NEWSLETTER

COMPASsCO$_2$

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APRIL 1, 2021

Issue 1

This project has received funding from the European Union's Horizon 2020 Research and Innovation Action (RIA) under grant agreement No. 958418.

WELCOME

Dear reader,

First of all, I thank you for showing your interest in our project COMPASsCO$_2$!

As a Project Coordinator, I'm pleased to be in a team of highly qualified professionals that are motivated to push the limits on existing technologies and contribute to the highly needed energy transition.

We know that big improvements are required in order to achieve the gigantic challenge of zero net CO_2 emissions. We are therefore thankful to the European Commission for giving support through the A.SPIRE program and enable the development of new materials and new components in order to realize more efficient and sustainable industrial processes. In our case we are focused on electricity generation through the integration of concentrated solar plants and supercritical CO_2 Brayton cycle.

COMPASsCO$_2$ already started with the very challenging conditions of the year 2020. Due to the travel restrictions we made use of the available technologies and started the project with all 12 members plus the EC's Project Officer via an online Kick-Off Meeting on November 3rd 2020.

Although most of the participants have not met each other personally yet, we feel very close together as the working structure is tightly interconnected, requiring the effective collaboration and communication of all team members.

I hope you share our excitement to research on new materials that allow innovative and sustainable cycles to be implemented. By following the project progress, you will witness how new materials compare to the state-of-the-art and what the laboratory tests and pilot demonstrations tells us about the possibility to have durable and efficient combinations of particles and heat exchanger tubes in order to operate highly efficient Brayton cycles with a solar tower system, thus bringing two innovative technologies together.

In this 1st Newsletter you will learn about the first steps being done in this project. This stage basically focused on defining boundary conditions for the materials to develop and select the state-of-the-art candidate materials that will serve as basis for the creation of new compositions, alloys and/or coatings that fulfill the extreme operating conditions regarding temperature, pression, abrasion and hot oxidation/carburization.

Please take your time to go through our 1st Newsletter and in order to follow this research project, please visit our website and join our social media channels!

Sincerely yours,

Daniel Benitez
Project Manager at the German Aerospace Center (DLR)

ABOUT COMPASsCO2

COMPASsCO$_2$ aims at integrating CSP particle systems into highly efficient s-CO$_2$ Brayton power cycles for electricity production. The key component for such an integration, i.e. the particle/s-CO$_2$ heat exchanger, will be validated in a relevant environment (will be tested first under laboratory conditions and then at a CO$_2$ loop with particle temperature up to 900^{o}C and sCO$_2$ pressure at 100 bar, therefore reaching TRL 5). The consortium will produce tailored particle and alloy combinations that meet the extreme operating conditions in terms of temperature, pressure, abrasion and hot oxidation/carburization of the heat exchanger tubes and the particles moving around/across them. The proposed innovative CSP s-CO$_2$ Brayton cycle plants will produce flexible, highly efficient, economic and 100% carbon neutral electricity.

The research focus of COMPASsCO$_2$ is on three main technological improvements:

- **Development of new particles:** In order for particles to meet high temperatures (over 700°C) new ceramic particles with improved performance will be developed and tested in several volume quantities.
- **Development of new metal alloys:** The project will provide answers about how the processing and combination with substrate steels will affect the microstructure, phase composition and also chemical stability of the newly developed materials. The developed materials (monolithic and/or coatings) will be investigated in regard to their behavior and performance at high temperatures. Modelling the degradation progress with time to estimate the lifetime of the new materials and coatings under different conditions will be analyzed.
- **Development of the heat exchanger section:** To validate the interaction between the developed particles and the new structural materials in a relevant environment, the project includes the design, construction and testing of a heat exchanger section. Parameters relevant for the lifetime, like attrition rates, and performance parameters, like heat transfer, on the tube and first operating experiences are tested and validated in a relevant heat exchanger environment (validated at CVR's infrastructure with supercritical CO$_2$ and electrically heater particles at the expected operational conditions).

