases Solar Thermal Potential with Innovative SHIP Project

*The inauguration of the 30 MW parabolic trough plant at the Heineken factory in Seville, Spain, on 30 September 2023 was exactly on time. The investor and plant operator Engie España had to put the plant into operation before the end of September to receive the extensive subsidy of EUR 13.4 million from the European Regional Development Fund. With its 30 MW, it is the largest solar industrial heat plant in Europe. It is followed by two flat plate collector fields – 10.5 MW in Nibbixwoud, Netherlands, for the Mol Freesia farm and 10 MW for Boortmalt´s malting plant in Issoudun, Southern France. A week after the inauguration, a group of experts from the IEA Solar Heating and Cooling Programme visited the enormous installation.*

"This flagship project opens doors to industries that until now did not believe it is worthwhile to look into solar heating technologies."

ANDREAS HÄBERLE

*Task Manager of IEA SHC Task 64 on Solar Process Heat*

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**Solar Thermal at Work** *from page 12*

“This flagship project opens doors to industries that until now did not believe it is worthwhile to look into solar heating technologies,” Andreas Häberle is convinced. He is Chair of the IEA SHC Task 64 on solar process heat, which organized the technical tour of Heineken’s SHIP installation. Engie España signed a 20-year heat delivery contract with the client. According to a press release sent out by Heineken Spain on the day of the inauguration, the solar heat from the parabolic trough field will cover 50% of the factory’s heat needs and deliver hot water at 210 °C and 25 bar to the energy grid of the manufacturing sight.

The Belgian turnkey SHIP project developer Azteq, with its German subsidiary Solarlite and Spanish office, played a pivotal role in designing and implementing the heat power plant. The construction was carried out in a record time of twelve months, far quicker than the initial forecasts, which were for almost double this period.

“This project could be replicated in any other industry that meets the requirements and needs heat for its processes. It also confirms the position of Spain as a pioneer country in the implementation of this kind of decarbonizing industrial heat initiative,” summarized Peter Vandeurzen, co-founder and Business Development Director of Azteq.

The facility has a number of special features:

- The parabolic troughs are identical in size and structure to those of large concentrating solar power plants for electricity production (12 m x 5.77 m).
- The major components – receivers and mirrors – were shipped from China; the entire installation work was carried out by an Andalusian company.
- The solar circuit is filled with pressurized water, thus avoiding the use of environmentally precarious synthetic oils.
- The storage volume consists of eight stratified, pressurized steel tanks with a total volume of 800 m$^3$.

“While the operation of large concentrating collector fields is well known from CSP plants, the integration of the eight large, pressurized water storage tanks is a milestone for solar process heat and is certainly an interesting area for further investigation,” commented Häberle after the technical tour. He also stressed the fact that the technicians from Heineken who led the tour were convinced of the technical maturity of the facility, which saves Heineken a lot of money.

| Site | Seville, Spain |
|---|---|
| Client | Beer brewer Heineken Spain |
| Aperture area of parabolic trough collector field | 43,414 m$^2$ |
| Thermal capacity of the parabolic trough collector field | 30 MW |
| Solar share of the total heat demand of the factory | > 53 % |
| Processes for which solar heat is used in the factory | Beer brewing (all heat-requiring processes) |
| Type of collector | HYT6000/SL5770 (size of CSP collectors 12 m x 5.77 m) |
| Estimated solar yield | 30,000 MWh/a |
| Specific estimated solar yield | 691 kWh/m$^2$ aperture area |
| Type and size of heat storage | Eight pressurized steel tanks with a total capacity of 800 m$^3$ (68.8 MWh) |
| Heat transfer fluid in solar field | Pressurised water |
| Range of operation temperature of the solar field | Up to 210 °C |
| Range of operation temperature of the client's heat network | 140 to 150 °C |
| Energy service company and owner of the SHIP plant | Engie España (Spain) |
| EPC for solar collector field | Azteq (Belgium) / Solarlite (Germany) |
| Duration of heat purchase agreement between Engie España and Heineken Spain | 20 years |
| Period of construction of SHIP plant | June 2022 to June 2023 |
| Total investment for SHIP plant including storage and installation | EUR 21 million |
| Specific investment costs | 484 €/m$^2$ aperture area |
| Total amount of subsidy | EUR 13.4 million |

