MinWaterCSP Newsletter

Edition: December 2017

Topics

1 Editorial 1

2 Special topic: Water consumption reduction for mirror cleaning operations 2

3 News 5

4 Events – Meet us at… 7

5 Stay in contact with us 7

1 Editorial

Dear Reader,

An important aspect of the MinWaterCSP project is the aim to reduce water consumptions in CSP plants, especially during the cleaning process of the mirrors. In this fifth edition of the MinWaterCSP newsletter, we will present you **how this reduction in water consumption can be achieved in mirror cleaning operations by employing truck-based and robot-based cleaning devices**. Besides, we will inform you about the latest blogs on our project website and on CSP related events. A **special event highlight will be the International Conference "Reduced water consumption in CSP plants" organised by the MinWaterCSP consortium in Marrakech, Morocco on 24th-25th April 2018** to which you are cordially invited. The conference will focus on new approaches in mirror cleaning, cooling and simulations in CSP.
This newsletter is issued approximately every four months. It is addressed to all interested 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.

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

We wish you an inspiring read!

Falk Mohasseb
Coordinator of MinWaterCSP
Kelvion Holding GmbH

2 Special topic: Water consumption reduction for mirror cleaning operations

MinWaterCSP project partners involved in this activity:

- ECILIMP Termosolar, Spain
- Soltigua, Italy
- Fraunhofer ISE, Germany
- Waterleau, Belgium

Introduction

MinWaterCSP aims at reducing the water consumption for the cleaning of collectors such as Heliostats, Parabolic Trough and Linear Fresnel in CSP plants. The reduction of water consumption will be achieved by further developments and improvements in the cleaning hardware as well as via water recycling and reflectivity monitoring for cleaning cycle optimization.

Current state of the art and challenges

There are industrial solutions on the market for the cleaning of Parabolic Trough and Heliostat collectors and the Solar Fields are adapted to this kind of equipment, which consists of an industrial vehicle which cleans the mirrors while moving along the solar field lines. This technology requires a large quantity of water which amounts to nearly 50% of the water consumed during a manual cleaning process. These industrial solutions were considered to offer a great advance because it reduced the amount of water needed for the cleaning process close to the half and the time invested threefold.

Picture 1&2: Manual cleaning of mirrors consumes a large amount of water
(© ECILIMP and Soltigua)

New generations of CSP plants however require not only a decrease in water consumption, but also maintaining performance, quality and cleaning ratios. This even has become more relevant, considering that the mirror surface of new solar fields is growing while water resources are decreasing.

For Linear Fresnel collectors, automatic solutions were specifically developed in the past for utility scale systems; however, these are based on very sophisticated and cumbersome robots making the solutions very complex under operation and maintenance purposes.

The MinWaterCSP approach

Truck-based cleaning of Heliostats and Parabolic Trough collectors

MinWaterCSP partner ECILIMP has reached an important improvement concerning the truck-based cleaning process for Heliostats and Parabolic Trough collectors. Having redesigned the cleaning process and the cleaning hardware, they achieve a considerable reduction in water consumption of up to 25% compared to conventional cleaning systems.

Furthermore, the redesign of the brush system now allows for a full cleaning coverage of the mirror surface, even inside collector's gaps and a better distribution of loads, thereby reducing the risk of mirror breaking and abrasion due to pressure and fiber diameter.

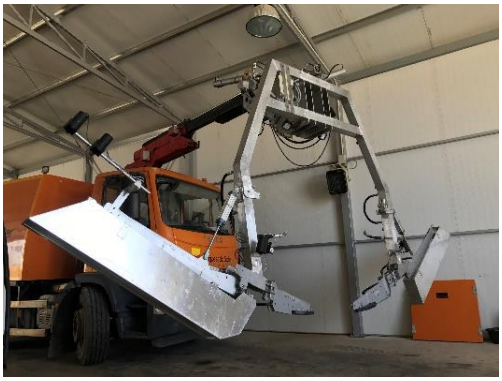
Picture 3: ECILIMP's previous vehicle

Picture 4: Technology property of ECILIMP / Valle Plant Property of Torresol Energy ©SENER

Picture 5: Technology property of ECILIMP / Gemasolar Plant Property of Torresol Energy ©SENER

Pictures 3-5: Innovative brush system developed by ECILIMP guarantees full cleaning coverage of the mirror surface

The Spraying system has also been adapted for a full cleaning coverage of the mirror surface while the number of nozzles has been reduced. Thus, the cleaning power is increased while water consumption is reduced.



