Solar Facilities for the European Research Area - Third Phase

Reporting

Project Information

SFERA-III

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Project website

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Project closed

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€ 9 102 630,66

Coordinated by
CENTRO DE INVESTIGACIONES ENERGETICAS MEDIOAMBIENTALES Y TECNOLOGICAS
Spain

Periodic Reporting for period 4 - SFERA-III (Solar Facilities for the European Research Area - Third Phase)

Reporting period: 2023-01-01 to 2023-12-31

Summary of the context and overall objectives of the project

According to the objectives of the EU in the field of sustainable energy supply,climate change and energy security needs strong efforts in innovative technologies and education.The amending EU's

Renewable Energy Directive sets a binding target of 40% final energy consumption from renewable sources by 2030.Solar energy is the primary source of renewable energy and CST power can supply electricity on demand, which distinguishes these plants from other highly variable renewable electricity production technologies like photovoltaic or wind power.In this context,this project aims at coordinating efforts of the main European research institutions operating a unique set of RIs to promote innovative research,to improve services offered by concentrating solar RIs and to train researchers and engineers on the CST technologies.

Work performed from the beginning of the project to the end of the period covered by the report and main results achieved so far

4 doctoral colloquia and summer schools and 5 training for industry implemented.9 workshops held,15 short term training visits organized,and 42 mobilities performed.
Database summarising the state-of-the-art of the RIs and services offered by the consortium developed,potential missing infrastructures/services missing to reach the targets of the updated CST Implementation Plan identified and discussed amongst stakeholders.Concept notes for harmonised funding opportunities finalised,and workshop carried out.EU-SOLARIS became an ERIC.Cooperation carried out with other CST-related EU projects and international initiatives.
Documents to implement the TA activity prepared.5 calls launched;4 access campaigns completed.4 webinar sessions on TA.
Work done on the establishment of a protocol for dynamic corrosion of structural materials by molten salt (MS),on the methodology to study the feasibility of materials as latent or sensible thermal energy storing media,and on the prototype testing guidelines.Critical components of MS loops identified, and a review of the current procedures performed.Dissemination workshop on characterization of components for CSP MS plants realized.
Work done on the establishment of protocols and guidelines for reporting the behaviour of DWT systems, a common definition of proper testing procedures to assess the performance of new components and materials to be implemented in DWT, and the refinement of simulation software and the verification of the correlations employed within them. Implementation of new experimental set ups.
Work on developing standardized material test for thermodynamic,kinetic, and cycle stability tests completed.Literature review of over 200 publications in the area of solar fuel (SF) production processes performed and used to formulate figures of merit for SF production reactors.
Test bench to assess thermo-mechanical properties of CSP receivers improved and first solar tests conducted.Camera prototype assembled,based on a new method to improve the temperature measurement of CSP solar receivers.RRT on emissivity measurements conducted. Work done on parameters identification to determine the temperature of tubes of linear collectors using an IR camera. Work done to improve accelerated ageing setups.
Guideline on measurements for soiled mirrors created,soiling scattering behaviour analysed,and model-based analytic transfer functions provided.Further REPA load data generated on test bench and solar collector including sensor data analysis.New parabolic trough (PT) receiver heat loss measurement procedure developed.Hybrid forecasting model validated,forecast model developed.Influence of using sky imager data on the accuracy of performance parameter determination for PT investigated.Robustness of Fresnel RI against DNI variations published.LFR

collector on 2-axis platform installed and operated.Heliostat shape RRT performed with different techniques for outdoor shape measurements. RRT for shape measurements of parabolic trough facets performed,including the developed VISproPT.Report on the methodology implementation for heliostat fields to improve heliostat aimpointing and tracking control.
Preparation of technical specifications and administrative procedure to subcontract a specialized company for the detailed design of the e-Infrastructure (e-I) completed. Report with definition of tools and services to be offered by a CST e-I published. Review of the current state of existing e-I in Europe and proposal for the configuration, structure and specifications for the operation and maintenance of the e-I completed. Implementation and testing of a prototype of the e-I carried out. Detailed engineering of the e-I and planned budget issued. DMP released.
Logo,visual identity and website created and updated.Social media accounts regularly feed with news. Regular newsletters sent to a wide data base of more than 1700 recipients. Brochures developed. Presentation video produced.Joint actions with other H2020 CSP projects carried out. Scientific papers published. Conferences attended to promote SFERA-III. Exploitation workshop organised to boost the understanding on exploitation paths for RIs.Final info day carried out.

Progress beyond the state of the art and expected potential impact (including the socio-economic impact and the wider societal implications of the project so far)

Technological impact:(1) upgraded services to develop more reliable storage systems;(2) increased efficiency of both multiple-effect distillation and membrane distillation technologies, and improved process reliability for water treatments and disinfection;(3) improved testing procedures for chemically active materials utilised solar thermochemical fuel production technologies, as well as standard figures of merit for assessing the performance of solar fuel production reactors. Developed software for the automated control and optimisation of solar fuel reactors under intermittent conditions to increase the production of solar fuels;(4) new or upgraded services and technologies to qualify solar receivers, and increased lifetime;(5) increased accuracy in optical,thermal and mechanical measurement services,and new guidelines,allowing better optimization of components of the solar field and receiver,for a higher performance of the CST technology;(6) creation of an e-infrastructure.
Economic impact:new test procedures,devices and protocols,together with the TA twill improve the know-how and qualification in this field,enriching the European sector devoted to CST technologies,thus contributing to the consolidation of the current European leadership worldwide.
Environmental and social impact:CST applications including STE can contribute to increase the flexibility of the European energy system by providing dispatchable renewable power.CST can help meet the energy needs of large parts of the world (sun belt countries) with significant prospects as both an export sector for the European industry and to support the decarbonisation agenda of the Paris Agreement.CST also includes water treatment and desalination technologies which address topic #7 of the UN Millennium goals to ensure mankind’s environmental sustainability,notably as 40% of the global population still suffer from water scarcity.SFERA-III helps to reduce the North-South inequalities between Europe and the poor regions on earth (e.g. the MENA region),lowering the migration pressure and permitting a share of the poorer countries on global welfare.Local content of CST projects is high because significant workforce is needed locally on the construction site.By

increasing competitiveness of CST and opening European RI to users from poorer countries,an energetic and economic partnership between EU and the sunnier MENA region is possible.

Solar Accelerated Aging Facility (SAAF) at CNRS vertical MSSF

Fraunhofer measurement setup for comparative measurement of soiling for CSP

Molten salt facilities at (a) Fraunhofer, (b) CIEMAT, (c) CYI, (d) ENEA and (e) UEVORA.

Location of infrastructures offered within the framework of the TA Programme.

Experimental setup at PSA for testing the IR temperature measurement system of PTC receiver tubes

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