▲ **Key figures for the solar industrial heat plant in Seville. The subsidy was provided by the European Regional Development Fund (ERDF) and managed by the Institute for Energy Diversification and Saving (IDEA)**
Source: Azteq / Solarlite

*continued on page 14*

## Heat Purchase Agreement for 20 Years

The contract between Heineken Spain and Engie España has different aspects. Engie is the investor of the EUR 21 million. Heineken Spain provided the 8 hectares of land for the parabolic trough collector field and the storage tanks. The companies agreed that Engie would provide completely renewable heat at a previously agreed price, and when the agreement is 20 years old, the solar thermal plant will become the property of Heineken.

▲ **Participants in IEA SHC Task 64 on Solar Process Heat tour the Heineken factory.** Photo: Alan Pino Araya / IEA SHC Task 64

The Heineken plant was built in an extremely short time of 12 months. “Such an extremely short construction period for an installation on a power plant scale was only possible thanks to the above-average commitment of all teams, both from the suppliers and the Azteq Group,” emphasized Joachim Krüger, CEO of Solarlite, Germany. “Our own supply chain and production capacity provide the security and delivery capability to execute projects in a short time.”

The land area requirement for this project was around 2,700 m$^2$/MW of installed solar thermal capacity, even including the large storage tank facility. “As there is usually a restricted availability of land around industrial companies, we arrange the rows of parabolic trough collectors as close to each other as possible. A rule of thumb here is two square meters of land area for one square meter of aperture area,” explained Krüger.

▲ **A high-ranking visitor from Madrid came to the inauguration - Pedro Sánchez, President of the Government of Spain (second from right). He is accompanied by Carmen Ponce, Director of Corporate Relations and Sustainability of Heineken Seville, and Loreto Ordóñez, CEO of Engie España (first and second from left in first row), as well as Etienne Strijp, President of Heineken Spain (on the right).** Photo: Heineken Spain

## 3.5 MW Linear Fresnel Field Under Commission at Heineken Factory in Valencia

The heat delivery contract takes Heineken Spain a big step further toward its internally set climate protection goals. According to a press release, Heineken aims for full decarbonization by 2025 and anticipates that by the end of 2023, renewable sources will provide 50% of its heat and electricity needs and then 62% at the end of 2024.

“At Heineken, we were pioneers in introducing sustainability in the beer sector more than two decades ago. Today we are again pioneers, with the help of Engie España, with this totally innovative project that positions Spain in a prominent place in the energy transition”, said Etienne Strijp, President of Heineken Spain, according to the press release.

Besides the SHIP system in Seville, Heineken lists a number of other renewable energy systems that guarantee the fulfillment of the targets. A 3.5 MW linear Fresnel system is being commissioned at the Heineken factory in Quart de Poblet in the province of Valencia. Here, the Spanish company CSIN is the turnkey supplier of the solar field and signed a steam purchase agreement with the client. Plus, a PV system was installed at El Andévalo in the province of Huelva, the production of biogas is planned at four factories in Spain, and the manufacturing site in Jaén will get a biomass boiler.

*This article was contributed by Bärbel Epp, editor-in-chief of solarthermalworld.org. For more information on SHC Task 64 visit the website, https://task64.iea-shc.org.*

Task 63

# 10 Questions on Solar Neighborhood Planning and Design Strategies

*10 key questions, 12 authors, and 2 years of drafting time led to a comprehensive paper on planning and design strategies for solar neighborhoods published in the journal Building and Environment. Maria Wall, the Task Manager of IEA SHC Task 63 on Solar Neighborhood Planning, spearheaded this initiative. "We worked hard to choose questions that have relevance not only for researchers but also for policymakers, practitioners, and urban planners," notes Wall. The idea for publishing a "Ten Questions" series was initiated in 2016 by the editors of Building and Environment.*


▲ **Visualization of the ten areas concerning solar neighborhood planning and design strategies treated in the Ten Questions paper.** Source: Paper, Building and Environment 246 (2023) 110946

What is a solar neighborhood? What are the passive and active solar strategies in solar neighborhoods? What are the challenges when implementing passive solar strategies into solar neighborhoods? What legislative agenda is needed to support solar neighborhoods? These are some of the questions raised and comprehensively answered in the paper.

