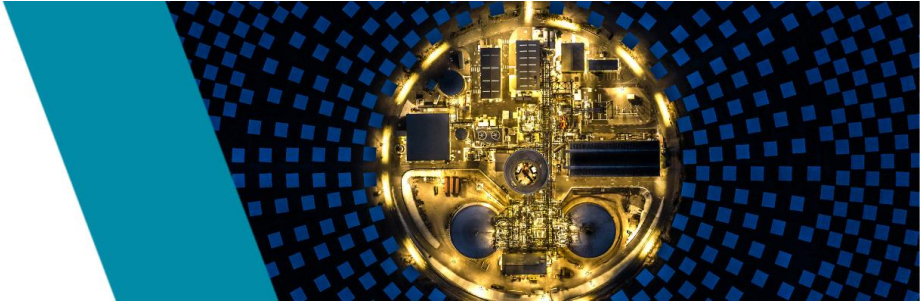

# NEWSLETTER ISSUE 1 – APRIL 2021

## In this issue:



## State of Play

Having been running since Oct 2020, SOLARSCO2OL is an EU H2020 funded project aiming at developing an innovative, economically viable and easily replicable supercritical $CO_2$ ($sCO_2$) power block for demonstrating the use of $sCO_2$ cycles as a potential key technology to increase the flexibility of concentrated solar power (CSP) plants. This will reduce their Levelised Cost of Electricity (LCOE) to values below 10 c€/kWh in Europe and promote an innovative power plant cycle layout not requiring water.

The innovative SOLARSCO2OL plant layout, coupled with fast-reactive electric heaters and efficient heat exchangers (HEXs), will enable the operation and design of novel integrated CSP plant layouts.

The kick-off meeting was held on the 7th Oct 2020 at KTH premises in Stockholm. The project has just turned the first six months of its work, mostly studying aspects related to definition of the cycle and preliminary conceptual design of the cycle components.

Read More


The project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No 952953.



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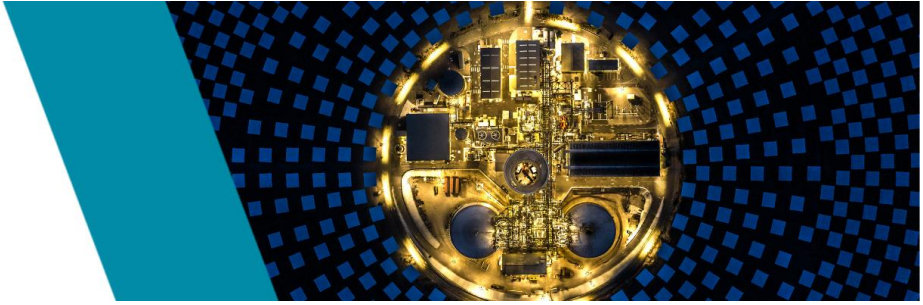

## Project Activities Updates

### WP 1: Key milestones have been achieved – advanced CSP+sCO$_2$ plant layouts have been proposed and prioritized for further analysis. The specific SOLARSCO2OL demo layout, which will serve to prove the viability of the up-scaled advanced layouts and related components in the near term, has also been presented including process and integration diagrams and overall system description.

Led by KTH, WP 1 partners have identified the boundary conditions and limitations for the most promising CSP plant layouts integrating sSCO$_2$ cycles and presented the most attractive CSP plant layouts that can be integrated with the SOLARSCO2OL concept – based on their maturity, cost, high temperature, and system complexity. The report (deliverable D1.1) also highlights how the demo will serve to prove the viability of the up-scaled layouts in the near term. Moreover, the preliminary KPIs' panel for the evaluation of SOLARSCO2OL performance has been identified. This set of KPIs will be presented in the next report (deliverable D1.2) and it will be used in both simulation and demonstration activities. In the upcoming months, preliminary techno-economic models for one of the identified plant layouts will be developed.

### WP 2-3: Conceptual designs of compressor and turbine to be integrated in SOLARSCO2OL demo have been presented.

Following WP1 activities, Baker Hughes and FTM has contributed to defining the thermodynamic cycle of the demo plant keeping in consideration the operability of the turbomachinery keeping an eye open on the operating performance constraints like Turbine inlet temperature and the fact that the compressor will work close to the $CO_2$ critical point.

A dedicate sensitivity analysis has been performed in order to facilitate the comprehension of all the partner about the critical and the correlate risks of turbomachinery operating points.

Moreover, an architecture definition has highlighted a risk related to the production of the compressor due to the small dimensions, especially for the impellers. This risk is currently under evaluation by a dedicated manufacturability assessment. All these preliminary analysis brought to the definition of sCO$_2$ turbomachinery conceptual design of compressor and turbine. For what it concerns the compressor, from design analysis standpoint, a detailed CFD analysis on the impellers and on the flow path are in progress together with the rotordynamic assessment. With the completion of this analysis will be accomplished the conceptual phase of the compressor design and will be possible to start the detail design phase.

