The Partners

Kelvion Holding GmbH
Germany
www.kelvion.com

ENEXIO Management GmbH
Germany
www.enexio.com

Kelvion Thermal Solutions (Pty) Ltd.
South Africa
www.kelvion.com

Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V., Fraunhofer Institute for Solar Energy Systems ISE
Germany
www.ise.fraunhofer.de

Sapienza - Università di Roma
Italy
www.uniroma1.it

ECILIMP TERMOSOLAR S.L.
Spain
www.ecilimp.com

Stellenbosch University
South Africa
www.sun.ac.za

Notus Fan Engineering
South Africa
www.notus.co.za

Laterizi Gambettola srl - SOLTIGUA
Italy
www.soltigua.com

ENEXIO Germany GmbH
Germany
www.enexio.com

Institut de Recherches en Energie Solaire et Energie Nouvelles – IRESEN
Morocco
www.iresen.org

Steinbeis 2i GmbH
Germany
www.steinbeis-europa.de

Waterleau Group NV
Belgium
www.waterleau.com

The Project at a glance

Summary

The MinWaterCSP consortium addresses the challenge of significantly reducing the water consumption of CSP plants while maintaining the overall cycle efficiency. Our objective is to reduce evaporation losses and mirror cleaning water consumption for small- and large-scale CSP plants through a holistic combination of next generation technologies.
In addition, comprehensive water management plans for CSP plants in various locations are developed. The MinWaterCSP consortium aims to make CSP more attractive for investment purposes in order to drive growth in the CSP plant business as well as create new jobs at European companies.

Experimental facilities and demonstration sites

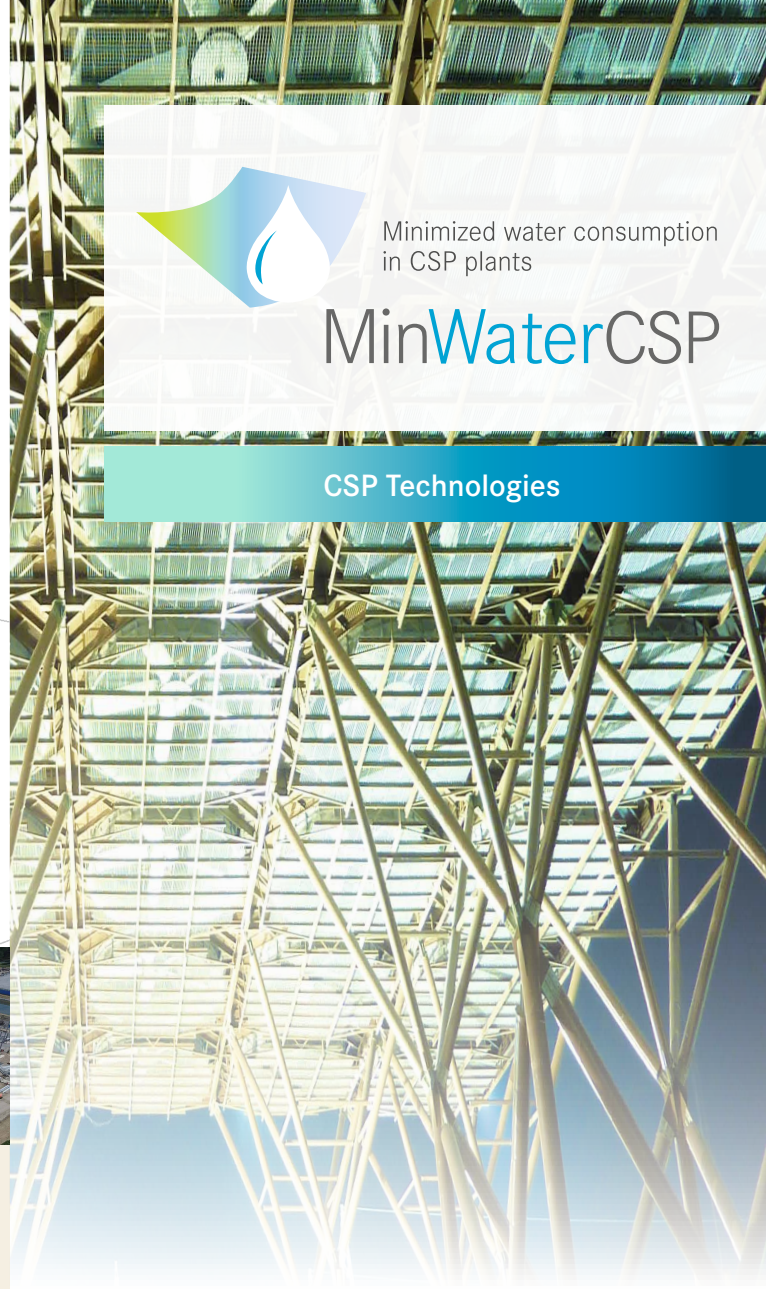
- Full-scale fan and deluged cooling test facility, University of Stellenbosch, South Africa
- Deluge cooling fouling test facility and Fresnel collector cleaning demonstration, Green Energy Park, Iresen, Morocco
- Parabolic collector cleaning site, Torresol, Spain