The questions can best be answered by an interdisciplinary team. This is exactly where the strength of the IEA SHC Programme lies. For ten years, Maria Wall has led an international, multi-disciplinary research group on solar urban planning within IEA SHC. From May 2013 to April 2017, the activities ran under SHC Task 51 on Solar Energy in Urban Planning. Since September 2019, they have been part of SHC Task 63 on Solar Neighborhood Planning.

The question, how are passive and active solar strategies applied in solar neighborhoods? is answered in the paper with practical examples. SHC Tasks 51 and 63 experts describe planning and design strategies using detailed case studies. In the paper, five projects are illustrated: One Central Park in Sydney (Australia), West5 in London (Canada), Norwegian University of Science and Technology in Trondheim (Norway), Violino district in Brescia (Italy), and Science and Technology Park Adlershof in Berlin (Germany).

You can find factsheets for more than 30 case studies on a world map on the SHC Task 51 webpage, collected within the Task. The experts of SHC Task 63 will add around 20 new case studies to the map next year.

In the decade since 2013, there have only been a few occasions when a larger international group of IEA SHC solar urban planning experts have teamed up to write an interdisciplinary paper. The first was in 2019 as part of SHC Task 51, titled "A cross-country perspective on solar energy in urban planning: Lessons learned from international case studies," which is also available in open access: https://doi.org/10.1016/j.rser.2019.03.041.

However, the Ten Questions paper is a special case in its overarching content, according to Maria Wall. "We have summarized experiences and findings from more than ten years of international research in this paper and quoted more than 200 references", she said. "The writing process was really a great experience since we learned a lot from each other and got different perspectives on our work."

For the first time, this paper introduces a novel classification for solar neighborhoods, which consist of neighborhoods primarily using solar energy as a renewable energy source. The four categories are the pure (or target-free) solar neighborhoods, the energy-centered solar neighborhoods, the carbon-centered solar neighborhoods, and the energy- and carbon-centered solar neighborhoods. Furthermore, the answers to the ten key questions pinpoint the knowledge gaps in solar neighborhood design and provide insights into future research trends in this field.

You can download the Ten questions concerning planning and design strategies for solar neighborhoods paper, here.

*To learn more about the SHC Tasks on this topic, visit SHC Task 51 and SHC Task 63. If you have questions, contact the Task Manager of both these Tasks, Maria Wall, at maria.wall@ebd.lth.se.*

# New Work

## In the Pipeline

*Two projects are under development and scheduled for approval at the June 2024 IEA SHC Executive Committee. Interested in joining? If from an IEA SHC member country, you are welcome to join the planning stages, simply contact the Task Organizer.*

### Solar Cooling for Emerging Economies

Building off the current Task on Solar Cooling for the Sunbelt Regions, this proposed new project aims to demonstrate the potential for sustainable and efficient heating/cooling solutions as a system approach for industrial applications in Southeast Asia, the Pacific region, and African and South American countries. The work will also focus on thermal energy storage and industrial waste heat recovery. The cooling and air conditioning systems included will range from 2 kWr to 5,000 kWr and use both solar thermal and photovoltaic (PV) technology as both can deliver efficient heat and cold combinations for industrial applications, including agri-food, manufacturing, and tourism.

The primary target audience of the new project are energy consultants, planners, project developers, energy managers, plant manufacturers, solar thermal collector manufacturers, solar cooling turnkey providers, and chiller producers using natural refrigerants but also investors and financing bodies, especially but not only from the regions mentioned above. These stakeholders are invited to help strengthen the proposed Task work to demonstrate sustainable and efficient heating/cooling solutions in industry.

