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Solar Energy in Industrial Water and Wastewater Management (Task 62): Update from Subtask C

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The International Energy Agency (IEA) runs The Solar Heating and Cooling (SHC) program, which includes Task 62 that aims to improve the solar energy and water nexus. IEA SHC Task 62, led by Christoph Brunner (AEE INTEC, Austria), seeks to increase the use of solar thermal/photon energy in industry, promote the development of new collector technologies and opening up of industrial and municipal water treatment as a new area of application of solar energy with a high market potential. This is motivated by the shift to renewable energy supplies to support sustainable industries and the need for supplementing scarce fresh water resources by non-conventional water resources such as seawater and brackish water.

Task 62 is organized into three subtasks. Subtask A, led by Dr Isabel Oller (CIEMAT-PSA, Spain), deals with thermally driven water separation technologies and recovery of valuable resources while Subtask B, Dr Joachim Koschikowski (Fraunhofer-Institute for Solar Energy Systems ISE, Germany), reviews solar water decontamination and disinfection systems. Subtask C, reported in this abstract and led by Prof Mikel Duke (Victoria University, Australia), is aimed at system integration and decision support for end user needs. The main objective of the subtask is to develop a guideline for decision support, designed purposefully for end users or technology adopters to select the optimized combination of water technology coupled with solar thermal/photon energy supply technology to achieve a certain practical outcome. Typical end users include, among others, solar thermal companies, manufacturers, food producers and water utilities operating wastewater treatment plants.

The current progress from Subtask C is:

- Completion of the draft report (Deliverable D. C1) “Report on technologies to be considered for guidelines”
- Completion of the draft report (Deliverable D. C2) “Report on how water-energy nexus concept is actually being applied in the industry”
- Completion of Industry Workshop in Australia, 25 November 2020
- In progress (Deliverable D. C3) “Report on draft version of guidelines/decision making tool”

This presentation will update on Subtask C deliverables. The final report and decision making tool will be available on the website: http://task62.iea-shc.org/

Key findings from Deliverable D. C1 “Report on technologies to be considered for guidelines”

The first report (D. C1) concluded there were 19 technology categories relevant to solar photon or thermal (or combined) processes available for industrial water treatment, with TR levels ranging from 1 to 9. The countries with a focus on these included Austria, Australia, Netherlands, Spain, Sweden, Italy and Chile. Therefore technologies meeting certain requirements for water treatment are available, or in various stages of development (lab to pilot trials).

Key findings from Deliverable D. C2 “Report on how water-energy nexus concept is actually being applied in the industry”

The second report (D. C2) concluded three cases where industry was implementing solar thermal for water treatment applications. The drivers for the industry that led to their implementation included:

1. Lack of availability of fresh water, and abundance of impaired water source;
2. Direct demonstration of value from system output (including the water itself, agricultural output);
3. Fit for purpose technology complexity;
4. Assurance/control of the quantity and quality of the water supplied;
5. For large scale systems, heat supply was also required; and
6. Apparently best technology option, where solar availability is first factor, while other selection factors include relative simplicity and scalability.

Key findings from Industry Workshop

The Industry Workshop was attended from 37 delegates, both from Australia and overseas, representing research, water utilities, consultants and technology providers. The program included guest speakers from AEE INTEC (Austria), Águas de Portugal (Portugal), Melbourne Water (Australia), Fraunhofer ISE (Germany), Plataforma Solar de Almería/CIEMAT (Spain), RMIT (Australia) and F CUBED (Australia). In discussing needs for solar technologies for the water industry, some of the conclusions included:

- Technologies today could meet 2050 targets, but not all meet the required selection criteria;
- Business cases are essential;
- Important role of regulations;
- Cost and reliability more important selection criteria. Others include resource recovery, emissions reduction and community benefit; and
- Sharing risks and responsibility, financing, skills, etc.

For research, the following points were made:

- Pilot trials on existing technologies should be prioritised over fundamental research on new technologies (except for ZLD);
- Energy storage and technology flexibility;
- Information on cost and reliability;
- Tests over long periods of time; and
- Communication and dissemination of results

Key findings from Deliverable D. C3

Subtask C is now working towards Deliverable D. C3, preparing the draft version of guidelines/decision making tool. It will follow closely the Integration Guidelines deliverable D2 from Task 49. In commencing, the following ‘end user’ starting points have been defined:

- Scenario 1: Existing plant & water treatment + no solar
- Scenario 2: Existing plant & no water treatment + no solar
- Scenario 3: Existing plant & no water treatment + solar thermal
- Scenario 4: New plant that requires water treatment

In defining the end user’s Scenario as the starting point, by the current draft map presented in Figure 1, the end user will be taken through a series of steps in the tool to lead to a recommended solar technology for a water treatment need. Basic performance metrics will also be provided in order to make performance and cost estimates, as well as provide the current TR level.

Figure 1: Draft map for industry end user looking to harness solar energy to treat a wastewater, from their specific Scenario to a recommended set of technologies with indicative performance.

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