SOLARUPDATE

VOL. 71 | JULY 2020

Newsletter of the International Energy Agency Solar Heating and Cooling Programme

SHC
INTERNATIONAL ENERGY AGENCY
Solar Heating & Cooling Programme

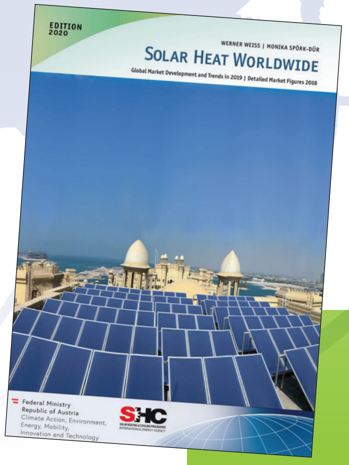
#SolarHeat
#SolarThermal
#SolarProcessHeat
#SolarCooling
#SolarDistrictHeating

In This Issue

www.iea-shc.org

Solar Heat Worldwide 2020

Megawatt Installations on the Rise

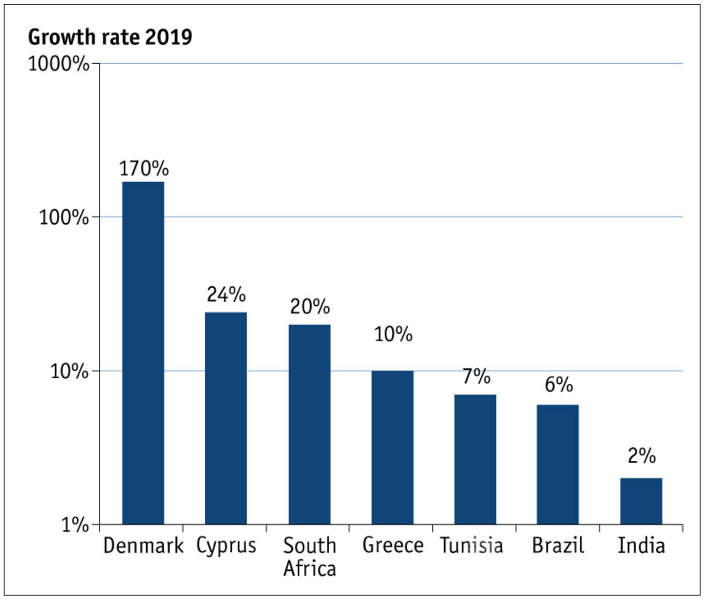


Solar thermal for district heating is on the rise worldwide. In Denmark, where the market grew by about 170% in 2019, and other countries like China and Germany, this rise is primarily due to advances in cost competitiveness. Also, driving this growth is the rising demand for industrial and agricultural applications. While residential water heating systems, the largest market sector, were under pressure in China and Central Europe from competing technologies, residential sales increased significantly in South Africa, Greece, Cyprus, and Brazil.

Highlighted below are some findings from this year's report, Solar Heat Worldwide 2020. You can download the full report for free on our website.

Shifting Global Markets

The market for new installations once again varied by country, with shrinking volumes in large markets like China, the USA, Germany, and Australia. Driven by the decline in new collector installations of about 8% in China, the worldwide market shrank approximately 6% in 2019 compared to 2018. On the flip side, Denmark reported another banner year with a 170% growth rate, followed by Cyprus, South Africa, Greece, Tunisia, Brazil, and India.



▲ **Positive trend: Increasing sales in major solar thermal markets in 2019.**
Source: Solar Heat Worldwide 2020

SHC Members
AUSTRALIA
AUSTRIA
BELGIUM
CANADA
CCREEE
CHINA
DENMARK
EACREEE
ECI
ECREEE
EUROPEAN COMMISSION
FRANCE
GERMANY
ISES
ITALY
NETHERLANDS
NORWAY
PORTUGAL
RCREEE
SACREEE
SLOVAKIA
SOUTH AFRICA
SPAIN
SWEDEN
SWITZERLAND
TURKEY
UNITED KINGDOM

continued on page 2

Solar Heat Worldwide 2020 *from page 1*

Large-scale Solar Systems

Megawatt installations are on the rise. In 2019, a record number – 74 new large-scale systems (>350 kWth, 500 m²) – was commissioned for district heating networks and large buildings. Bringing the total number of installations to 400 large solar thermal systems in operation with a total capacity equal to 1.62 GWth and 2.3 million m² of installed collectors.

Solar Heat for Industrial Processes

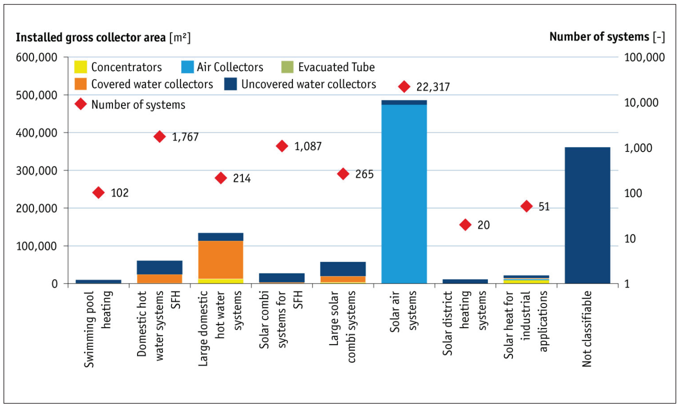
As of early 2020, 800 solar process heat plants with a collector area of 1 million m² were installed worldwide.

Two new applications in this sector worth highlighting are solar heated greenhouses, which include systems ranging from 126 m² collector area to just over 14,000 m², and solar heated gas pressure control systems, which use solar to heat natural gas at gas pressure regulation stations during pipeline transportation, an interesting niche application being used in several systems in Germany.

Heat and Electricity from the Same Roof

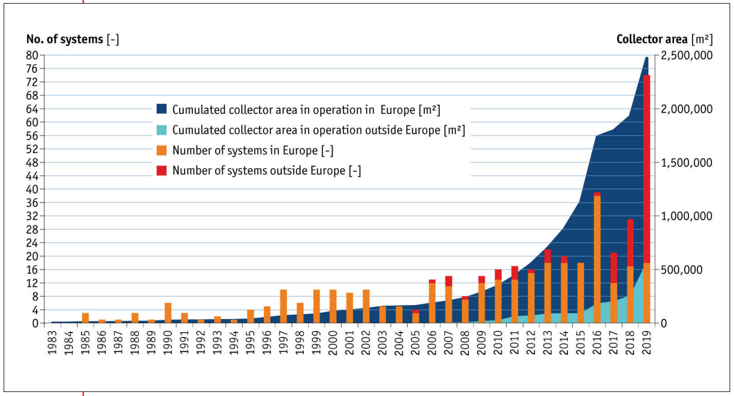
For the second time, Solar Heat Worldwide carried out a market survey among PV-Thermal (PVT) collector manufacturers. A PVT system is unique in that it combines the production of both types of solar energy – solar heat and solar electricity, thus reaching higher yields per area. This application is particularly valuable when the available roof area is limited, but a climate-neutral energy supply is wanted.

The PVT market is gaining momentum in several European countries and represents 58% of the global installations, of which 41% are in France. Asia, excluding China, follows with 24% of the installations and then China with 11%. Total PVT capacity by the end of 2019 reached 606 MWth, and the PV power was 208 MWpeak worldwide, an increase of 9% compared to the end of 2018.



▲ **PVT systems in operation by application, collector type and collector area at the end of 2019.** (Source: SHC Task 60 survey, AEE INTEC)

continued on page 3



▲ **Large-scale systems for solar district heating and large residential, commercial and public buildings worldwide – annual installations and cumulative area.** (Data Source: Daniel Trier (PlanEnergi, Denmark), Jan-Olof Dalenbäck (Chalmers University of Technology, Sweden), Sabine Putz (SHC Task 55, Austria), Bärbel Epp (solarthermalworld.org, Germany)

▲ **The world's largest solar process heat plant Miraah in Oman was significantly enlarged in 2019 and now has an installed capacity of 300 MWth.** Photo: GlassPoint Solar, Inc.

▲ **A 6.5 MWth collector field heats a greenhouse in Heerhugowaard, the Netherlands.** Photo: G2 Energy

Solar Heat Worldwide 2020 *from page 2*

▲ **Brazil's Minha Casa, Minha Vida social housing programmes included installing around 400,000 thermosiphon systems.** Photo: Tuma

Small-scale Solar Thermal Heating Systems

Systems that provide hot water and heating in residential and public buildings, as well as hotels and hospitals and public buildings, represent around 60% of the newly added systems. A key point to note is that significant market growth occurred mostly only in those countries with market sales dominated by small-scale systems (in particular thermosiphon systems). The report shows that national social housing programs linked with the installation of solar water heating systems have a very positive impact on market development.

Quick Stats

Total Capacity

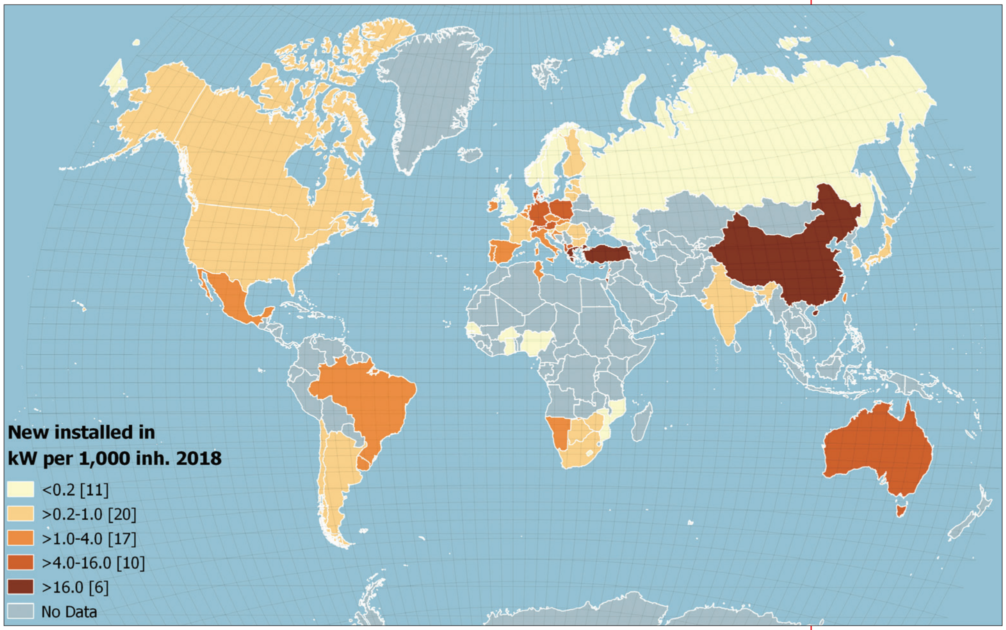
- 479 GWth (684 million square meters of collectors) = cumulated solar thermal capacity in operation at the end of 2019.
- 389 TWh = solar thermal energy supplied in 2019.

Market Growth

- Top markets in 2019 = Denmark (170%), Cyprus (24%), South Africa 20%, Greece 10%, Tunisia (7%), Brazil (6%), and India (2%)

New Capacity

- 33.5 GWth = new installed capacity in 2018. Once again, led by China (24.8 GWth) and Europe (2.9 GWth), which together accounted for 83% of the total new collector installations.