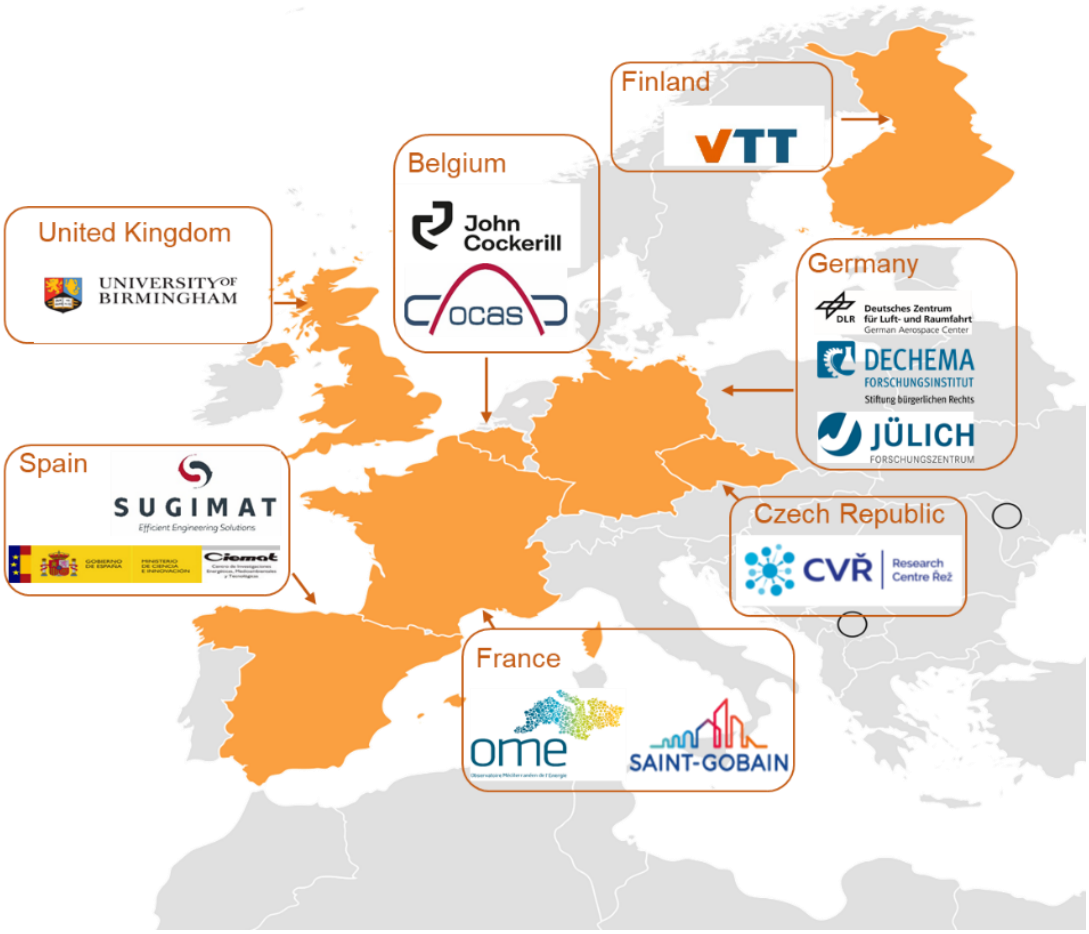
> **Research focus:** New particles, metal alloys and heat exchanger

> **Consortium:** 12 partners from 7 countries

> **Duration:** 1 November 2020 – 31 October 2024

TEAM

COMPASsCO$_2$ project is led by the German Aerospace Center (DLR), with eleven additional project participants from seven European countries.



DELIVERABLES

During the first 5 months of implementation, COMPASsCO$_2$ produced 6 deliverables. In addition to D7.1 (project website), the other 5 deliverables are described below: All public deliverables are freely accessible through the project's website: https://www.compassco2.eu/

D1.1: Process parameters of solar sCO$_2$ Brayton cycle

WP1: Materials operation conditions and their feasibility studies

Date: January 13th, 2021

Deliverable type: Report

Dissemination level: Public

Lead participant: John Cockerill

Download

The goal of this deliverable **(D1.1)** is to fix the parameters relevant for the heat exchanger design (mass flow, temperatures and pressures). In order to obtain this data, a Brayton cycle needs to be selected. Because this cycle is not commercially applied yet, there are many options described in the literature. The supercritical CO$_2$ Brayton cycle for COMPASsCO$_2$ should have a very high efficiency, as this is one key requirements of the project.

D1.2: Process parameters of Solar Particle Cycle

WP1: Materials operation conditions and their feasibility studies

Date: January 31st, 2021

Deliverable type: Report

Dissemination level: Public

Lead participant: DLR

Download

The goal of this deliverable **(D1.2)** is to determine the operating conditions in the particle cycle, defined by the particle- sCO_2 heat exchanger (HX), the solar field, the receiver and the thermal energy storage (TES) system.

D1.3: Material candidates for solar sCO2 Brayton cycles

WP1: Materials operation conditions and their feasibility studies

Date: February 28th, 2021

Deliverable type: Report

Dissemination level: Confidential

Lead participant: DECHEMA

Download (restricted)

The process parameters of the sCO_2 Brayton cycle were analyzed and defined in D1.1. Simulations were carried out to identify the lowest levelized cost of electricity (LCOE) as well as the highest power block efficiency. These simulations were necessary to select the cycle type and the process parameters regarding the particles-sCO_2 heat exchanger. These process and design parameters are used in this deliverable (**D1.3**) in order to identify current alloys suitable to manufacture the heat exchanger and the heat carrier particles. The selected materials will be used as state-of-the-art (S.O.A.) materials during the COMPASsCO_2 project.