There is still time to participate in this exciting and important work.

*The next meeting will be in conjunction with the April 2024 ISEC conference in Graz, Austria. To learn more about the proposed project and how to join, contact the Task Organizer, Uli Jakob, at uli.jakob@drjakobenergyresearch.de.*


**Solar cooling system at Camp Castor in Mali. The system uses 700 m2 of vacuum tube solar collectors to drive an absorption chiller with a 348 kW cooling capacity to provide AC to a cafeteria and kitchen. Photo credit: Frank Molter, SolarNext**

### Energy Carriers from Solar Powered Reactors

Fact – Decarbonization requires a change in our energy supply and hybridization. Green fuels will and can meet industrial energy demand (e.g., hydrogen and in combination with $CO_2$ energy carriers (e.g., methane, methanol, ethanol). But, today, e.g., 99% of $H_2$ for industrial use is from non-renewable energy sources![1]

That is what one would call an untapped potential for solar reactors. The demand for "green" energy sources is increasing, and using the sun to produce them is a win-win.

This proposed project would work on technologies to use solar radiation to produce $H_2$ and other fuels via photothermal, photocatalytic, and photo-electrochemical processes. The work would

*continued on page 17*

**In the Pipeline** *from page 16*

be divided into three areas: 1) materials and component development, 2) reactor design, and 3) system integration.

If you want to be part of this expert exchange network on Solar Fuels, join us in our shared efforts to realize the use of sunlight for novel fuel production.

*The next meeting is on April 9, 2024, in Graz, Austria, one day before the ISEC 2024 conference on April 10-11. To learn more about the proposed project and how to join, contact the Task Organizer, Bettina Muster-Slawitsch, at b.muster@aee.at.*

▲ **Solar reactors using solar radiation for the production of H2 and other fuels via photo processes.**

# SHC Publications

## New Publications Online!

You won't want to miss our new reports highlighted below. You can read them online or download them for free. Our complete library of publications – online tools, databases, and more – dating back to the start of the SHC Programme can be found on the IEA SHC website under the tab "Publications" or under a specific Task.

## Solar Cooling for the Sunbelt Regions

### *Building and Process Optimization Potential*

An overview of the SHC Task 65 work on the potential of energy-efficient buildings and processes for new and existing buildings in Sunbelt regions is described in this report. Several projects are used to quantify the amount of energy used for cooling systems, and results from a literature review highlight different passive and active low-tech solutions to optimize the energy performance of a building.


### *Design Tools and Models*

This report summarizes the work completed on reviewing and adapting tools and models for technical and financial assessment, solar cooling design, and project phases from pre-feasibility to simulation to monitoring.

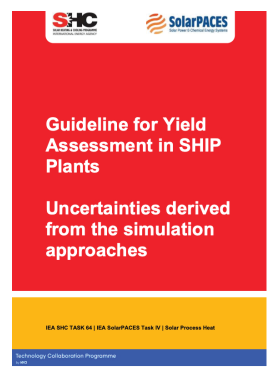
### *Lessons Learned (technical and non-technical)*

In this report, discover key insights on solar cooling adoption across diverse regions and review the survey results on stakeholders' requirements, expectations, and circumstances.

## Solar Heat Processes

### *Guideline for Yield Assessment in SHIP Plants*

Four case studies are used in this report to compare solar collectors using different simulation tools to identify differences and impact on the leading performance indicators.



# IEA SHC programme

The International Energy Agency was formed in 1974 within the framework of the Organization for Economic Cooperation and Development (OECD) to implement a program of international energy cooperation among its member countries, including collaborative research, development and demonstration projects in new energy technologies. The members of the IEA Solar Heating and Cooling Agreement have initiated a total of 68 R&D projects (known as Tasks) to advance solar technologies for buildings and industry. The overall Programme is managed by an Executive Committee while the individual Tasks are led by Task Managers.

**Follow IEA SHC on**

## SOLAR UPDATE

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by
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