▲ **New installed capacity in kWth per 1,000 inhabitants in 2018.**

Environment

- 389 TWh solar thermal energy yield correlates to a savings of 41.9 million tons of oil and 135.1 million tons of CO2. Fun fact: the CO2 savings are 3.5 times the annual CO2 emissions of Switzerland.

Jobs

- 650,000 = estimated number of jobs (production, installation, and maintenance) in 2018
- 15.4 billion (US$16.9 billion) = worldwide turnover of the solar thermal industry in 2018

Applications

- Domestic hot water systems = most common application at 53% of total capacity and 33% of new installations in 2018 – a downward trend.
- Large-scale domestic hot water applications = 37% of total capacity and 60% of new installed capacity – an upward trend. The reason for this uptick is attributed to it taking over some of the market shares for swimming pool heating and domestic hot water heating in single-family houses.
- Two other applications to note are solar district heating and solar process heat, both of which are steadily increasing although still only represent 3% of the global market.

continued on page 4

"It's true that solar thermal is going through challenging times, but it is important to note that this is mainly due to declines in the Chinese market. But despite this trend, solar thermal is experiencing steady growth in two key sectors – district heating and industrial processes. Plus, solar heating and cooling technologies will always have a positive impact on climate protection,"

DANIEL MUGNIER, *IEA SHC Chairman*

Top 10

Top 10 Markets in 2018 (in MWth)	**Top 10 Markets per 1,000 inhabitants in 2018** (in kWth)
China 24,801	Israel 35
Turkey 1,316	Cyprus 32 ^
India 1,252 ^	Barbados 29 ^
Brazil 875	Greece 22 ^
United States 623	China 18
Australia 408	Australia 17
Germany 401	Turkey 16
Israel 291	Denmark 9 ^ *
Mexico 284 ^	Austria 8
Greece 230 ^	Palestinian Territories 7

^ denotes increase from 2017
* not on the list in 2017

Top 10

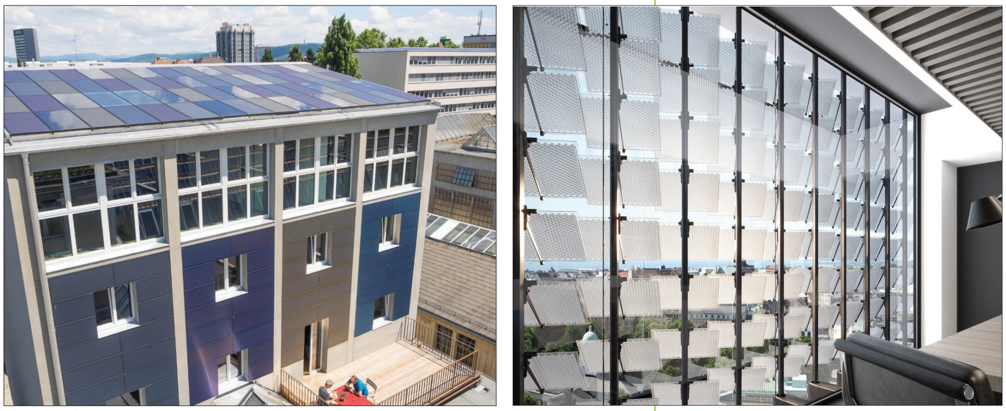
Total Installations in 2018 (in MWth)	**Total Installation per 1,000 inhabitants in 2018** (in kWth)
China 337,816 ^	Barbados 565 ^
United States 17,935 ^	Cyprus 446 ^
Turkey 17,596 ^	Austria 408
Germany 13,877 ^	Israel 398 ^
Brazil 11,258 ^	Greece 309 ^
India 9,457 ^	Palestinian Territories 271 ^
Australia 6,451 ^	Australia 261
Austria 3,583	China 244 ^
Israel 3,351 ^	Turkey 217 ^
Italy 3,305 ^*	Denmark 202 ^

^ denotes increase from 2017
* not on the list in 2017

You can read the full report on the IEA SHC website, http://www.iea-shc.org/solar-heat-worldwide.

Building Integrated Solar Envelopes: Current Status and Actions Needed

The objective of our Task on Building Integrated Solar Envelope Systems for HVAC and Lighting was to answer how solar envelope systems can become common practice in building construction. The SHC team that tackled this challenge was a group of experts from eight countries representing seven companies, six universities, and four research institutes. How they went about it was to tackle the issue from different angles – simulation of multifunctional envelope systems, review of laboratory tests and norms, and market assessments. The following is what they concluded needs to be done and by whom to push this technology further into the building market.



▲ **Figure 1. Examples of solar envelope systems described in SHC Task 56 report, State-of-the-art and SWOT analysis of building integrated solar envelope systems. On the left, Kromatix BIPV panels (photovoltaics, Swissinso). On the right, Lumiduct (photovoltaics and shading system, TUe).**

Decarbonization of the heating and cooling sector in buildings is one of the main challenges to reduce greenhouse gas emissions and achieve the Paris Agreement objectives. The transformation of the current building stock into net-zero or positive energy buildings requires investing in energy efficiency to lower buildings' overall energy demand and to replace fossil fuel energy sources with renewables. The exploitation of a locally available renewable source, such as solar energy, is not only desirable to reduce the import of high primary-energy carriers on-site but also needed for the reliable and resilient operation of electric grids.

Building integrated solar envelope systems for HVAC and lighting offer a promising solution to this challenge. On the one hand, they can improve daylighting and control solar gains, hence reducing the building's electrical and thermal energy needs. On the other hand, a share of the building's residual energy demand can be covered by harvesting, storing, and distributing the solar radiation reaching the building façade.

Current Status

Solar envelope solutions cover a rather broad range of technologies, but there are two main market segments. The first relates to solutions that control incoming solar radiation. Innovative solutions, such as motorized shadings or electrochromic glass, have a place beside traditional shading devices, such as shutters, blinds, and curtains, which already have a well-established market in the residential and tertiary building sectors.

The second market segment relates to solar harvesting technologies – building integrated photovoltaic panels, solar thermal collectors, and PVT collectors. These systems are a niche market, despite the large number of building integrated photovoltaic products reaching the market in the last years.

Several challenges hindering the penetration of innovative solar envelope systems in the construction market are:

- The design, manufacture, and installation of these systems are usually more complex and time-consuming compared to conventional cladding solutions.

continued on page 6

▲ **Figure 2. Examples of solar envelope systems described in IEA-SHC Task 56 Deliverable DA1+2. From left to right, Okalux Okasolar 3D (shading system, Bartenbach), Kindow (shading system, Kindow & TUe), and SunRise façade (solar thermal system, Eurac Research).**

- The legal liability for correct installation and operation, warranties, and maintenance must be cleared and planned before installation.
- The compliance with both construction codes and energy-related norms is required; the lack of consolidated international standards and test methods devised for building integrated components may deter planners, investors, and clients from adopting these technologies.
- The need for adequate design tools to estimate energy performance and architectural impact during the initial concept design.

Actions Needed

Manufacturers

To overcome such barriers and better promote the use of solar energy in buildings, manufacturers and policymakers need to take action. Industry should work in the direction of offering **systemic design and construction packages**, which would support the adoption of solar envelope systems in the building design phase. Also, this action could generate new business opportunities based on innovative partnerships, business models, and financing schemes. Prefabrication and plug-and-play design could also simplify the manufacturing and installation stages.

The **value propositions of solar envelope systems** should be reframed to avoid single-selling point market strategies (e.g., based on energy savings only). Instead, a broader, systemic perspective should be adopted that takes into account the impact of the solutions on sustainability protocols (e.g., LEED and BREEAM), higher property values, reduced impact on the grid and user comfort and wellbeing. User and human-centric solutions can be strong "go to market" strategies.

Manufacturers should provide **life-cycle cost and risk assessments** that are adapted to their markets and customer needs and account for commodities prices, incentives, norms, and legal frameworks.

Another important lesson is that a **customizable architectural appearance** is key to enter the construction market. There is no general rule of what is preferred by architects, public authorities, building owners, or occupants; thus, manufacturers should offer aesthetically flexible solar envelope systems to comply with specific architect requirements.

Policymakers

For policymakers, they should work to **harmonize regulations for building integrated products**, which may require higher level or country-specific legal approvals, thus creating a significant market-entry barrier for manufacturers. Policymakers should

continued on page 7

Integrated Solar Envelopes *from page 6*

CHALLENGE	ACTION NEEDED
A large number of actors are involved in manufacturing, planning and installing solar envelope systems	To offer systemic design and construction packages
The construction market is often unaware of the potential of solar envelope systems	To promote professionals training To elaborate on new “user-centric” value propositions: • to provide LCC and risk assessment • to provide information for sustainability protocols • to provide information on user comfort and wellbeing
Architectural integration is not easy, but it is key for acceptance	To offer customizable architectural appearance
The regulatory framework is often unclear with respect to building integrated technologies.	To implement a normative framework facilitating the integration of solar technologies in the construction sector, as uniform and international as possible
Current regulations can be a barrier to the foundation of energy-sharing economies	Improve the regulations to ease the implementation of energy communities
Early-stage assessment of solar envelope technologies is crucial, but there is a lack of tools	To support the development of tools, like 3D solar cadasters, to evaluate the solar availability on façades
The construction sector is conservative and innovative solutions can hardly penetrate the market unless a proven record of installations is available	To promote pre-commercial-procurement demonstration projects in public buildings To devise administrative and legal procedures promoting private-public investment initiatives

address this obstacle by defining and enforcing a regulatory framework that is as uniform and international as possible.

At the same time, current regulations on energy communities can be an obstacle to sharing locally produced energy among neighboring buildings, thus devising legal frameworks that allow the **practical implementation of energy communities** can make the needed difference.

Moreover, **public support of solar envelope systems** should not be limited to the mere deployment of incentives supporting specific technologies. Instead, public support should be considered the elaboration of an integrated framework of measures that creates a level playing field with conventional solutions. This could include developing practical tools like 3D solar cadasters to assess the solar source availability on building façades, devising pre-commercial procurement demonstration projects, or using administrative and legal procedures to promote public-private joint investment initiatives.

This article was contributed by Roberto Fedrizzi of Eurac Research and the Operating Agent of SHC Task 56. You can learn more about this work and download the free reports, tools and Technology Position Paper from the Task webpage, https://task56.iea-shc.org/.

INTERVIEW

Building Integrated Solar Envelopes

Interview with Roberto Fedrizzi

The SHC Programme finalized its work on Building Integrated Solar Envelope Systems for HVAC and Lighting (Task 56) this month. To learn first-hand of the Task's impact on buildings, we asked Roberto Fedrizzi, the Task Operating Agent, to share some of his thoughts on this 4-year project.

Why is a project like this needed?

Roberto Fedrizzi (Roberto): Projects like this SHC Task are needed because they push industry and researchers to focus on topics relevant for the energy transition and foster advances in energy technologies, be it solar envelope systems or other technologies. Plus, the experiences and knowledge shared in this cooperative environment allow participants to look at the same problem with new eyes.

What is the current status of the technology?

Roberto: Building integrated solar envelope systems are increasingly entering the construction market, but we are not there quite yet. The integration of active components such as photovoltaic panels and solar thermal collectors still represents a niche market. The notable exception here is shading devices, which have a well-established market in the residential and tertiary building sectors. The construction sector is experiencing a drift towards industrialization, and building integrated solar envelope systems will likely gain shares of the market thanks to joint ventures between innovative companies and new business models oriented to offer systemic design and construction packages.

