S3
Smart Solar System

Project duration: from 04.2021 to 03.2023
Report submitted: 05.2022

Publishable Summary

With high fuel costs, the increased likelihood of carbon taxation and pressure to reduce the environmental impact of their business activities, various industrial sectors are becoming increasingly aware of the need to become less dependent on fossil fuels. In order for industry to do this, suitable technologies have to be available that can provide them with cost effective and user-friendly alternatives.

One of the best renewable options to supply industrial process heat is Concentrated Solar Thermal (CST) technology, especially as it can use Thermal Energy Storage (TES) to provide heat on demand. During the EDITOR project (co-funded by SOLAR-ERA.NET), a Parabolic Trough Collector (PTC) and TES were installed at KEAN Soft Drinks Ltd in Limassol, Cyprus, demonstrating full dispatchability of process heat. To further improve the overall performance of this system, as well as transition towards Industry 4.0, it is necessary to develop a smarter control system.

The primary objective of this industrial research project is to realise a next generation Smart Solar System (S3) for steam generation based on CST technology. The smart control system will feature self-learning, adaptive, predictive and automatic characteristics and will be demonstrated for the solar plant installed at KEAN Soft Drinks Ltd in Limassol, Cyprus. The smart control system will consist of a Main Control Unit (MCU), and based on operational data from Local Control Units (LCU), weather & load forecasting inputs and the consumer demand schedule, the MCU will automatically select an optimum operation strategy. The degree of intelligence of the smart control system targeted- is in accordance with the objectives of the SOLAR-ERA.NET call (subtopics E1, E5 and E6) and the aims of the European strategic energy technology (SET) plan for CSP to improve the performance of a CST system and will lead to lower operation and maintenance costs, while in line with the goals of Industry 4.0.

The seven objectives of this project are:

1) Development of a smart solar system that runs efficiently and can predict the optimum strategy at all times depending on weather and load (energy demand) forecasting.
2) Evaluation of the fossil fuel cost saving potential for KEAN (and industry in general) that could be achieved by the use of an up-scaled CST system. This would involve a study of KEAN's fossil-fuel fired boiler performance as well as the CST's solar boiler performance, to develop better forecasting of KEAN's energy demand and CST's demand matching.
3) Development of new hybrid operating modes and further operation strategies to better match the consumers demand patterns.

4) Increase CST boiler's performance through smarter and more robust control system.
5) Testing of a new Heat Transfer Fluid (HTF) HELISOL® XLP, that will reduce plant purchase and operating costs, in an industrial application. This will allow the more widespread use of this product.
6) Identification of optimal cleaning schedules of the mirror assembly and heat collecting element (HCE) for the different seasons of the year with the aim to reduce the water consumption and O&M costs.
7) Identification of optimum maintenance of the silicone Heat Transfer Fluid (HTF) system to control hydrogen concentration.

Project consortium

Coordinator and all contact details:

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Participating countries and financing:

Country	**Number of organisations involved**	**Project costs in EUR**	**Public funding in EUR**
Germany	3	401 477	355 118
Greece	1	97 800	97 800
Total	4	499 277	452 918

Funding agencies involved and contracts

Funding Agency	**Contract N° and Title**
Projektträger Jülich Forschungszentrum Jülich GmbH Energie-Technologie-Nachhaltigkeit (ETN 1)	PRO/0089A PRO/0089B PRO/0089C
General Secretariat of Research and Innovation (GSRI)	5161504