Picture 6 & 7: Optimized spraying system of cleaning truck by ECILIMP for cleaning of Heliostats and Parabolic Trough (© ECILIMP, Vehicle property of Marquesado Solar in Andasol 3 CSP plant – New tools' intellectual property of ECILIMP)

Moreover, some new features, the so called “attachable parts” have been designed and pre-tested. They consist in a combination of mechanisms that can be incorporated into the new cleaning hardware, such as the collection of the cleaning water for subsequent reuse and the reduction of the rinsing water during the brushing process.

Furthermore, the scratching tests performed showed a reduction of scratching due to proper fiber selection and optimization of operating parameters such as pressure, lubrication, turning speed and maintenance programs.

ECILIMP obtained a system which is both eco-friendlier and ensures mirror integrity. It will be perfect for those clients who require high efficiency cleaning services for big solar fields in countries with scarce water supplies as in Spain, Morocco, South Africa and the United Arab Emirates.

Robot-based cleaning of Linear Fresnel

Within MinWaterCSP, project partner Soltigua has developed a simple yet effective prototype robot called “Soltibot” to clean the primary mirrors of its linear Fresnel solar fields. The robot moves automatically over the mirror lines and cleans the mirrors with a three-phase process:

- A nozzle system wets the glass surface with just a small amount of water.
- A high-speed brush removes and detaches the dust from the mirror, even when it’s sticky.
- Finally, a wiper removes the dirty water and restores the mirror reflectivity to its best.

The average water consumption for robot-based mirror cleaning is 0.09 l/m^2, which compares to an industry average for truck-based systems of 0.9 l/m^2.

Picture 8: Prototype robot called “Soltibot” developed by SOLTIGUA for cleaning of Linear Fresnel (© Soltigua)

Soltibot can automatically cross the collector drive system which lies just in the middle of the collector and recognizes any obstacle, which might be in the way, preventing any damage to itself or to the collector in case an operator executed an incorrect instruction.

At the end of each mirror line, Soltibot automatically moves from the mirror to a trolley, which completes the cleaning system. The trolley is used by an operator to slide the robot to a new mirror line and re-fill it with water.

The new cleaning concept developed by Soltigua comprises also a tool to clean the collector receiver, which is located at 5 meters or more above the ground.

An operator can use a high-pressure nozzle head by walking on the ground. The nozzle head is custom shaped so that water can rinse all the active areas of both the absorber tube and the secondary mirror.

Soltigua successfully tested both prototypes at their premises during the summer of 2017, and a new system is now being manufactured to be tested in Morocco at the IRESEN Green Energy Park.

Impact

These examples show how research and continuous improvement of activities such as mirror cleaning are closing the gap with conventional other energy systems by reducing the solar system Levelized Cost of Electricity (LCOE).

The reduction of water consumption, together with an improvement in plant efficiency, shows a lifecycle approach which takes into account the total ownership costs of renewable systems.

MinWaterCSP enabled the improvements of robot- and truck-based cleaning solutions to reduce water consumption and to optimize cleaning results compared to other cleaning systems on the market.

Authors: *Javier Garcia, ECILIMP Termosolar, Spain;*
Vittorio Orioli, Soltigua, Italy

3 News

- **Euronews TV at IRESEN's demo-site Green Energy Park**

In September, a team of Euronews TV visited IRESEN's Green Energy Park to produce a documentary of the containerized fouling test rig.
There are two videos available on the MinWaterCSP website under the following link:
http://www.minwatercsp.eu/news/mediapress/
(c) European Commission/Euronews, 2017

- **SAVE THE DATE - 24th April – 25th April 2018**

Reduction of water consumption in CSP plants -
new approaches in mirror cleaning, cooling and simulations
International Conference by the Horizon 2020 project MinWaterCSP

Date: 24th April – 25th April 2018
Marrakech, Morocco
The two-day conference will present the current development status of:

- Different mirror cleaning systems
- Measurement and analysis of soiling and its impact on reflectors
- Innovative developments for air cooled condensors and cooling towers
- Axial flow fan developments done during MinWaterCSP
- Simulation based analysis of water consumption in CSP plants
- Strategies for water management
- Best practices in water consumption reduction in CSP – stated by different invited CSP projects

The conference will include a site visit to Green Energy Park in BenGuerir.