Is there one result or outcome that surprised you?

Roberto: Innovation is not only about brand-new concepts. There is also a lot going on in the improvement of traditional solutions, for example, blinds, roller shutters, and textile screens. Here, we've seen advances in the shapes of slats, the use of retro-reflective surfaces, and the integration of PV and solar thermal elements, and lastly, motorization.

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

Roberto: SolarWall from Canada has been working with much success for more than three decades, with millions of square feet of SolarWall air heating systems installed across the globe. Two years ago, the company established a strategic collaboration with a large Chinese manufacturer, which gives more reasons for the hope that this technology will have a bright future. This is proof that despite all the challenges, with good ideas and determination, it is possible to upscale the market and have a significant impact.

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

Roberto: A cooperative environment, like the one found in SHC Tasks, is key to addressing issues with open minds and a constructive attitude. Sharing ideas with colleagues with diverse working and cultural backgrounds on common topics not only enriches personal views but also effectively improves the know-how. What is really important is that the Task results do not stay within the group of experts, but are widely disseminated to target stakeholders.

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

Roberto: The technology of solar envelope solutions is progressing toward intrinsically systemic solutions that are designed for multifunctional performance. Prefabrication and integral design of solutions into construction packages will play an important role in this process. This market is still vastly unexplored so there is a large potential for creating fruitful and innovative businesses. The scaling up to a mass-market could be accelerated by the actions of policymakers to harmonize building codes and make energy communities a reality since this is believed to require maximizing the surfaces available to capture solar energy.

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

Roberto: Having a project such as this in the framework of IEA SHC Tasks guarantees the availability of a support network that can assist the project in various steps, such as dissemination and communication activities and review of outcomes. The name itself, SHC Tasks, is synonymous with high-quality work and results and prompts experts and external partners to participate and contribute to activities with enthusiasm.

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

Roberto: SHC Task 56 has come to an end, but several other Tasks are active in this area, among which is SHC Task 63 on solar neighborhood planning, SHC Task 60 on the application of PVT collectors in HVAC systems and IEA PVPS Task 15 on BIPV systems. There is still a lot to do though so the Task experts compiled a list of topics that either other SHC Tasks or a new Task should take on.

OPINION

Optimism for Solar Beyond the Great Lockdown

Dr. Richard Hall, a Vice Chair of the Solar Heating and Cooling Programme, discusses ways in which the lessons from solar power could help bring the decarbonization of heating and cooling back on track.

I write this opinion piece on Sunday the 26th of April 2020, a day when the death toll from the novel coronavirus has reached 200,000. Whilst the situation is starting to stabilize in many parts of the world, the severe impact of the COVID-19 pandemic on both public health and the economy is something that we will all be dealing with for many years to come.

2020 was meant to be a year of optimism; a seminal year when policy makers from across the world came together to present their ambitious new commitments to meeting the emissions targets agreed in Paris in 2015. But with the necessary reallocation of government resources to dealing with the immediate public health crisis, along with the need for social distancing, the 26th UN Conference of the Parties (COP26) has been postponed until 2021. In the face of postponement, however, the UN Climate Change Executive Secretary, Patricia Espinosa, has a clear message for policy makers: "we cannot forget that climate change is the biggest threat facing humanity over the long term".

You may think that the postponement of the crucial COP26 meeting and the almost certain likelihood of severe, pandemic-induced, global recession would be a time for absolute despair for the solar heating and cooling sector, but I want to make the case for optimism. This is not blind optimism, but evidence-based optimism, built on an understanding of how solar power has developed over the last decade to become astonishingly inexpensive. I want to make the case that if policy makers are smart about the way they direct public finances in post-COVID economy stimulus packages, that the 2020s could be the decade when solar heating and cooling also became astonishingly competitive.

"...the 2020s could be the decade when solar heating and cooling also became astonishingly competitive."

Solar Power and the Great Recession

The story of solar power over the past 10 years has been one of dramatic cost reduction and significant deployment growth, with solar power going from a relatively standing start, to overtaking solar heat in installed capacity. This was not an accident. Prior to 2010, solar power was dominated with what has been affectionally described as 'scrappy start-ups', many of them founded into the early 2000s and self-financed. At this time, solar power was relatively expensive, but there was a solid niche market for roof-top solar power in countries like Germany, which had introduced generous and robust demand incentives. Growth in deployment was rising steadily. And then, in 2009, the Great Recession hit the world economy, threatening the existence of the emerging solar power sector.

This could easily have been the end of solar power. But various states, identifying the importance of solar power in solving the climate crisis, declared it a 'strategic emerging sector. They acted robustly, championing the sector and suppling it with multi, 100 million plus, stimulus packages, to ensure that it stayed on track. These stimulus packages included demonstration programs, strong support loans from banks and generous Feed-in-Tariffs (FITs) to stimulate demand. For example, the United Kingdom (UK) introduced a robust FIT that enabled solar power installations to go from virtually zero in 2010, to almost 1,000,000 by the end of the decade. Countries which

continued on page 10

Covid-19 *from page 9*

identified solar as strategically important are now reaping the rewards, with the solar power sector employing over 3.4 million people worldwide, and supporting hi-tech innovation and manufacturing. As well as being a buoyant economic sector, the power sector is now almost on track to decarbonize in line with the Paris Agreement; although a lot of hard work is still needed to get there.

The Case of Optimism

The progress made on solar power since the Great Recession gives us a model by which to decarbonize the heating and cooling sector following the Great Lockdown. As during the Great Recession, policy makers are now in the process of devising huge stimulus and recovery packages to restart their economies. There will be fierce debate over the coming months about the best ways to direct public finances to stimulate economies. But based on the World Bank sustainable recovery checklist and comments from the UN Climate Change Executive Secretary, sustainable stimulus packages are likely to:

1. Be labor-intensive and shovel-ready (begin quickly), to create decent jobs in the short term.
2. Stimulate inclusive employment across widespread geographies, to ensure the effects of the stimulus are felt across nations.
3. Lead to deep decarbonization of sectors of economies that are not already on-track to meet the Paris Agreement commitments.

There is a strong argument to be made that supporting the solar heating and cooling sector during this recession would meet the requirements of a clean and resilient recovery. In addition, the new International Renewable Energy Agency (IRENA) Global Renewables Outlook provides a persuasive argument that stimulating the renewables sector is both good for the environment and provides a substantial boost to the economy, with every £, €, $ or ¥ spent bringing returns of between three and eight £, €, $ or ¥.

Lessons for the Decarbonisation of Heating and Cooling

Based on the impacts on the solar power sector of the various stimulus packages released following the Great Recession of 2009, we can suggest the following for post-COVID-19 solar heating and cooling stimulus packages:

1. States must identify the solar heating and cooling sector as one of strategic importance and act as a champion for the sector.
2. States must extend and introduce new policies that simultaneously stimulate demand for both centralized, low-carbon, large-scale generation (solar heat networks for deep decarbonization) and small-scale, energy efficiency (roof-top solar for mass-scale distributed employment).
3. States must support manufacturers with finance to set-up and expand highly automated turnkey manufacturing facilities.

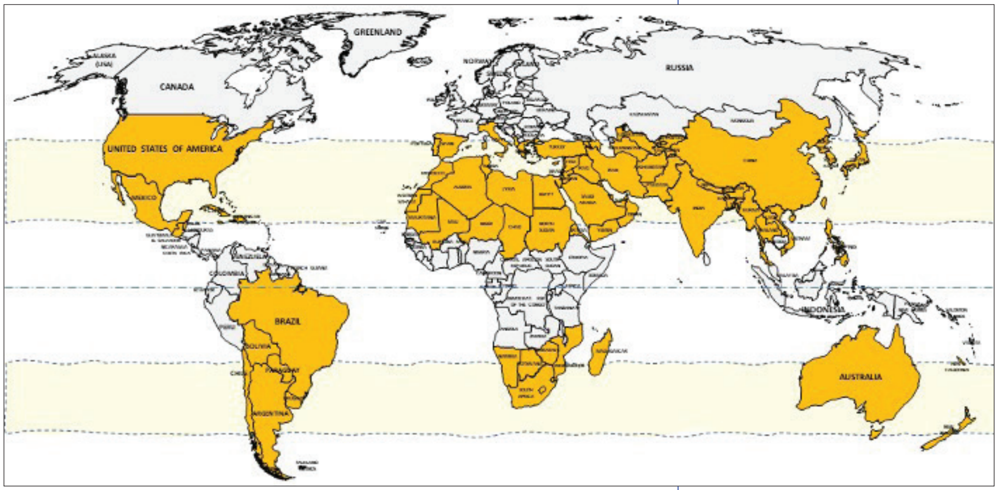
The historic evidence from the solar power sector strongly suggests that the decisions made now by policy makers will determine whether the decarbonization of heating and cooling is on-track to meet the Paris Agreement commitments in 2030. As members of the IEA Solar Heating and Cooling Programme, we are uniquely positioned to support policy makers in developing high quality stimulus packages to support a clean and resilient recovery. With COP26 just around the corner and sustainable stimulus packages in the making, there has never been a better time to create an environment conducive to getting the solar heating and cooling sector back on-track.

Task 65

New Solar Cooling Project

The new project, Task 65: Solar Cooling for the Sunbelt Regions, builds upon our past four solar cooling Tasks. This Task will be different in that it focuses on innovations for affordable, safe, and reliable solar cooling systems in sunbelt regions. The primary driver for continuing this work is that air-conditioning accounts for nearly 20% of the total electricity demand in buildings worldwide and is growing faster than any other energy use in buildings. If measures are not taken to counteract this increase, the demand for space cooling will almost triple by 2050, with estimates reaching 6,200 TWh or 30% of the total electricity use in buildings.

The Task's main objective is to adapt, verify, and promote Solar Cooling as an affordable and reliable solution across Sunbelt countries. The existing technologies need to be adapted to the specific boundaries and analyzed and optimized in terms of investment, operating cost, and environmental impact (e.g., solar fraction) as well as be compared and benchmarked on a unified level against reference technologies on a life cycle cost basis. To ensure that the Task has the largest impact it can, experts will work with Mission Innovation's Innovation Challenge #7, Affordable Heating and Cooling of Buildings (MI IC7).



▲ **The sunbelt regions represent the sunny, hot-arid, and hot-humid climates between the 20th and 40th degrees latitude in the northern and southern hemispheres.**

Over the next four years, an international team of experts will focus their work on solar thermal and solar PV driven systems between 2 kW and 5,000 kW in size. The Task will be divided into four work areas 1) Adaption, 2) Demonstration, 3) Assessment & Tools, and 4) Dissemination.

Are you interested in learning more about this project? Contact Uli Jakob,
uli.jakob@drjakobenergyresearch.de.

"One exciting aspect of this Task is the planned cooperation with industry and target countries like the UAE through MI IC7. Linking SHC Task work with Mission Innovation activities and funding opportunities will no doubt help the market uptake of solar cooling in sunbelt regions."

ULI JAKOB, *SHC Task 65 Operating Agent*

COUNTRY HIGHLIGHT

A Spotlight on Renewables in the Slovak Republic

The Slovak Republic (SR) became an independent nation in 1993. In 2000, it became a member of the Organization for Economic Cooperation and Development (OECD), a Member State of the European Union (EU) in May 2004, a member of the International Energy Agency (IEA) in 2007, and then in 2016 joined the IEA SHC Programme.