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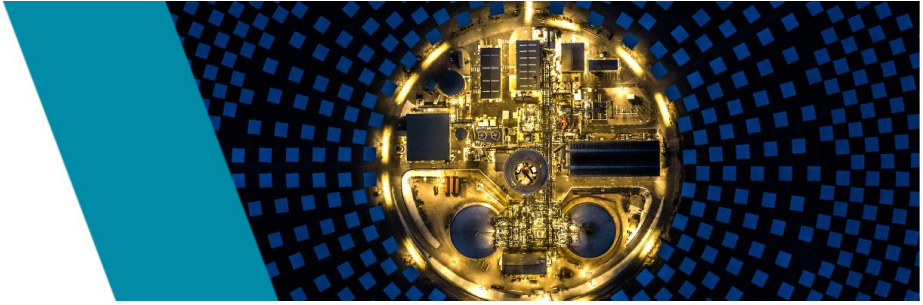

## WP4: Conceptual designs for the recuperator ($sCO_2$-$sCO_2$ exchanger) and the primary heater ($sCO_2$-molten salts exchanger) have been presented, and the initial approach for the electrical heater has been revealed.

LOINTEK and SEICO have been working alongside the turbomachinery manufacturers to optimize the final BoP of the $sCO_2$ cycle. The joint effort between all partners resulted in a fine balance between the compressor, turbine, the electric heater and heat exchangers that maximizes the effectiveness of the cycle. The definition of the operating conditions provided LOINTEK & SEICO with the necessary inputs for the preliminary designs of the shell-and-tube heat exchangers and the electrical heater. LOINTEK has defined the key aspects of the geometry for the recuperator ($sCO_2$-$sCO_2$ exchangers) and the primary heater ($sCO_2$-molten salts exchanger), while SEICO has also revealed the initial approach for the electrical heater. Two conceptual designs for the above mentioned Heat Exchangers and the electric heater have been prepared by LOINTEK and SEICO.

These features are the starting point for the next phase, in which SEICO and LOINTEK will be supported by CERTH, IKERLAN and RINA-C to simulate the performance of the mentioned equipment by means of computational fluid dynamics (CFD) and finite element analysis (FEA). The upcoming CFD study will confirm the expected behaviour of the fluids inside the vessels while seeking optimization of internal parts. FEA will test the mechanical designs of the heat exchangers when simulating the most severe operation conditions expected in this pilot plant.

## WP 5: On-design and off-design thermodynamic cycle operating conditions for the SOLARSCO2OL demo have been assessed and presented, including sensitivity to inlet temperature and pressure conditions

One of the objectives in this work package is to define the dynamic simulation and the control of the demonstration plant. To define the main control architecture of the plant, a first code to simulate off-design conditions has been developed. To test the code, a simple simulation has been performed where the Turbine Inlet Temperature (TIT) was varied to achieve a reduction in the power output of the cycle and very preliminary results showed a good behaviour of the model developed until now and also gives some indications on this specific control strategy.

Furthermore, preliminary models and support has been crucial to define the overall democycle layout in collaboration with WP1-2-3-4 partners.

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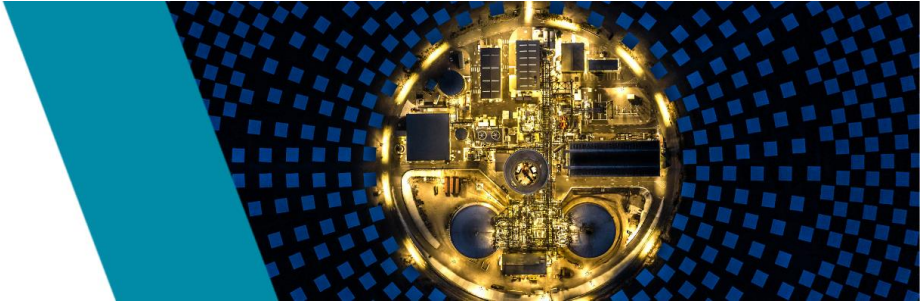

## WP 8: Website and communication tools are ready!

Launched in Dec 2020, the official website www.solarsco2ol.eu offers easier access to not only the detailed information about the project goals and its concept, but also news about the project progress and results. Besides the latest news in the field and featured activities of the project, the website also includes an interactive diagram illustrating the concept of the project. To learn more about the project, take you time and find out useful information about the project. A leaflet detailing the project concept can be found here: DOWNLOAD LEAFLET

# Events Participation

## Past Event

SOLARSCO2OL partners KTH and UNIGE have participated in the 4th European $sCO_2$ Conference in 2021 focusses on supercritical carbon dioxide ($sCO_2$) for energy systems. Dr. Rafael Eduardo Guédez from KTH has presented SOLARSCO2OL project in one of the $sCO_2$ application session. To learn more about the event proceedings and view presentation here.

## Upcoming Event


Partner Event at EU Green Week 2021 : 4 June 2021 (Time : 10 :30 – 12 :00 CET)

A short webinar will be hosted by SOLARSCO2OL partners to present the project concept and how $sCO_2$ can be used in CSP power plant to archive the decarbonisation of energy system.

Consortium key partners from both $sCO_2$ turbomachinery (FTM, BH-NP) and CSP sectors (ABE, SEI, MAGTEL) will present their R&D activities and how they consider SOLARSCO2OL Strategic to achieve their objectives and CSP vision.

Learn More

## Stay Connected With Us

**Social media:** @Solarsco2ol @Solarsco2ol or look for **#SOLARSCO2OL** posts on social media

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