Photo credits: ECILIMP TERMOSOLAR S.L., ENEXIO Management GmbH, Fraunhofer ISE

Contacts

Kelvion Holding GmbH / ENEXIO Management GmbH
Project coordinator / Technical coordinator
Dr. Falk Mohasseb / Dr. Albert Zapke
contact@minwatercsp.eu
www.minwatercsp.eu

Follow us:
@MinWaterCSP
MinWaterCSP



Minimized water consumption in CSP plants

MinWaterCSP

CSP Technologies

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

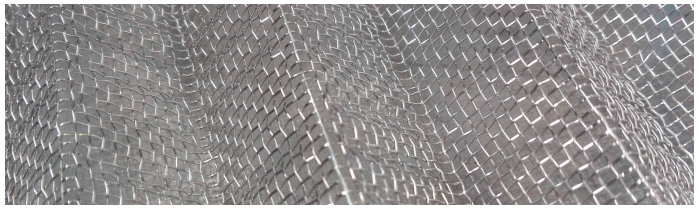
Technologies and Benefits

Hybrid (dry/wet) cooling system

CSP plants are typically located in arid regions and subsequently often make use of dry-cooling systems instead of smaller and more effective wet-cooling systems. A novel hybrid (dry/wet) cooling system is being developed.

The Benefits

- Reduction of overall water consumption relative to evaporative cooling systems while maintaining cycle efficiency or offering improved efficiency relative to dry cooling systems
- Improved power cycle efficiency



Corrugated textile fabric forming a heat transfer surface area for flat tube air-cooled condensers.

Wire structure heat transfer surfaces

Wire structures are heat transfer enhancement technologies suitable for dry-cooling applications and are manufactured from metal textile fabrics. The structures allow high heat transfer rates at reduced fin material quantities, thus saving energy and resources. Computational Fluid Dynamic simulations and experimental investigations are being undertaken in order to adapt this technology to air-cooled condensers, which form part of the steam cycle in CSP plants.

The Benefits

- Reduced material quantities
- Reduced overall finned tube bundle mass in air-cooled condensers
- Increased heat transfer surface area and heat transfer coefficients
- Increased overall performance of dry-cooling systems
- Increased attractiveness of dry-cooling from a cost and performance point of view

Axial flow fans

Large diameter axial flow fans are installed in air-cooled condensers, which are typically used in CSP plants. Potential improvements are identified in the fields of aerodynamic design, manufacturing techniques, electrical drive systems and noise reduction in order to improve the overall performance of dry-cooling technologies with particular reference to reducing auxiliary power consumption.

The Benefits

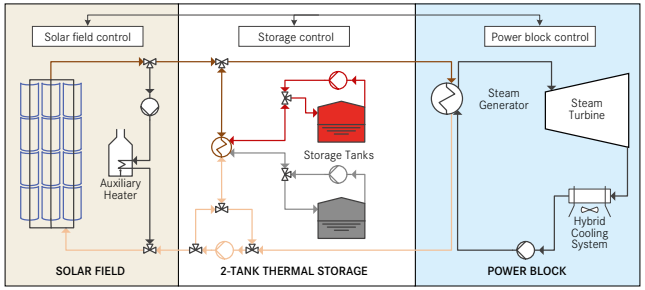
- Improved large axial flow fan static efficiency
- Improved structural design techniques to enable fan operation in safe margins away from mechanical excitation frequencies
- Improved drive torque to weight ratio
- Reduced tonal noise of the overall cooling plant

Mirror cleaning

Mirror cleaning improves mirror reflection and therefore available input heat in CSP plants. Cleaning technologies for heliostats and parabolic trough mirrors are improved to reduce water consumption through the re-cycling of cleaning water. A new agile mirror cleaning robot and receiver cleaning device for linear Fresnel technology is developed. A mobile device for soiling and cleanliness measurements is used as part of the overall optimization of the mirror cleaning process.

The Benefits

- Reduced water consumption
- More realistic and reliable models for reflectiveness to monitor the cleaning cycles
- New cleaning robots for linear Fresnel mirrors
- Improved mirror soiling predictions and cleaning strategies



Schematic of the ColSimCSP simulation model of a parabolic trough collector plant with the novel Hybrid (dry/wet) cooling system.

CSP plant simulation software / Water management plan

The simulation software ColSimCSP is being further developed and eventually used for simulation and optimisation of CSP plants. This includes parabolic trough, solar tower and linear Fresnel technologies for the evaluation of the overall cycle performance and water consumption. Overall water management concepts for CSP plants will be designed, covering the whole chain from sourcing via treatment to distribution.

The Benefits

- New software integrating the new hybrid cooling system and its novel features as well as the conventional cooling systems for comparison purposes
- Integrated energy model including techno-economic evaluation and optimized water management and consumption
- New centralized and decentralized water treatment systems
- Implementation of mirror cleaning schedules in the overall plant simulation

Expected Impacts

- Reduced cooling system capital and operating costs
- Increased net power output and saving water
- Expanding CSP technology to locations with limited water supply
- Reduced dependency on fossil fuels and greater financial attractiveness of CSP
- Reduced impact on the environment during the entire life-cycle of a CSP plant