> *"In 2019, the Slovak Republic committed to achieve carbon neutrality by 2050."*

The Slovak Republic places great weight on reducing greenhouse gas (GHG) emissions, mitigating climate change, and ensuring energy security and affordability. At the policy level, the country is taking numerous proactive steps.

In November 2014, the Government of the Slovak Republic approved the Energy Policy (EP SR), which set goals and priorities for the energy sector until 2035 with a view to 2050. The strategic objective of the EP SR is to achieve competitive low carbon energy, ensuring a secure, reliable, and efficient supply of all forms of energy at affordable prices while taking into account consumer protection and sustainable development.

In 2019, the Slovak Republic committed to achieve carbon neutrality by 2050. SR has reasonably balanced the share of nuclear fuel and fossil fuels in gross domestic consumption. The development of an energy policy in the Slovak Republic is aimed at optimizing the energy mix so that GHG emissions and pollutants are reduced as much as possible while maintaining and responsibly increasing energy security and affordability of different types of energy.

The Energy Policy of the Slovak Republic (EP SR) is based on four fundamental pillars:

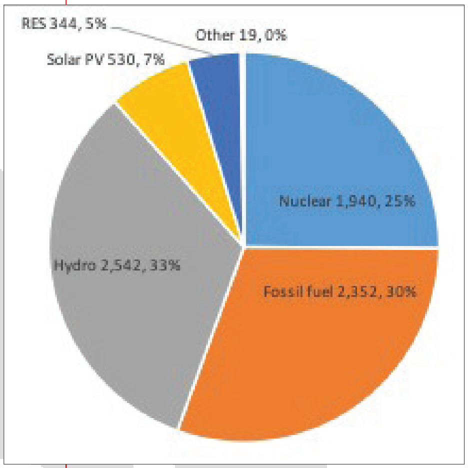
- energy security,
- energy efficiency,
- competitiveness, and
- sustainable energy.

The EP SR also includes science, research, and innovation.

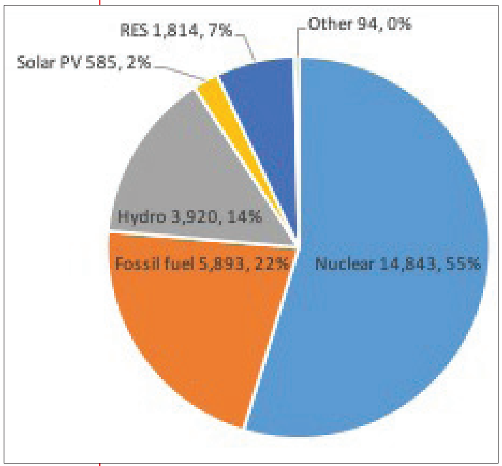
The National Energy and Climate Plan (NECP) updates the EP SR extending it with the dimension of decarbonization.

Sustainable development must meet the current needs of the population without limiting the possibilities for future generations to meet their own needs. Therefore, it is necessary to change technologies, procedures, and habits both on the production side and on the consumption side.

The main quantified energy and climate targets for 2030 across the European Union are a reduction in GHG emissions by at least 40% compared to 1990 (individual Member States have fixed shares according to local conditions). The binding target level of the EU is to achieve the share of energy from renewable sources (RES) in gross final consumption energy consumption of at least 32%, with the share of RES in transport in each Member State at least 14%, the national contribution to energy



▲ **Figure 1. Installed capacity in MW (2018).**



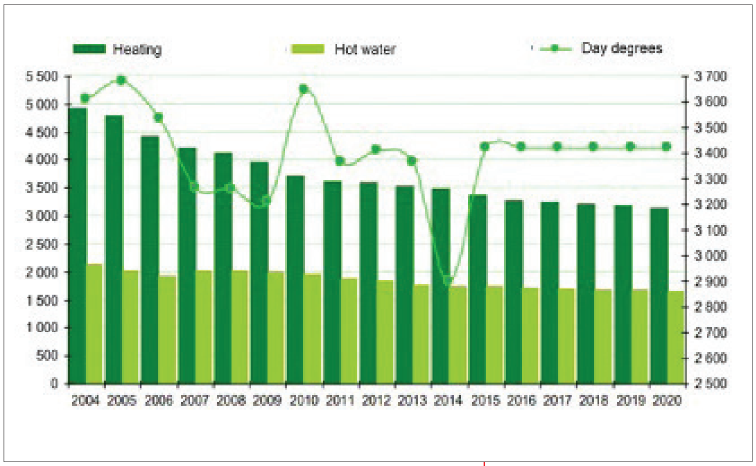
▲ **Figure 2. Production in GWh (2018).**

continued on page 13

Slovak Republic *from page 12*

efficiency at least 32.5%, and interconnected electrical systems at a level of at least 15%.

The main quantified goals of the NECP for the Slovak Republic until 2030 are to reduce GHG for the non-ETS sectors by 20%. The use of RES for final energy consumption is set in 2030 in the amount of 19.2% with the fulfillment of the required target of 14% RES in transport.



▲ **Figure 3. Real (and forecasted 2019, 2020) heat consumption in GWh in a block of flats, supplied by District Heating Systems.**

Electricity Production in the Slovak Republic

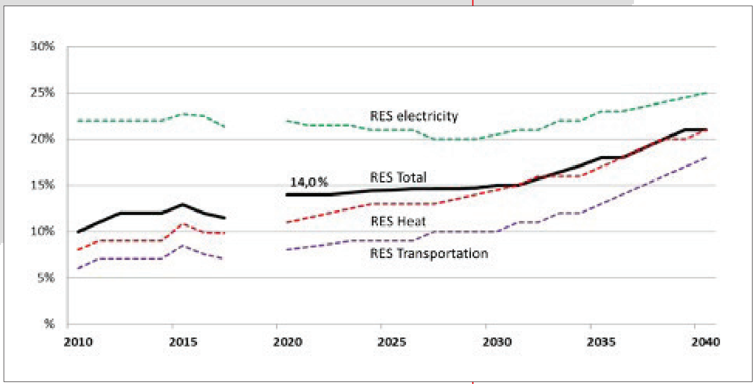
The installed capacity of electricity generation facilities reached 7.728 MW in 2018.

Renewable Sources of Electricity

Of the total installed capacity of 2,542 MWe hydropower plants, 1,626 MWe are in flow power plants and 916 MWe in pumped storage power plants. The largest hydroelectric power plant is Gabčíkovo with an installed capacity of 720 MWe. Its annual production (2,200 GWh) is almost half of the total electricity production of hydroelectric power plants in the Slovak Republic.

There are currently five wind turbines in operation in the Slovak Republic with a total installed capacity of 3.1 MW and annual production of approximately 5.5 GWh of electricity. Wind turbines in the conditions of the Slovak Republic fail to compete with other sources of electricity.

Biomass generates 1,185 GWh annually with an installed capacity of 224 MWe.

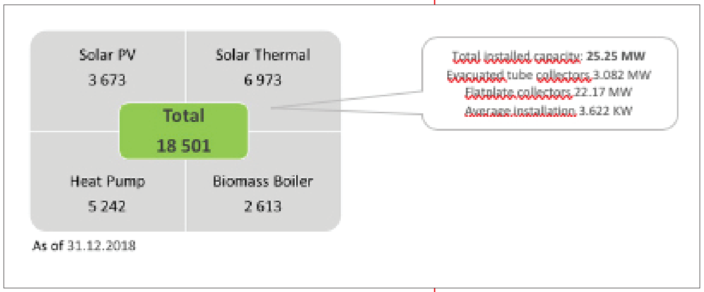


▲ **Figure 4. Indicative trajectory based on current policies and measures.**

Photovoltaic power plants recorded the greatest development between 2011 and 2013, reaching 530 MWe of installed capacity, with the annual usability around 1,000 hours, reaching an annual production level of 530 GWh. Since 2013 no new installations were launched until the end of the first quarter of 2020.

At the beginning of February 2020, the Ministry of Economy announced a pilot auction for electricity produced from renewable energy sources in Slovakia. It promised a total of 30 MW of new installed capacity from the sun, wind, biomass, biogas, water, etc. The projects were to be operational over approximately two to four years, depending on the type of installation, and subsidies being paid for 15 years of operation.

The first auction for the production of green energy in Slovakia was canceled on March 31. While Hungary and Estonia recently announced the results of their first auctions, in other countries, including Slovakia, the dates of further auctions and deadlines are postponed due to problems in supply chains as a consequence of the worldwide COVID-19 pandemic.



▲ **Figure 5. Number of installations by technology.**

continued on page 14

Slovak Republic *from page 13*

Forecasted Development until 2030

The development of electricity consumption will be affected by the success of measures in the area of energy efficiency (energy savings) and the rate of growth of electromobility.

By 2030, enough power is projected to be in place, and there are no expectations to build-up larger resources. After completion of Nuclear power plant Mochovce (EMO) 3 and 4, the system will be from the point of view of securing power electricity, safe even in the event of non-operation of the largest fossil fuel sources of electricity (PPC Malženice, PPC Bratislava, TE Vojany and TE Nováky). It is assumed that the total installed capacity of production facilities in 2030 will be at the level of 8 720 MW, of which RES (including installed capacity hydropower plants) 3 790 to 4 630 MW. The maximum load will increase in proportion to 1.2% year-on-year growth in consumption up to 5250 MW.

The Heat Sector

It is expected that the decline in heat consumption will continue, but no longer in such a significant way that it has been for the last 15 years. Estimates and forecasts until 2020 indicate a decline in heat consumption by 8.5%, respectively, about 450 GWh.

The forecast of the development of heat consumption for the coming years was determined based on an analysis of the potential for energy efficiency of heating systems, mainly the expected development of heat consumption for heating in apartment buildings (block of flats). In addition to reducing heat consumption in apartment buildings, a significant reduction is expected in the heat consumption of public buildings with the supply of heat from District Heating Systems (DHS).

Renewables

The policy in the field of RES and the measures based on it follow from the previous strategic documents approved by the Government of the Slovak Republic (Energy Security Strategy - 2008, National Action Plan for energy from renewable sources - 2010 and Energy Policy of the Slovak Republic - 2014) and supports an increase in the share of renewable energy sources in energy consumption and a reduction in the share of fossil fuels. Among the set of measures, one is related to so-called prosumers -support for small power plants for the production of electricity and heat in family and apartment houses. The beneficiaries are motivated to consume as much electricity as possible and minimize supply to the system from the small-scale electricity generation installations. This approach addresses their energy self-sufficiency and reduces the impact of variable RES on the electricity system (prosumerism).

Growing Prosumerism

During 2014-2020 the Green for Households projects was launched in connection with the Operational Program Quality of Life. The Operational Program focuses on the transition to a low-carbon economy using renewable energy sources and improving energy efficiency (increasing production heat and electricity from renewable energy sources, systematic reduction of greenhouse gas emissions, and development of efficient DHS). In contrast, the Green for Households project focuses on small renewable resources in homes and apartment buildings to increase the share of renewable energy use.

Green for Households Project Results

Phase 1 started in 2016 and ended in 2018. During this period, 41.19 million EUR were provided as subsidies for 18,501 households, and the total installed capacity was 141.33 MW (Solar PV 10.01 MW, Solar Thermal 25.25 MW, Heat Pumps 44.28 MW, and Biomass boilers 66.07 MW).

