SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

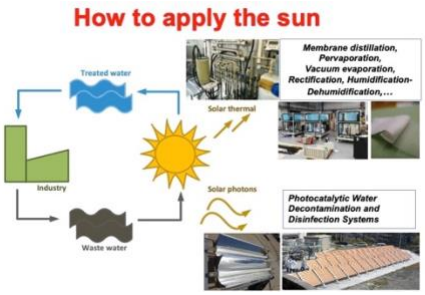
2019 HIGHLIGHTS

Task 62 – Solar Energy in Industrial Water & Wastewater Managment

THE ISSUE

The change to a sustainable, resource- and energy-efficient industry represents a significant challenge for 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 a circular economy must go hand in hand. The use of solar process heat represents a large, but so far largely unused, potential in industry. Innovative and concrete solutions are needed for the long-term and successful introduction of solar thermal energy. The integration of solar process heat to supply technologies for wastewater treatment represents a new field of application with excellent technical and economic potential for solar thermal energy. The efficient interaction, the nexus between solar energy, water and industry opens up new and innovative approaches.

OUR WORK



SHC Task 62 is developing and providing the most suitable and accurate information on the technical and economical possibilities for effectively applying solar thermal energy and solar radiation to disinfect, decontaminate and separate industrial process water and wastewater. This Task is supporting specifically the solar energy industry, the water technology sector and the producing industry in identifying new technologies, innovative fields of application and business opportunities.

The main objective of Task 62 is to improve the conditions and increase the applications of solar-driven separation and water purification technologies in industrial applications in order to push the solar water treatment market and to solve water problems at locations with abundant solar energy resources. Innovative results are expected in the field of collector technology and the identification of new applications, such as for municipal and industrial wastewater treatment plants.

Participating Countries

Australia
Austria
Germany
Italy
Netherlands
Spain
Sweden
France
Portugal

Task Period	October 2018 – September 2022
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KEY RESULTS IN 2019

Strong Industrial Involvement

Task 62 continues to successfully increase industry awareness of the NEXUS Solar Energy-Water-Industry's role in future strategies for energy and CO2 reduction in industrial companies. Industry participants are looking for options and concrete solutions (e.g., decision-making framework/guidelines, new solar thermal collector concepts, etc.) for the successful introduction of solar thermal heat in the application of wastewater treatment. One area of key interest to the industry partners is Membrane Distillation. As this technology continues to successfully perform in a variety of projects, its market potential is notable in different sectors.

Specification of System Design and Key Performance Indicators as a Basis for Comparative Simulation Studies

The optimization of Membrane Distillation (MD) modules and systems and their integration into industrial environments is complex. The special property of MD is two-fold 1) a membrane is used, which poses specific problems as well as advantages that need to be considered and 2) heat is the prime mover, which brings along a variety of energy sources, such as waste heat from different sources and renewable energy with very different associated costs.

To validate if MD can be a technical solution for a specific industrial problem and to perform comparative simulation studies, a first step is to specify "key application indicators" by resolving the following background information:

- Thermodynamic boundaries → properties of feed (e.g., vapor pressure of components).
- Reliability of the membrane against feed → stable hydrophobicity, mechanical stability, fouling and scaling potential.
- Specific thermal energy demand → is (cheap) waste heat available or the application of an evaporative process recommended / only option?
- Specific electrical energy demand → if low cost heat is available and MD is in competition with electrical driven system then the electrical energy demand of MD must be significantly lower.

To design MD modules, which can have very different configurations for different applications in terms of internal channel stacking (e.g., separated channels for heating and process fluids), channel length (e.g., with or without internal heat recovery), module size and system integration, simulation tools are required. Since MD is still in transition from research to market, there exist several simulation tools developed by research groups and being deployed by companies. To better understand what tools exist, the Task has developed a questionnaire to gather this information and prepare a comparative simulation study. The three technical key performance indicators that will be used for the comparison of the simulation results and finally describe the performance of a MD module in a comparative way are:

- Flux [kg/m^2h]
- Specific thermal energy consumption [kWh_{th}/m^3]
- Specific electrical energy consumption [kWh_{el}/m^3]

User Need and Technology Profile (UNTP)

To better understand the need for solar thermal and photon water treatment technologies in industry and the technologies available from researchers and companies, the User Need and Technology Profile (UNTP) template was prepared. The results to date show a small number of organizations actively promoting a technology that directly uses thermal or photon energy to treat water. This work will continue in 2020 and include industries already reusing wastewater, such as for agro-food processing.