Link to conference: http://www.minwatercsp.eu/conference-marrakech-april-2018/
Link to programme: http://www.minwatercsp.eu/programme/
Registration will be opened beginning 2018

- **New project in the MinWaterCSP Network – shortly introducing…**
    - **RAISELIFE**

RAISELIFE is a project funded by the European Union's Horizon 2020 research and innovation programme (*GA No. 686008)*. The project addresses the challenges of materials for CSP technology focusing on the 2020 targets stated in the Materials Roadmap (SEC(2011)1609).

It focuses on extending the in-service lifetime of five key materials for concentrated solar power technologies: 1) protective and anti-soiling coatings of primary reflectors, 2) high-reflective surfaces for heliostats, 3) high-temperature secondary reflectors, 4) receiver coatings for solar towers and line-focus collectors, 5) corrosion resistant high-temperature metals and coatings for steam and molten salts. For this purpose, the project brings together a broad consortium formed of leading industry partners, SMEs and research institutes of the concentrated solar thermal and material science sector.

- **MinWaterCSP blogs published monthly**

Project partners are publishing monthly blogs on key experiences, technological developments, events they are organising or have attended and activities they want to share on the MinWaterCSP website. Visit our website to find out more information in the 21 blogs published to date.

Click on any of these links to view our newest blogs and articles:

- Blog # 21 - Water analysis and treatment for Special Issues about water savings in CSP
- Blog # 20 - MinWaterCSP is making good progress in reducing water consumption in CSP plants
- Blog # 19 - Studying the Fouling effect on the test demo at Green Energy Park, Ben Guerir, Morocco under MinWaterCSP project
- Blog # 18 - Making energy cheaper – euronews article and video about MinWaterCSP solutions

Stay tuned! - *http://www.minwatercsp.eu/news/blogs/*

- **Joint activities with other H2020 CSP projects (CAPTure, MOSAIC, WASCOP)**

MinWaterCSP continued the collaboration with other H2020 CSP projects:

- The 2nd edition of a **joint newsletter** providing information on the progess of H2020 funded CSP project has been published in November 2017 with a contribution from MinWaterCSP.
  Follow us by subscribing to the joint newsletter: http://eepurl.com/cOtWvj
- A joint **"H2020 CSP projects"** group on LinkedIN has been created which provides news linked to CSP and to our projects. Follow the four projects via the joint LinkedIN Group: *https://www.linkedin.com/groups/13519618*

4 Events – Meet us at…

Events

- **Solar Expo**, 15th-18th January 2018 in Abu Dhabi, United Arab Emirates, Roundtable session "Focus on CSP – its benefit as part of the baseload energy mix", *https://www.solarexpo.ae/*
- **STAGE-STE Workshop "Latest joint efforts between Research and Industry for strengthening European CSP leadership"**, 23rd January 2018, at the European Economic and Social Committee (EESC) in Brussels, Belgium, *http://www.stage-ste.eu/workshop/*
- **Advanced Energy Materials Congress**, 25th-28th March 2018, in Stockholm, Sweden, *https://www.vbripress.com/aemc18/*
- **International Summit on Conventional and Sustainable Energies**, 30th-31th March 2018 in Orlando, Florida, USA, *https://sustainableenergies.conferenceseries.com/*

Meet us at…

- **Special highlight – SAVE THE DATE:**
  International Conference "Reduction of water consumption in CSP plants
  - new approaches in mirror cleaning, cooling and simulations
  Conference by the Horizon 2020 project MinWaterCSP", 24th-25th April 2018 in Marrakech, Morocco; http://www.minwatercsp.eu/conference-marrakech-april-2018/

5 Stay in contact with us

- Visit us on: http://www.minwatercsp.eu
- Subscribe to our newsletter
- Visit us on Twitter: https://twitter.com/MinWaterCSP
- Stay connected via LinkedIn: MinWaterCSP
- Visit our press and media area: http://www.minwatercsp.com/news/mediapress

Editors: Communication and Dissemination Secretariat
Steinbeis 2i GmbH
Charlotte Schlicke / Kathrin Eckerlin
E-Mail: secretariat@minwatercsp.eu

Coordinators: Project Coordinator/Technical Coordinator
Kelvion Holding GmbH /ENEXIO Management GmbH
Dr. Falk Mohasseb / Dr. Albert Zapke
E-Mail: contact@minwatercsp.eu

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 654443