Indicator	Unit	Result
Installed capacity for production of electricity	MW	10.01
Installed capacity for production of heat	MW	131.3289
Savings of CO2 emissions per year	t/year	55,494
Public expenditure per unit of installed capacity	€/KW	317.7
Public expenditure per CO2 emissions reduction (15 years)	€/t	54.06

Phase 2 started in 2019 and is expected to last until 2023. The budget allocation is 48 million EUR. The goal is to have 21,000 small RES systems up and running with an installed capacity of 140 MW.

As of the end of the first quarter of 2020, there were 2,046 Solar Thermal systems installed with a total installed capacity of 7.56 MW (evacuated tube collectors 0.67 MW, flat plate collectors 6.88 MW) with an average installation 3.69 kW.

Prepared with the data from NECP published by the Ministry of Economy and internal data of Slovak Innovation and Energy Agency (regarding the Green for Households project). Article contributed by Artur Bobovnický, the Slovakian SHC Executive Committee representative.

NEW MEMBERS

IEA SHC Welcomes Three New Organizations

SACREEE, the South African Centre for Renewable Energy and Energy Efficiency, joins four other UNIDO Global Network of Regional Sustainable Energy Centres (GN-SECs) members in the IEA SHC Programme. What is exciting is that each GN-SEC member brings a different regional focus to our work. SACREEE brings the perspective and experiences of sixteen Southern African countries.

Southern African Governments Navigating Implementation of Their Solar Thermal Roadmaps

One project that will no doubt benefit from the new collaboration between SACREEE and IEA SHC is the well-established SOLTRAIN (Southern African Solar Thermal Training and Demonstration Initiative) project. This regional initiative is supporting capacity building and demonstration of solar thermal systems throughout the Southern African Development Community (SADC) region. A project funded by the Austrian Development Agency (ADA) and OPEC Fund for Development (OFID) since 2009.

Six SADC countries – Botswana, Lesotho, Mozambique, Namibia, South Africa, and Zimbabwe – have developed Solar Thermal Roadmaps and Implementation Plans as part of the SOLTRAIN project. The purpose of these roadmaps and plans is to outline the path towards a national vision for solar thermal applications in the country, targeted at enhancing the quality of life of the citizens through the provision of a sustainable and quality-assured solar thermal technology value chains.

The current Phase IV of the project is focussing on the implementation of the Solar Thermal Roadmaps and Implementation Plans in a medium-term in close coordination with the renewable and solar energy policies and programmatic activities of the partner countries. The SADC Centre for Renewable Energy and Energy Efficiency (SACREEE) is supporting the execution of these Roadmaps and Plans. SACREEE is a regional inter-governmental organization established in 2015 with a mandate to promote market-based adoption of renewable energy and energy efficiency in increasing access to clean and modern services as well as regional energy security.

▲ **Harare Children's Home, Harare, Zimbabwe.**

SACREEE's role, as an inter-governmental organization, is to ensure that the implementation of the Solar Thermal Roadmaps receives wider political support, thus ensuring alignment with regional strategies such as the SADC Renewable Energy and Energy Efficiency Strategy and Action Plan (REEESAP) and the SADC Industrial Energy Efficiency Programme (SIEPPP). Some of the activities to support this goal include:

- Providing policy and administration advice to different application groups.
- Communicating the goals of the Roadmaps and Implementation Plans.
- Coordinating capacity building programs.

continued on page 16

New Members *from page 15*

- Supporting national measures to implement the Roadmap and Implementation Plan.
- Supporting the mobilization of national and international funds for implementation.
- Supporting governmental bodies with the necessary legal information and industry wanting to venture into manufacturing solar collectors, tanks, or complete solar thermal systems with technical skills.

Between January and February 2020, SACREEE, together with the SOLTRAIN coordinator, AEE – Institute for Sustainable Technologies (AEE INTEC), held various national policy workshops in Namibia, Lesotho, South Africa and Zimbabwe in partnership with national implementing partners. The objective of these national policy workshops was to:

- Inform policymakers on Phase IV of the SOLTRAIN project.
- Work on national measures to implement and realize the goals of the Solar Thermal Roadmap and Implementation Plan.
- Mobilize national and international funds for the implementation, and
- Support governmental bodies on policies for different application groups for the acceleration of installation of solar thermal systems in the country.

The outcome of the workshops is that countries have prioritized the preparation of bankable solar thermal projects that support the implementation of the roadmaps and action plans. The preparation of these projects is supported by national, regional, and international financing institutions.

According to the SADC Industrial Energy Efficiency Programme (SIEEP), there are significant opportunities for solar thermal applications in the food, beverage, and mineral processing sectors. The SIEEP is focused on objectives and actions that provide an enabling environment (policy, regulatory, institutional, financial frameworks) and projects that demonstrate energy savings and the co-benefits of reduced costs of doing business, greenhouse gases (GHG) emissions, job creation, and contribution to industrialization. These industries in the SADC region need to adopt solar thermal technologies and energy efficiency to reduce the cost of production, create competitiveness, and minimize GHG emissions.

Financiers and solar thermal solutions providers are invited to work with the Southern African countries in implementing solar thermal solutions to make them economically competitive in the wake of the COVID-19 pandemic while reducing their GHG emissions. Solar thermal solutions are essential in the fight against COVID-19 as warm water preparation is ideal in maintaining hygienic standards at home, health facilities, and work environment.

The vast experience of the Solar Heating and Cooling Programme will be valuable in supporting the Solar Thermal Roadmaps and Implementation Plans through co-operative research, development, demonstration, and exchange of information regarding solar heating. This new level of collaboration will constructively support the scaling up of solar thermal technology in the SADC region.

This article was contributed by Kudakwashe (Kuda) Ndhlukula, the Executive Director of SACREEE and IEA SHC Executive Committee representative. For more information on SACREEE visit www.sacreee.org

SACREEE Partner Countries

- Angola
- Botswana
- Comoros
- Democratic Republic of Congo
- Eswatini
- Lesotho
- Madagascar
- Malawi
- Mauritius
- Mozambique
- Namibia
- Seychelles
- South Africa
- Tanzania
- Zambia
- Zimbabwe

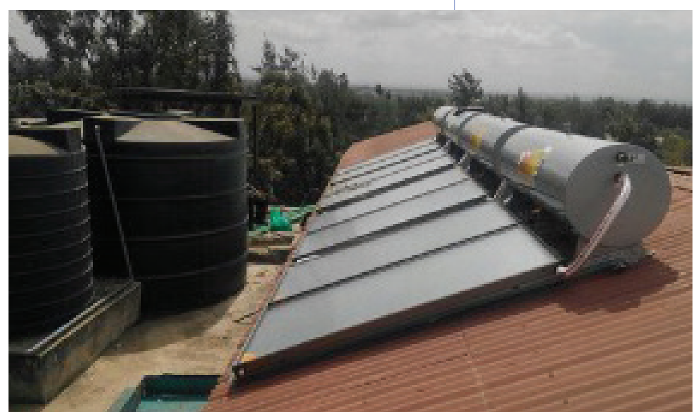
◀ **SOLTRAIN demonstration project at the Susanne Grau Heim Old Age Home, Windhoek, Namibia.**

EACREEE, the East African Centre for Renewable Energy and Energy Efficiency, joins four other UNIDO Global Network of Regional Sustainable Energy Centres (GN-SECs) participating in the SHC Programme. Each of these GN-SEC members brings a new regional focus to our work. EACREEE brings the perspective and experiences of six East African countries, Burundi, Kenya, Rwanda, South Sudan, Tanzania, and Uganda.

EACREEE
Building a Sustainable Energy Future

East African Region Sees Huge Potential for Solar Water Heating Industry

Resource Potential



East Africa Community (EAC) Partner States collectively have a huge solar energy potential, exploited only marginally. The region continues to enjoy nearly uniform solar insolation throughout the year. This is mainly because of the geographic location along the Equator that offers the EAC region climatic conditions that are technically favorable for solar energy exploitation. For example, even during seasons that are classified as rainy – that is mostly cloudy – there is sufficient daily insolation. More precisely, the daily sunshine produces between 4 - 6 kWh per m^2 per day, with an annual average of 8 hours of sun per day. The average solar radiation per year in the EAC region is about 1825 kWh/m^2, and therefore solar heating systems can offer average total heating energy of 800 kWh/m^2/year.

This abundant solar resource presents excellent opportunities and benefits for both solar photovoltaic and thermal applications in the region. It is well documented that shifting to solar photovoltaic and thermal applications can contribute substantially to climate change mitigation in the building sector and hence to meeting the target of keeping the global temperature not more than 1.5°C above pre-industrial levels. In the EAC region, shifting to solar water heating has the additional advantage of releasing electric power from the grid for other applications. This is a real benefit as the region still lags significantly behind in electrification rates.

Despite the tremendous solar potential in the region, the adoption of solar water heating in the region is still very low. The main reason is that the region faces a number of barriers to exploit solar thermal resources effectively. Some of these limitations include inadequate technical skills, high upfront costs, lack of innovative business models, limited financing options, limited awareness/interest and demand, unclear policy requirements, lack of water, disjointed institutional mandates, inadequate technical standards, limited enforcement capacities among mandated institutions, low-quality products and services, and owner-occupier mismatch. With ongoing measures, though incrementally slow, to catalyze the adoption of solar water heating systems, the huge untapped market will eventually fully open up.

Regulatory Environment

Efforts are underway by the EAC countries to create a conducive environment for solar water heating through the development and implementation of enabling policies and legislation in renewable energy sectors. For instance, all countries have made solar energy equipment tax-exempt according to the East African Community Customs Act (2004) and Legal Notice No. EAC/23/2014 of 20 June 2014. In addition, to stimulate the solar water heating market, the EAC Partner States have instituted various interventions, including capacity building, promulgating and enforcing regulations and tax incentives, and other measures. For example, in 2012, Kenya promulgated the Energy (Solar Water Heating) Regulations, which required that all commercial facilities (e.g., hotels) install and use solar water heating systems if their hot water requirements exceed one hundred liters (100 L) per day. In 2015, Rwanda put in place Regulations N°004/

continued on page 18

EACREEE *from page 17*

ENERGY/SWH/RURA/2015 on Solar Water Heating with similar requirements. These measures have had a tremendous impact on the adoption of solar water heating systems.

Solar water heating market potential

According to the EAC Renewable Energy and Energy Efficiency Status Report 2016[1], Kenya was the leader in the solar water heating market in the EAC, accounting for 80% of the market volume. Uganda and Rwanda had smaller but growing solar water heating markets due to the enabling environment for renewable energy investments. As of June 2017, the Kenya Revenue Authority (KRA) data revealed that Kenya had imported a total of 65,789 solar water heating systems. Considering those imported outside the scope of the KRA data and those locally manufactured systems, it was estimated that there were about 77,000 units installed with a collector area of approximately 415,524 m^2, corresponds to 0.3GWth of installed capacity. Based on the average annual imports of about 7,500 units, it was estimated that there were a total of 90,000 units of solar water heating systems. The potential market for solar water heating units in Kenya today is expected to be about 3.5 million units, assuming 100% market penetration. This clearly shows that only about 2.6% of the potential market has been exploited, leaving over 97% of the market potential untapped. With the current population growth rate and a housing deficit of about 2.5 million units, these figures are likely to increase. It is important to note, however, that due to the lack of credible data on restaurants and eateries as well as laundry facilities in Kenya, the potential market could be marginally larger. This substantial untapped market could be harnessed through awareness-raising and enforcement of the 2012 Energy (Solar Water Heating) Regulations combined with a variety of financing mechanisms to promote the uptake of solar water heating systems. And both these actions should go hand in hand with the rigorous enforcement of the regulations.

