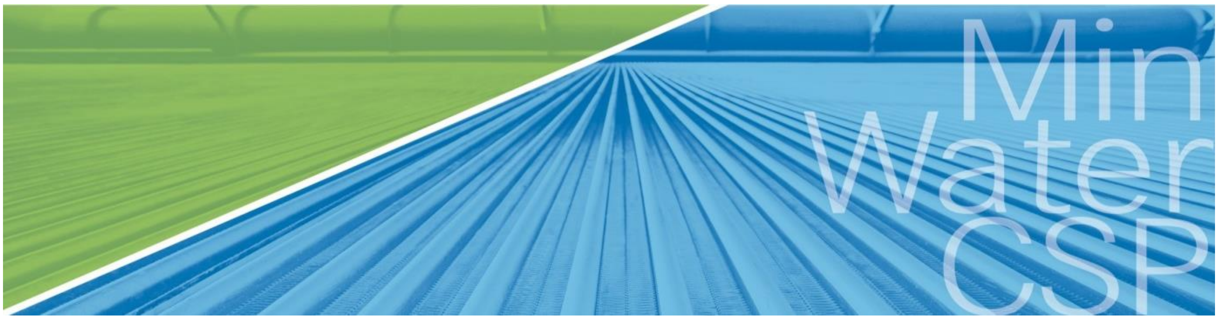

MinWaterCSP Newsletter

Edition: August 2016

Topics

1. Editorial

Our newsletters focus on minimized water consumption in CSP plants. In this first edition of the newsletter you will learn about the project in general and the project team members.

The six-monthly newsletters are addressed to all stakeholders who are active in the field of Concentrated Solar Power Plants, from power plant developers / operators and technology suppliers to the scientific communiy as well as governmental bodies. Members from the general public who are interested in topics related to the MinWaterCSP project, such as solarthermal energy, water management at CSP plants and other environmental matters will also gain from our newsletter. You will receive information about MinWaterCSP on a regular basis, covering project progress, special topics, news, where to find further information and where to meet us at events.

If you have received this newsletter via a project partner’s contact, please feel free to subscribe at our website to have the newsletter automautically forwarded to you in the future.

Enjoy reading!

Falk Mohasseb
Coordinator of MinWaterCSP
Kelvion Holding GmbH

2. The MinWaterCSP project at a glance

The MinWaterCSP project partners address the challenge of significantly reducing water consumption at CSP plants, while maintaining their overall cycle efficiency. This includes the development of advanced cooling and mirror cleaning technologies as well as integrated water management plans. We aim to reduce cooling system water consumption by up to 95% (compared to wet-cooling systems) and mirror cleaning water consumption by up to 25%. These improvements will make CSP technology more attractive for investment purposes and will drive growth in the CSP plant business. This will in turn contribute to job creation at European companies which are active in the CSP market.

The project is funded by the European Union's Horizon 2020 research and innovation programme and is running from January 2016 to December 2018.

2.1 Project Objectives and Technologies

MinWaterCSP aims to significantly reduce water consumption in CSP plants through a holistic combination of next generation technologies in the fields of:

- Hybrid dry/wet cooling systems
- Axial flow fans
- Wire structure heat transfer surfaces
- Mirror cleaning techniques and
- Optimized water management

Hybrid dry/wet cooling systems

The scarcity of water in arid locations where CSP plants are often constructed is one of the main drivers towards the use of dry-cooling (cooling with air) for power plant cooling purposes, as opposed to wet-cooling (cooling with water). However, although dry-cooling methods allow an order of magnitude reduction in cooling water consumption, the overall power cycle efficiency is generally lower compared to power plants where wet-cooling is implemented.

In order to provide an improvement in the performance of a dry-cooling system for CSP applications the MinWaterCSP project focusses on the development of a novel hybrid cooling system which can be operated in a dry and dry/wet mode, depending on the ambient conditions.

MinWaterCSP targets a 2% cycle efficiency improvement compared to dry-cooled rankine cycles, while significantly reducing water consumption compared to the use of wet-cooling. The hybrid dry/wet cooling system concept is combined with the development of three further technologies:

- High efficiency axial flow fans
- Heat exchangers incorporating wire structure heat transfer surfaces
- Software tools for design and simulation of cooling systems and CSP power cycles

Axial flow fans

Large diameter axial flow fans find application in forced or induced draft air-cooled condensers. These fans are typically constructed by either using extruded aluminium sections or composite material lay-up techniques. These construction methods sometimes limit the performance of the final manufactured product. Additionally it only allows for a fixed number of fan configurations to be at the disposal of the cooling system designer.

The following possibilities for improvement in large diameter axial fan design and manufacturing exist:

- The aerodynamic design of a fan rotor to simultaneously render high total to static efficiencies and low noise levels. The aerodynamic design will consider the manufacturing technique to be used for the fan blade.
- A blade manufacturing technique that would produce sufficiently stiff and light weight fan blades with a high level of accuracy. The manufacturing process will be adaptable in such a way that the manufactured fan can be tailored to the requirements of the cooling system designer.

