TASK 62 INTERVIEW

Solar Energy in Industrial Water and Wastewater Management

Christoph Brunner

The SHC Programme finalized its work on Solar Energy in Industrial Water and Wastewater Management (SHC Task 62) at the end of 2022. To learn first-hand about the Task's impact, we asked the Task Manager, Christoph Brunner of AEE, to share his thoughts on this 4-year project.

Why was a project like this needed?

Christoph Brunner (Christoph): A project like this is needed to address the challenges and opportunities related to sustainable wastewater treatment and energy supply in the industrial sector. With 80% of the world's energy needs still being met by fossil fuels, there is a pressing need to transition to renewable energy sources. At the same time, wastewater treatment is a significant global issue due to water shortages and contaminants like microplastics. By exploring the integration of solar energy in water and wastewater treatment, this project aimed to develop innovative, resource-efficient, and economically viable solutions to reduce the reliance on fossil energy and promote a circular economy.

What is the current status of the technology?

Christoph: The current status of the technology is varied. The market study conducted in this SHC Task revealed that solar-driven technologies for water treatment are available, but most are still in the early stages of development (Technology Readiness Level, TRL 3 - tested at laboratory scale). Only a few technologies have reached the market (TRL 8), and the number implemented still needs to be increased. However, promising developments in thermal technologies, such as membrane distillation and evaporative technologies, show high potential for utilizing solar thermal energy. Plus, there are opportunities to use solar photons in advanced oxidation processes for decontamination and disinfection of wastewater.

Is there one result/outcome that surprised you?

Christoph: One notable outcome of this Task work is the successful implementation of a pilot plant utilizing membrane distillation (a separation process that uses a hydrophobic membrane to separate water vapor from a liquid phase) for ammonium recovery from wastewater. This application was suitable for using solar energy because of the required temperatures on the evaporation side of the plant. Using solar thermal energy to recover valuable materials from wastewater is a promising alternative to conventional separation technologies from both an energy and economic perspective. Another surprising technology with huge potential is using photons to convert water and wastewater into emerging energy vectors like hydrogen or methanol by photocatalytic technologies.

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

Christoph: The really promising combination of solar collector development and membrane distillation technology is the product of Solardew for purifying water. This, for sure, was a success story within Task 62.

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

Christoph: This Task brought together experts from 14 countries to analyze the potential of solar energy in water and wastewater treatment. By sharing knowledge, conducting studies, and exploring new technologies and application areas, the project helped build expertise in integrating solar energy into industrial and municipal water treatment processes. The developed concepts and decision-making tools can support stakeholders, including industrial companies, plant planners, and technology providers, in making informed decisions and planning overall systems that incorporate solar energy.

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

Christoph: This Task highlights the need for follow-up projects to demonstrate and increase awareness of solar supply and separation technologies for wastewater treatment. Integrating thermal technologies, like membrane distillation with solar process heat, holds promise for more sustainable and energy-efficient industry practices. And a growing focus is on developing

decontamination and disinfection systems using solar photons. Sunlight-based photo reforming, like photocatalysis, shows great potential to revolutionize the energy sector, providing a clean and sustainable energy source for various applications. The future of all these technologies relies on advancements in efficiency, scalability, and cost reduction, along with supportive policies and market incentives for renewable energy and sustainable wastewater treatment.

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

Christoph: Running this project as an IEA SHC Task had several benefits. First, it allows for international collaboration and knowledge exchange among experts from different countries, fostering a global perspective on solar energy and wastewater treatment. The Task provides a platform for experts to collectively address challenges, share best practices, and develop innovative solutions. Second, it facilitates the dissemination of research findings, enabling broader awareness and adoption of sustainable practices in industrial water and wastewater treatment. The SHC Task framework provides a structured and coordinated approach, ensuring the project's objectives align with global energy and environmental goals.

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

Christoph: Given the importance of renewable energy and sustainable wastewater treatment, it is likely that the IEA SHC Programme will continue to support and promote research, development, and implementation efforts in this area. The success and outcomes of Task 62 will no doubt inspire further work and collaboration within the Programme to advance the integration of solar energy in water and wastewater treatment technologies. In fact, a new Task on solar reactors for producing new energy vectors (hydrogen from wastewater, reducing carbon dioxide to, for example, methanol) is under preparation.

To learn more about the new Task see the sidebar on page 13.