EACREEE Partner Countries

- Burundi
- Kenya
- Rwanda
- South Sudan
- Tanzania
- Uganda

Technology and market segments

Residential, commercial, institutional, and industrial buildings are the four largest market segments for solar water heating potential. Most systems installed in the region are domestic solar water heating systems with tank capacities ranging from 150 to 300 liters. Many commercial organizations, such as hotels with solar water heating systems, also use modular domestic systems to meet their demand. The gross collective area of a domestic thermosiphon system ranges from 2.0 – 4.0m^2. Flat plate collectors are the most common systems in the EAC region (Figure 1). Although there appear to be widespread installations of evacuated tube systems, they are generally perceived to be weaker in performance and are of sub-standard quality. This perception could be due to their fragile nature and propensity to overheat combined with performance issues in areas with 'hard' or saline water, including some underground water supplies and areas along the coastline. Although these types of systems require regular maintenance, due to their affordability, the market for evacuated tube systems is growing in the EAC region, especially among end-users.

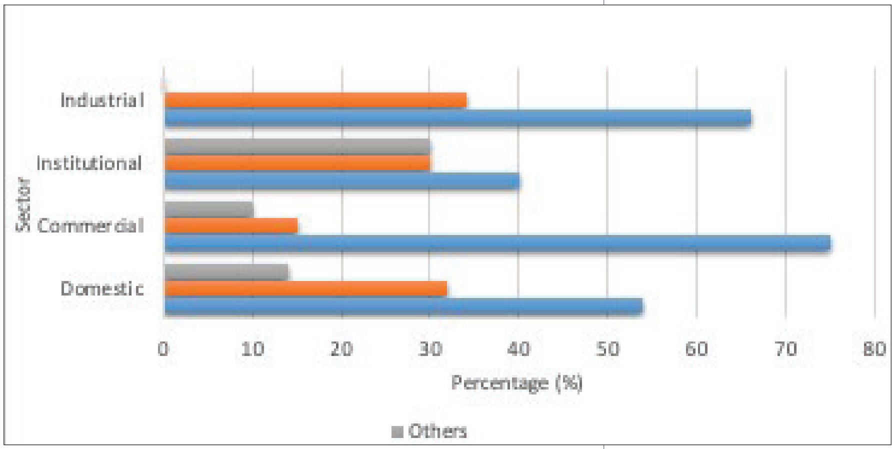
Navigating through the COVID-19 Pandemic

It is becoming evident that the COVID-19 pandemic threatens to reverse the enormous progress that solar thermal companies have made in increasing the installed capacity of solar water heating systems in the past few years. The new global economic crisis will make it more difficult for new and existing customers to pay for new solar thermal systems and related services. At the same time, disrupted supply chains and reduced investment flows may cause companies to run out of cash, thus reducing activity. With eminent dwindling liquidity, companies dealing with solar thermal systems will be forced to lay off staff, resulting in possible reductions of customers' access to services. As the EAC region prepares for the COVID-19 aftermath, there is a tremendous opportunity for a regional reset.

continued on page 19

1 EAC Renewable Energy and Energy Efficiency Status Report (2016)

EACREEE has just put in place an ambitious business plan that can provide green stimulus plans for the region to restore its targets while deepening its energy transition. The Centre will seek to support businesses temporarily closed due to the pandemic by working with partners to provide technical assistance, with stakeholders to provide sector-wide policy interventions, and with our partners to provide financial support for solar water heating companies.



▲ **Figure 1. Distribution of solar water heating technologies among end-users in the EAC region.[2]**

Going Forward

Clearly, the Kenyan experience shows that sound policy and legislative framework can help catapult solar water heating use to a very high level. However, there is still the need for strengthening the enforcement of regulations and providing more incentives to scale up the solar water heating market. It is also important to note that the six EAC Partner States are not at the same pace when it comes to solar water heating adoption and a regulatory policy framework. While Kenya and Rwanda have enforceable regulations, Uganda has only encouraged policy and incentives. Burundi and South Sudan, on the other hand, have neither a policy nor enforceable regulations. There is, therefore, a need to harmonize policies and regulatory frameworks across the region to ensure that no one is left behind. In addition, based on the Kenyan experience, increased adoption in other countries will require stimulating the demand for solar water heating technologies.

To address the multitude of barriers hampering the exploitation of renewable energy technologies, like solar water heating, in a cross-linked and inter-linked manner in the public and private sectors, EAC with support of the United Nations Industrial Development Organization (UNIDO), established the East African Centre for Renewable Energy and Energy Efficiency (EACREEE). The Centre has the mandate to promote renewable energy and energy efficiency through policy harmonization, capacity building, investment promotion, research and development, and knowledge management. The activities of EACREEE strategically ensure resource efficiency in policy development, learning and sharing from best practices regionally and beyond, and deepened integration.

With this new partnership, EACREEE looks forward to receiving support from the global pool of SHC experts and learning best practices from other countries. This collaboration will surely help to accelerate the pace of solar thermal technology development and deployment, promote standardization of solar thermal systems, enhance regional solar thermal technical capacity, and with higher learning institutions strengthen research and development in this region of Africa.

This article was contributed by experts from the East African Center of Excellence for Renewable Energy and Efficiency (EACREEE): Prof. Mackay Okure, the Interim Executive Director, Mr. Fred Ishugah, the Sustainable Energy Expert and Mr. Michael Kiza, the Project Management Expert. For more information on EACREEE visit https://www.eacreee.org/

2 Study of the Solar Water Heating Industry in Kenya (2017)

continued on page 20

Our newest member, CCREEE, the Caribbean Centre for Renewable Energy and Energy Efficiency Centre, joined the IEA SHC in early June. This Centre brings a unique regional focus to our work, and we are looking forward to working with CCREEE's staff in Bridgetown, Barbados and the fifteen member countries.

CCREEE
CARIBBEAN CENTRE FOR RENEWABLE ENERGY & ENERGY EFFICIENCY

Energy Challenges and Sustainable Energy Opportunities

The creation of CCREEE responds to the difficult energy situation in much of the Caribbean. Caribbean countries are facing how to access to modern, reliable and affordable energy services, energy security, and climate change mitigation and adaptation simultaneously. The primary energy challenges are:

- Lack of access to modern, reliable and affordable energy services is still a challenge in the remote areas of some Caribbean countries (Belize, Guyana, Haiti, and Suriname). This also includes lack of access to modern cooking services;
- Very high electricity tariffs and generation costs represent a burden for the economy, private households, local companies, and key industries in most Caribbean territories. Electricity tariffs charged to residential consumers in CARICOM (Caribbean Community) States range from as low as 4.5 U.S. cents per kWh to over 38 cents per kWh;
- Widening demand-supply gap in urban areas;
- Weak financial status of some utilities due to high diesel generation costs and technical and commercial efficiency losses;
- Low energy efficiency in buildings, appliances, industrial processes, and technical and commercial grid losses result in power cuts and load shedding in some countries;
- Frequent power outages have led to the installation of private diesel generators in some countries;
- National access rate to modern energy services remains at low levels on some islands;
- Untapped Renewable Energy and Energy Efficiency (RE&EE) potential; and
- Increasing extreme weather events impact infrastructure and energy planning.

▲ **64 collectors on a carport supply the hot water for a resort in Barbados.** Photo: Solar Dynamics

By developing renewable energy sources and implementing energy efficiency measures, many countries in the region could reduce their overall fossil fuel consumption, and thus promote clean economic growth and decreased dependence on costly, imported petroleum fuels. The development of sustainable energy is interrelated with a broad range of positive socio-economic impacts (e.g., reduction of fossil fuel imports, increased affordability for low-income groups through the reduction of electricity consumer prices in the long term, improved financial situation of utilities, increased competitiveness of companies and industry, reduction of stand-by diesel generators, creation of green jobs).

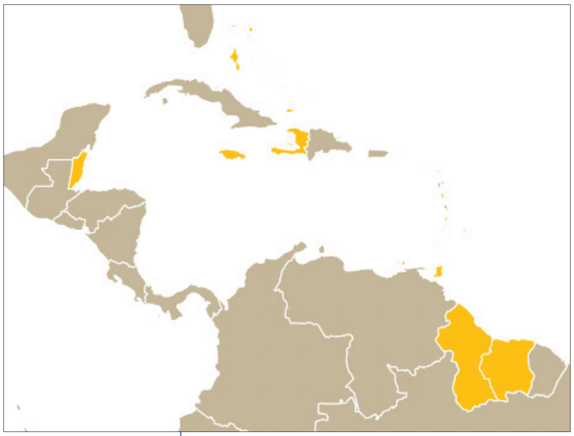
The Caribbean is blessed with a broad range of renewable energy sources (bioenergy, solar, wind, hydro, tidal, and geothermal energy). Plus, there is significant potential for energy efficiency improvements in lighting, appliances, buildings, transmission and distribution, and industrial processes, particularly in urban areas. Small-scale decentralized RE solutions can be cost-effective options to satisfy the needs of the rural population located far away from the main grid, which is particularly relevant for parts of Belize, Guyana,

Haiti, and Suriname. RE&EE solutions can be an important driver to increase the productivity and competitiveness of industrial key sectors - such as food processing, fishery, manufacturing of high-value niche products and services, and tourism. A growing sustainable energy market also creates new income and job opportunities for energy service and manufacturing businesses.

continued on page 21

CCREEE *from page 20*

Navigating through the COVID-19 Pandemic



As Dr. Gary Jackson, the Executive Director of CCREEE, noted in his April 2020 Opinion Piece, "COVID-19 Highlights Caribbean Community's Need to Build Resilience, "…COVID-19 presents a very real concern for the Caribbean's energy sector. This becomes crucial when we consider that energy demands have changed with the advent of the crisis and, they will continue to change in unpredictable and unprecedented ways. Currently, commercial and industrial energy use are reduced as many businesses are closed or have reduced operations but, use at the household level has increased due to government mandates to stay at home. Utilities will therefore have to adapt to these changes since the amount of energy being consumed and the pattern of its consumption have changed considerably. If energy generation capabilities exceed the demand, utilities may also consider running the powerplant at a reduced capacity, with possible negative financial implications and impacts on the quality of service provided. Importantly, as energy intersects with health, the ability to reliably power essential medical equipment – like ventilators – becomes critical.

Significant shifts in oil prices have also been predicted and are already emerging. Globally, there has been a steep decline in oil prices, due to decreased demand. These dynamics do not augur well for our Member States who have recently found large deposits of oil. Conversely, an increase in prices is expected when the crisis recedes and commerce and industry are able to function in earnest again. In anticipation of this, the Caribbean Community (CARICOM) needs to be prepared and use this time to ramp-up renewable energy and energy efficiency capacity, where possible. The timing is right, as most CARICOM Member States desire an energy transition to achieve energy security.

Householders can also prepare by reducing consumption now, as much as they are able. Pay attention to your electricity bill, track your usage and unplug appliances and devices when they aren't in use. Amidst the hundreds of thousands who are now unemployed due to COVID-19, a spike in household electricity bills and other energy-related costs to be met by the most vulnerable can have an untold impact. Though high unemployment rates have incredible impacts on economies, businesses and households, these unemployed individuals do now have the option of learning new skills, to place them at an increased advantage when the crisis has passed.