D7.5: Data Management Plan

WP7: Communication, dissemination and exploitation

Date: February 28th, 2021

Deliverable type: Report

Dissemination level: Confidential

Lead participant: OME

Download (restricted)

This report **(D7.5)** gives details about data collected and generated by the COMPASsCO_2 project. In particular, the report provides the general framework for data management, including metadata collection and publication (what type of data will be produced), naming conventions and storing and security of data, open access issues (what data that can be shared with the public and what will be exclusively for the consortium members and the European Commission) and allocation of resources as well as ethical aspects.

D8.1: EPQ Requirements

WP8: Ethics requirements

Date: January 29th, 2021

Deliverable type: Report

Dissemination level: Confidential

Lead participant: DLR

Download (restricted)

This document **(D8.1)** gives a summary of the data collected with the aim to demonstrate that the work done does not have negative effects on the environment, health or safety of the personnel. All partners have provided documentation that describe their internal rules and measures to avoid any harm to the health or safety of the personnel. Several partners have provided relevant authorizations for the implementation of their actions in the project.

MILESTONES

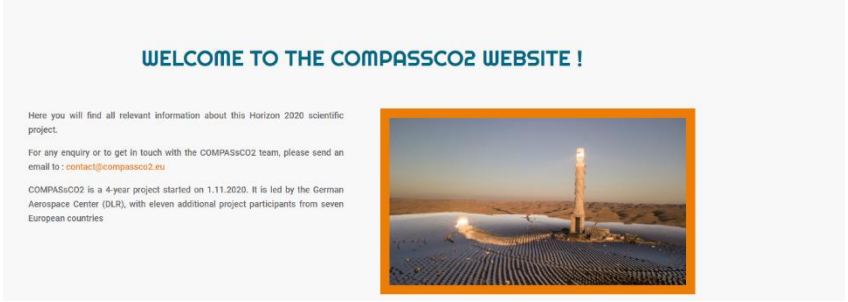
In addition to the project's launch on November 1st, 2020, several other milestones have been achieved during the first 5 months of the project's implementation, namely:

- The COMPASsCO$_2$ website has been developed and been operational since M3 (January). It is the main communication and dissemination tool through which information about the project, including main results (deliverables, milestones, newsletters, etc.) are made available for the different stakeholders.
- Solar-sCO$_2$ reference plant design is fixed, communicated and approved by all partners
- Distribution of different bulk particles to testing institutes
- Review of the particle loop conceptual design

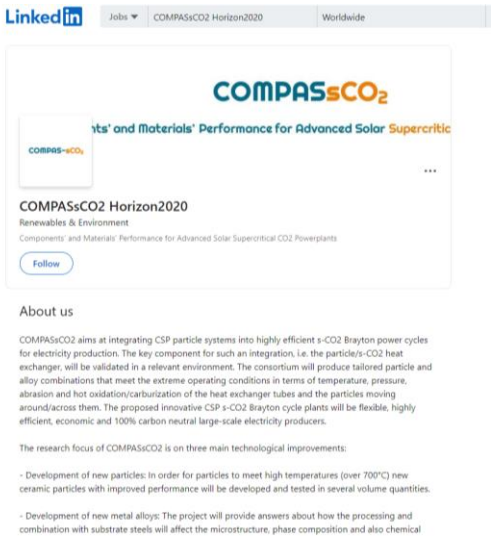
OUTREACH

COMPASsCO$_2$ Project Website

www.compassco2.eu



Social Networks



EVENTS

Kick-off Meeting - The kick-off meeting took place on November 3rd, 2020. Given the COVID-19 pandemic, the kick-off meeting was held virtually. In Addition to the COMPASsCO2 consortium, the EC project officer (Ms. Fátima González Gómez) has also participated in the meeting. After the welcoming and opening statement of the project coordinator (DLR) and the introduction of each partner, the project officer presented the legal and financial obligation, importance of Open Access, and communication aspects. Dedicated WP presentations in terms of objectives, scope, activities and following steps were presented by WP leaders afterward.

Technical Committee (TC) – Two TC meetings (video-conference) took place on November 10th and March 11th and gathered the project coordinator and WP leaders to discuss the overall project progress, interlinkages between WPs and timeline and any risks.

Dedicated WP Meetings – WP meetings are organized on a monthly basis by WP leaders to discuss technical aspects related to the activities of the project with the team involved.

Up-Coming Event

Next Project meeting - The 2nd project meeting is scheduled for June 2021. Given the sanitary situation, this meeting will be held virtually.

STAKEHOLDERS

How to get involved

Whether you want to learn more about specific WP activities, collaborate with the consortium or act as an external expert, kindly contact us at contact@compassco2.eu. We will keep you updated about project activities, invite you to attend the project's public events and ask your feedback on the progress and main outcomes of the project.

THANK YOU

For more information

Check the project's website: www.compassco2.eu

Contact us: contact@compassco2.eu

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