Wire structure heat transfer surfaces

At present state-of-the-art heat transfer surfaces in large air-cooled condensers mainly consist of steel tubes with aluminium fins in various configurations. Existing wire structure heat transfer surfaces can be adapted and developed for such applications. The main benefits of wire structures as heat transfer surfaces is the reduction in fin material, higher heat transfer surface area as well as higher heat transfer coefficients. Therefore experimental and simulation based studies will be done on a variety of designs by Fraunhofer ISE, Germany. If successful, samples for laboratory testing will be manufactured and tested to determine heat transfer and air-side pressure drop characteristics.

Should the outcome show benefits compared to existing state-of-the-art technology, a cooling system design based on the new heat transfer and air-side pressure drop characteristics will be carried out and overall gains will be quantified.

Cooling system design and simulation tools

Design and simulation tools play an important role in the development of new cooling systems. Kelvion Thermal Solutions, South Africa, is responsible for the development of performance prediction software for existing large-scale cooling systems as well as a newly designed hybrid dry/wet cooling system. The software is largely based on proven thermo-fluid dynamic theory and will be capable of predicting, among other things, heat transfer rates, steam-side flow distributions, water consumption and fan power consumption. The results obtained from the newly developed software will be used as input to existing CSP simulation software (ColSim), developed by Fraunhofer ISE, Germany, that is used for the life cycle analysis of complete CSP plants.

Mirror cleaning techniques

It is aimed to reduce mirror cleaning water consumption by 25% through
i) an improved mirror cleaning process for parabolic trough collectors,
ii) the development of a cleaning robot for linear Fresnel collectors and
iii) a reduced number of cleaning cycles. The reduction in cleaning cycles is enabled by enhanced monitoring of the reflectance of the mirrors.

The collector cleaning part of the project will contribute in the following ways:

- Improve actual state-of-the-art cleaning methodolgies and introduce technological improvements.
- Reduce water consumption by:
  - Treatment and subsequent reuse of cleaning water collected after a first cleaning cyle use.
  - Improving the monitoring of collectors in the solar fields for the optimisation of cleaning cycles.
- Creation of a new robot for Linear Fresnel primary mirrors and a system for cleaning the secondary mirror and receiver tubes.

Optimized water management

Comprehensive water management plans for CSP plants in various locations will be developed. The water management plans will be combined with overall plant performance simulations in order to maximize the impact of the resultant design improvements gained from the reuse of water via treatment to optimized distribution in a complete system context. Zero liquid discharge and the option of making use of solar energy or low grade waste heat for water treatment will be considered as well.

Simulation tools will be developed to support the development of the management plans. Particular solutions for centralized water treatment as well as decentralized water treatment systems for mirror cleaning, which can be mounted on trucks or robots, will be developed.

Theoretical investigations and simulation studies will be supported and validated by laboratory tests on single components or sub-systems.

2.2 Get to know the MinWaterCSP consortium

The MinWaterCSP project is coordinated by Kelvion Holding GmbH (Germany) and consists of 12 partners in an international consortium. Further partners are: Kelvion Thermal Solutions Pty Ltd. (South Africa), Fraunhofer ISE (Germany), Sapienza - Università di Roma (Italy), ECILIMP Thermosolar SL (Spain), Stellenbosch University (South Africa), Notus Fan Engineering (South Africa), Laterizi Gambettola SRL – SOLTIGUA (Italy), Enexio Germany GmbH (Germany), Institut de Recherches en Energie solaire et Energy Nouvelles - IRESEN (Morocco), Steinbeis-Europa-Zentrum der Steinbeis Innovation gGmbH (Germany), Waterleau Group NV (Belgium).

- Learn more about the partner organizations: http://www.minwatercsp.com/partners/
- Get to know the MinWaterCSP team: http://www.minwatercsp.com/team/

3. Visit the MinWaterCSP Website

Our website presents the different aspects of the MinWaterCSP project. Find out more about the project, the technologies developed and the impact of the envsiaged technical improvements. We also introduce the test facilities at the demonstration sites in Morocco, South Africa and Spain.

You also can learn more about the MinWaterCSP team and their expertise and role in the project.

The News area informs you about special topics through monthly blogs and articles and where you can meet us at events. For press and media stakeholders you find a press platform on our website.

4. Stay in contact with us

- Visit us on: http://www.minwatercsp.eu
- Subscribe to our newsletter
- Visit our press and media area: http://www.minwatercsp.com/news/mediapress

5. Meet us at Events

- 2016-09-28/29: ESTELA Solar Thermal Electricity Workshop and EU-Solaris Project Final Conference
  Location: Brussels, Belgium
  Click here to get more information about the event
  Click here for the conference announcement; use this link to register

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This first newsletter has been sent to you via a project partner. Please inform the sender of this mail if you don't want to receive it in the future. In case you are subscribed to this newsletter via the website – please click here to unsubscribe.

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