In 2008 when oil prices rose above US140 per barrel, the region's thrust toward renewable energy peaked. Subsequently, our renewable energy targets became very ambitious. Let us not wait until our backs are against the wall again, to see the necessity of energy resilience and self-sufficiency. We need to implement energy efficiency and renewable energy measures now throughout our operations, particularly in high-energy use sectors such as tourism. Tourism industries can benefit from sustainable operations as they seek to rebuild the tourism product during this period of inactivity.

Renewable energy and energy efficiency can provide tremendous benefits to Caribbean territories by minimizing costs and improving our environment. We can accomplish this and more with the long-term view of transforming the energy sector, for the benefit of Caribbean people. We can appreciate, it is not business as usual."

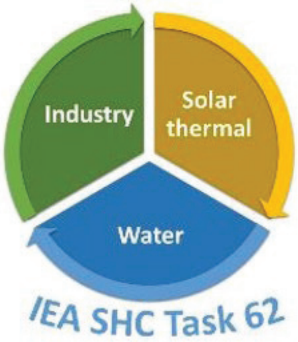
For more information on CCREEE visit www.ccreee.org.

CCREEE Partner Countries

- Antigua and Barbuda
- Barbados
- The Bahamas
- Belize
- Dominica
- Grenada
- Guyana
- Haiti
- Jamaica
- Montserrat
- Saint Kitts and Nevis
- Saint Lucia
- Saint Vincent and the Grenadines
- Suriname
- Trinidad and Tobago

Solar Energy in Industrial Water and Wastewater Management

The change to a sustainable, resource- and energy-efficient industry represents a major challenge in the coming years. The efficient supply of energy, the best possible integration of renewable energy sources and the recovery of resources in the sense of circular economy must go hand in hand. The use of solar process heat represents a significant but so far, mostly unused potential in industry. For the long-term and successful introduction of solar thermal energy, innovative and concrete solutions are needed. The integration of solar process heat to supply technologies for wastewater treatment represents a new field of application with great technical and economic potential for solar thermal energy. The efficient interaction, the nexus, between solar energy and water opens up new and innovative approaches.



The main objective of IEA SHC Task 62 is to increase the use of solar thermal energy in industry, to develop new collector technologies, and to open up industrial and municipal water treatment as a new area of application with high market potential for solar thermal energy. The nexus between solar thermal energy and water treatment enables the development of new and innovative technology combinations and the change to a sustainable, resource- and energy-efficient industry.

Task participants will work in three areas:

- Thermally driven water separation technologies and recovery of valuable resources (Subtask A, led by Joachim Koschikowski of the Fraunhofer Institute for Solar Energy Systems ISE, Germany)
- Solar water decontamination and disinfection systems (Subtask B, led by Isabel Oller Alberola of CIEMAT – P.S.A., Spain)
- System integrations and decision support for end-user needs (Subtask C, led by Mikel Duke of Victoria University, Australia)

To increase activities in Task 62, AEE INTEC (led by Operating Agent Christoph Brunner) together with the Austrian Federal Economic Chamber, hosted a workshop on the topic "Nexus Energy, Water and (Bio) Industry" in Vienna (Austria) in January. The event was supported by the Austrian Federal Ministry for climate protection, environment, energy, mobility, innovation and technology (BMK), and the climate and energy fund (KLIEN). The scheduled program arouse interest and brought together international stakeholders from different fields to present progress in research and development on innovative technologies and integrative approaches towards the efficient use of energy and water in industry.

SHC Task 62 participants from the different Subtasks highlighted the importance of Water and Energy in industrial processes as central thematic areas.

Isabel Oller Alberola from CIEMAT – Plataforma Solar de Almería (leader of Subtask

continued on page 23

Industrial Water and Wastewater *from page 22*

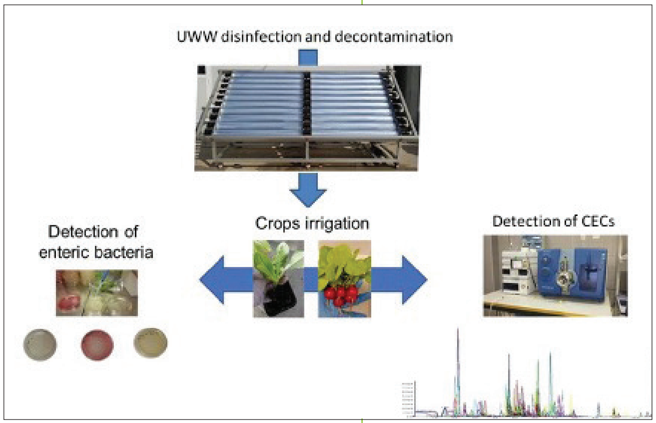
B) presented the developments on solar water decontamination and disinfection as a promising treatment method for improving the quality of wastewater.

Alexander van der Kleij from SolarDew presented their module developments on integrative water production via solar thermal energy.

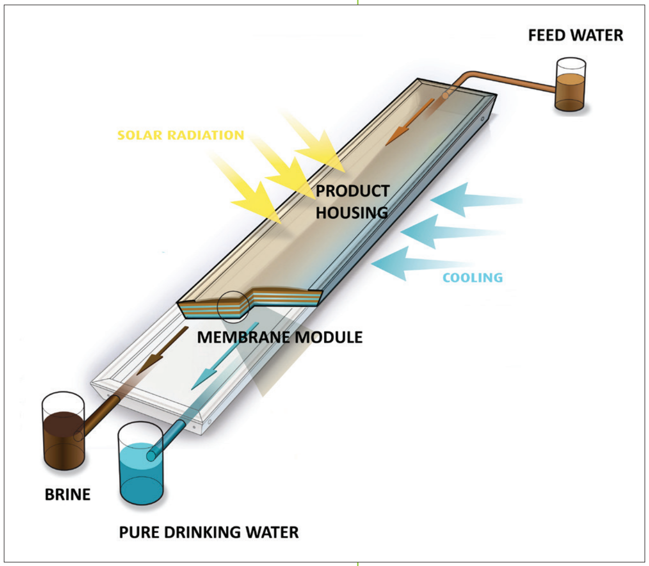
Wolfgang Gruber-Glatzl from AEE INTEC presented one approach of system integration for thermal separation technologies – specifically Membrane Distillation – in municipal wastewater treatment plants.

Based on these presentations and the interactive discussions, it became clear that optimized and integrated solutions for the Water and Energy Nexus lead to the need for holistic approaches and interdisciplinary networks – like SHC Task 62 – as a platform for exchange.

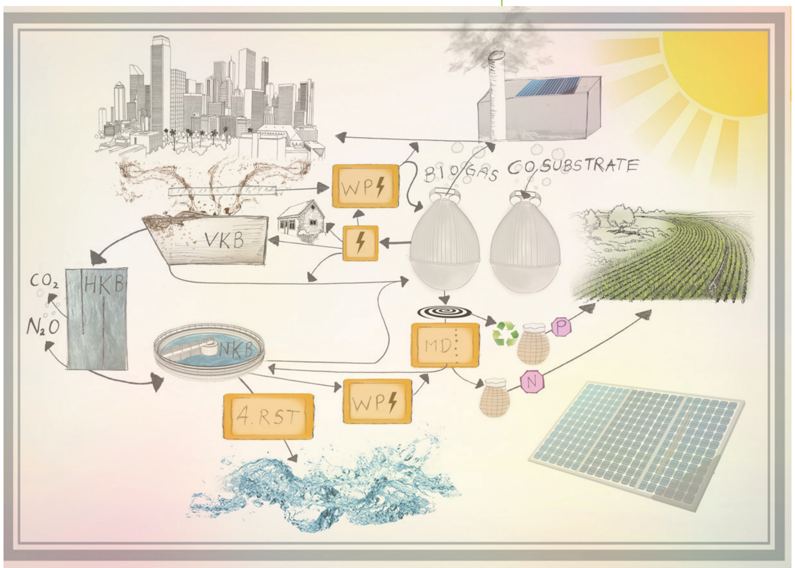
For more information on this Task, visit https://task62.iea-shc.org/ or contact the Operating Agent, Christoph Brunner, c.brunner@aee.at.



Solar water decontamination and disinfection of wastewater research work at Plataforma Solar de Almería. © CIEMAT



Using solar thermal energy for water production. ©SolarDew



Exploring Membrane Distillation for municipal wastewater treatment plants. ©AEE INTEC

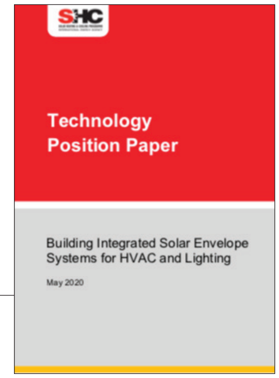
Publications

You won't want to miss the 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 and Tools" or under a specific Task.

Technology Position Papers

Three new papers! Each Technology Position Paper explains the relevance, current status, potential, and actions needed for the uptake and further development of a specific technology or application. The target audience is policy- and decisionmakers.

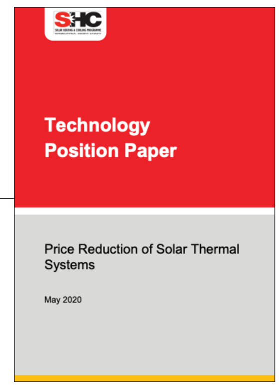
Building Integrated Solar Envelope Systems for HVAC and Lighting



Highlights the status and needed actions in the sector of building-integrated solar envelopes. This sector covers a rather broad range of technologies – building-integrated photovoltaics, solar thermal collectors, and photovoltaic-thermal (or PVT) collectors – that actively harvest solar radiation to generate electricity or usable heat. Shading systems instead control incoming radiation to lower the energy demand for air conditioning, enhance daylighting, and improve visual comfort.

**Based on the work of SHC Task 56: Building Integrated Solar Envelope Systems for HVAC and Lighting*

Price Reduction of Solar Thermal Systems



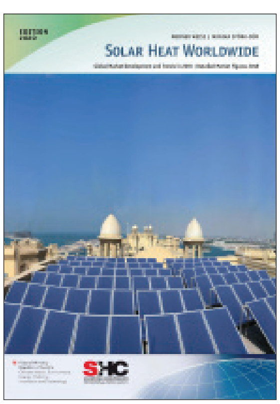
Examines what is needed to strengthen the competitiveness and market uptake of solar thermal applications through the investigation of the entire solar thermal value chain. The paper looks at technical and non-technical cost reduction potentials and ways to make the technology more attractive to the end-user.

**Based on the work of SHC Task 54: Price Reduction of Solar Thermal Systems.*

Solar Heat Integration in Industrial Processes

Solar Heat for Industrial Processes (SHIP) is at the early stages of development but has enormous potential for solar thermal applications. The industrial sector accounts for approximately 30% of the total energy consumption in OECD countries. This paper looks at how best to exploit this potential and further develop SHIP technology and its markets.

**Based on the work of SHC Task 49: Solar Heat Integration in Solar Processes*



Solar Heat Worldwide 2020

Global Market Development and Trends in 2019 / Detailed Market Figures 2018

This is the foremost report on the solar thermal market and trends. Data from 68 countries, representing 95% of the solar market, provides the basis for this comprehensive annual report on solar heat. The report is divided into two parts: Part 1(Chapters 3-4) covers the global market development in 2019 and highlights trends for different applications and Part 2 (Chapters 5-7) presents detailed market figures for 2018.

continued on page 25

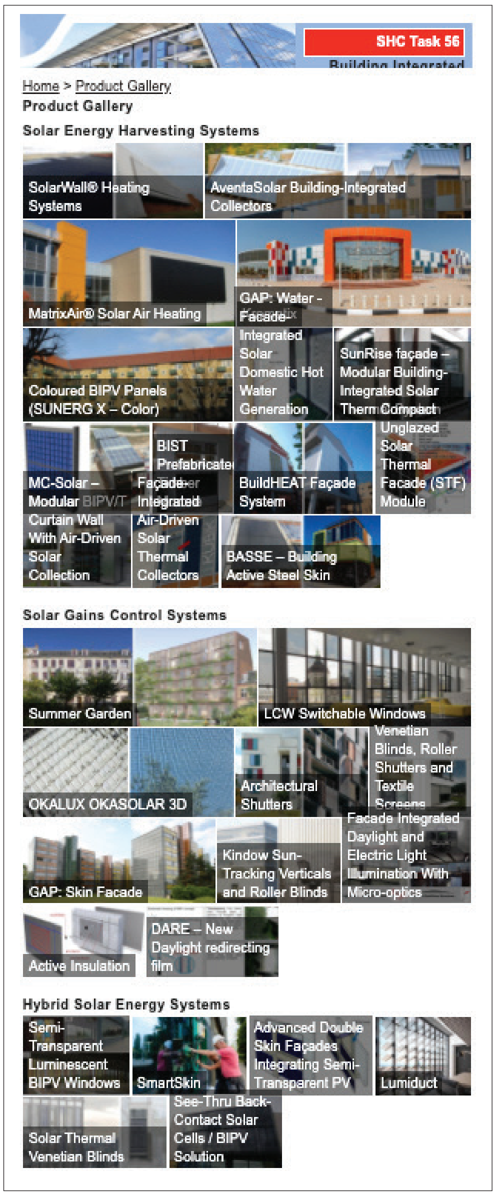
Publications *from page 24*

SHC Annual Report 2019

with a feature article on Solar Integrated Building Facades

Integrated Solutions for Daylight & Electric Lighting

Newsletter #1 of Task 61/EBC Annex 77



Building Integrated Solar Envelope Systems for HVAC and Lighting

IEA SHC Task 56 recently ended and all the results are published in a series of reports and fact sheets. Each publication complements the Task's overall objective – to coordinate the research and innovation effort taking place within the scientific community and the private sector towards broader utilization of envelope integrated technologies.

Building Integrated Solar Envelope Systems Product Gallery

Monitoring Results

Design Guidelines

System Simulation Results

System Simulation Models

Test Methods and Recommendations

Confidential Feedback Workshops as a Method to Foster Innovation

Report on the Development of Strategies for Market Penetration

Fact Sheets

- carnotUIBK Toolbox for MATLAB Simulink
- TRNSYS model for OFFICE CELL
- PHPPsheet for HP monthly calculation and PV self-consumption
- Modelica model for OFFICE CELL
- EnergyPlus model for OFFICE CELL
- DALEC (Day and Artificial Light with Energy Calculation)
- ALMAbuild Toolbox for MATLAB Simulink - Fact sheet

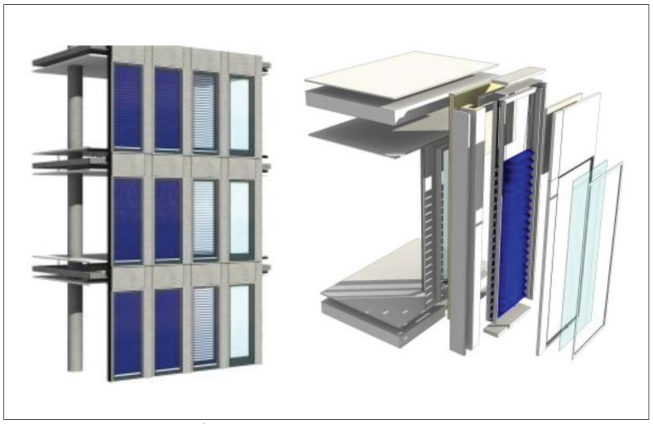
Marketplace

The Solar Heating and Cooling Programme is not only making strides in R&D but also impacting the building sector. This section of the newsletter highlights solar technologies conceptualized or developed in one of our Tasks and now being tested/ demonstrated or commercially manufactured.

Today in the Lab – Tomorrow in Energy?

This new IEA initiative is designed to shine a spotlight on research projects under development in the 38 Technology Collaboration Programmes. The first round highlights six projects, two of which showcase SHC Task work.

Solar Thermal Venetian Blinds: Energy-efficient, Attractive, Transparent



▲ **Visualization of a facade with a solar thermal blind and a diagram of the structure of such a blind with a vertical collection duct.**
Source: Priedemann Façade-Lab.

What is the aim of the project?

The Arkol project aims to develop a venetian blind for use in highly glazed facades that combines the benefits of conventional venetian blinds and solar thermal collectors.

How could this technology be explained to a high school student?

Heat pipes integrated into the blind slats transfer heat created by the sun to a tube on the side of the facade element. As well as generating renewable energy, the blind can remove excess heat from the façade, thus lowering the cooling demand of the room behind it.

What is the value for society?

- reduces cooling demand in buildings, which are responsible for over one-third of global final energy use.
- contributes to high-performance buildings, which only make up 5% of the building stock.
- provide a solution for both energy savings and architectural design.

At what stage of development is this project?

A first real-size test sample showed the technical feasibility but revealed the need for further development. The follow-up project, DESTINI, will improve and test the energetic performance, based on which an implementation in a real building is planned.

What government policies could bring this from the lab to the market?

- building codes promoting energy efficiency
- government funding for demonstration projects
- strong local government support and collaboration with property owners

The work on this project was done within the framework of SHC Task 56: Building Integrated Solar Envelope Systems for HVAC and Lighting.

Partners

Priedemann Facade-Lab

Fraunhofer Institute for Solar Energy Systems

Borderstep Institute for Innovation and Sustainability

DAW SE

KomZet

University of Stuttgart

Funder

German Federal Ministry for Economic Affairs and Energy

continued on page 27

Marketplace *from page 26*

Bringing the Heat of Summer into Winter

What is the aim of the project?

The CREATE project is working on the development of a heat battery that provides buildings with affordable and effective heat storage.

How could this technology be explained to a high school student?

The heat battery consists of a storage module and a heat source, such as solar collectors or a heat pump. The storage modules contain a heat-storing salt which can be dried in the summer via the solar thermal system, with the heat collected stored loss-free until winter.

What is the value for society?

- provides affordable heating options for multi-family buildings
- uses existing heat sources more efficiently
- increases the share of renewable energies

At what stage of development is this project?

A pilot project has been installed in a demonstration site in an orphanage in Warsaw, with the gathered data used to evaluate overall efficiency of the technology. The next step is the development and demonstration of industrially produced prototypes for which strong industrial participation and government support is key.

What government policies could bring this from the lab to the market?

- targeted support for market uptake of compact thermal energy storage devices
- support for local self consumption of renewable heat
- CO2 taxation

The work on this project was done within the framework of SHC Task 58: Material and Component Development for Thermal Energy Storage

IEA (2020), Today in the Lab – Tomorrow in Energy?, IEA, Paris. Learn more about the initiative, read the launch commentary, or explore the TCPs.

▲ **Laboratory test set-up of the prismatic heat battery (to the right) and the evaporator/condenser (middle).**
Source: AAE INTEC

Partners

AEE INTEC, Austria, leads a consortium of 11 multidisciplinary parties from universities, research and technology organizations, material suppliers and end-user companies

Funder

European Union under Horizon 2020

IEA programme SHC

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 64 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 Operating Agents.

Follow IEA SHC on

SOLARUPDATE

The Newsletter of the IEA Solar Heating and Cooling Programme

Vol. 71, July 2020

Prepared for the IEA Solar Heating and Cooling Executive Committee
by
KMGroup, USA

Editor:
Pamela Murphy

www.iea-shc.org

Current Tasks and Operating Agents

Towards the Integration of Large SHC Systems into District Heating and Cooling (DHC) Network
Ms. Sabine Putz
SOLID Solar Energy Systems GmbH
Puchstrasse 85
8020 Graz
AUSTRIA
s.putz@solid.at

Renovating Historic Buildings Towards Zero Energy
Dr. Alexandra Troi
EURAC Research
Institute for Renewable Energy
Via A. Volta 13/A
I-39100 Bolzano
ITALY
alexandra.troi@eurac.edu

PVT Systems
Mr. Jean-Christophe Hadorn
Solar Energy & Strategies
11 route du Crochet
CH 1035 Bournens
SWITZERLAND
jchadorn@gmail.com

Integrated Solutions for Daylighting and Electric Lighting
Dr. Jan de Boer
Fraunhofer Institute of Building Physics
Nobelstr. 12
70569 Stuttgart
GERMANY
jan.deboer@ibp.fraunhofer.de

Solar Energy in Industrial Water and Wastewater Management
Mr. Christoph Brunner
AEE INTEC
Feldgasse 19
A-8200 Gleisdorf
AUSTRIA
c.brunner@aee.at

Solar Neighborhood Planning
Dr. Maria Wall
Lund University
P.O. Box 118
SE-221 Lund
SWEDEN
maria.wall@ebd.lth.se

Solar Process Heat
Dr. Andreas Häberle
SPF Institute for Solar Technology
HSR University of Applied Sciences
Oberseestr. 10
8640 Rapperswil
SWITZERLAND
Andreas.Haeberle@spf.ch

Solar Cooling for the Sunbelt Regions
Dr. Uli Jakob
Dr. Jakob energy research GmbH & Co. KG
Postfach 2127
71370 Weinstadt
GERMANY
uli.jakob@drjakobenergyresearch.de

IEA Solar Heating & Cooling Programme Members

AUSTRALIA	Mr. K. Guthie	ISES	Prof. K. Vajen
AUSTRIA	Mr. W. Weiss	ITALY	Dr. M-A. Segreto
BELGIUM	Prof. S. Altomonte	NETHERLANDS	Mr. D. van Rijn
CANADA	Mr. B. Wong	NORWAY	Dr. M. Meir
CCREEE	Mr. G. Lindo	PORTUGAL	Dr. M.J. Carvalho
CHINA	Prof. H. Tao	RCREEE	Mr. A. Kraidy
DENMARK	Ms M.. Jessen-Schultz	SACREEE	MR. K. Ndhlukula
EACREEE	Mr. F. Ishugah	SLOVAKIA	Mr. A. Bobovnický
ECI	Mr. R. Pinter	SOUTH AFRICA	Dr. K. Surridge
ECREEE	Mr. G. Kouhie	SPAIN	Dr. M.J. Jiménez
EUROPEAN COMMISSION	Mrs. S. Bozsoki	SWEDEN	Mr. V. Dohlen
FRANCE	Mr. P. Kaaijk	SWITZERLAND	Mr. A. Eckmanns
GERMANY	Ms. K. Krüger	TURKEY	Dr. B. Yesilata
		UNITED KINGDOM	Mr. O. Sutton

CHAIRMAN
Dr. Daniel Mugnier
TECSOL SA.
105 av Alfred Kastler - BP 90434
66 004 Perpignan Cedex, FRANCE
Tel: +33/4 68 68 16 42
chair@iea-shc.org

SHC SECRETARIAT
Ms. Pamela Murphy
KMGroup
9131 S. Lake Shore Dr.
Cedar, MI 49621 USA
Tel: +1/231/620 0634
secretariat@iea-shc.org

Technology Collaboration Programme
by iea