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POWDER 2 POWER

MW-scale fluidized particle-driven CSP prototype demonstration

PROJECT SUMMARY

Concentrated Solar Power (CSP) is crucial for green energy supply. Today, liquid heat transfer mediums are used, with molten salt now leading the field. Particle suspensions promise even higher CSP plant temperatures, enabling more efficient power cycles, such a sCO2 cycle operating in the temperature range 700-750°C with 50% efficiency.

The POWDER2POWER (P2P) project is an innovative EU-funded project designed to demonstrate, in an operational environment (TRL7) and at a megawatt scale, an original and cost-effective particle-driven CSP technology, which can be applied to both electricity and industrial heat production.

MAIN GOAL

Under the "HORIZON-CL5-2022-D3-03-01" topic, the P2P project extends the advancements of the Next-CSP project (H2020). It aims to optimize the Next-CSP technology implementing a vertical particle conveyance system and validating an electricity-driven particle superheated thermal energy storage, enabling a high-temperature hybrid CSP-PV concept simulation.

The ultimate goal of the project is to evaluate the techno-economic performance and sustainability of the P2P concept for commercial development, focusing on a 30-60 MWe power plant. Scaling-up will rely on validated models and operational data.

OBJECTIVES

- **Demonstrate innovative, cost-effective components and system** in operational environment and at MW-scale
 - **Integrate Sustainable Energy** by developing a particle-to-sCO2 heat exchanger for high-capacity energy storage
 - **Reduce O&M Costs** by integrating particle-based storage solution and boosting sun-to-power cycle efficiency by ~12%



Support Renewable Energy Growth: Increasing variable renewables share with particle-based thermal energy storage

FACTS & FIGURES



Technology: Fluidized particle-driven CSP



Consortium: 9 partners 6 EU countries



Duration: 48 months **Start date:** 01/10/2023 **End date:** 30/09/2027



EU contribution: 5,274 M€ Funding scheme: IA GA nº 101122347



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CONCEPT AT A GLANCE

The P2P particle-driven CSP technology integrating key components in а 2 MWth prototype will be tested at the research Themis solar tower, France. Targasonne, The prototype features a complete particle-based CSP system with an already available hybrid gas turbine using pressurized air and particles for heat transfer and storage.

The project pilot power plant consists of three subsystems: solar field, particle loop, and working fluid loop. Innovative components include a fluidized bed solar receiver, a cold particle storage, a vertical conveyance system, a hot particle storage, a compartmentedfluidized bed heat exchanger, and a gas turbine. An electric heater upstream of the hot storage maintains particle temperature at 750°C for a hybrid CSP-PV concept.



Long duration operation of the pilot unit enables the concept upscaling to commercial-scale а sCO2 Brayton cycle. The P2P project evaluates various aspects of the viability, long-term techno-economic. and sustainability performance utilityat

scale.



EXPECTED IMPACTS

Technology: Enhance Efficiency and Reliability of CSP plants by developing an innovative solar technology, including testing, prototypes, and engineering solutions

Science: Strengthen European research and expertise in the deployment of renewable energy sources, fostering international collaboration and innovation

Society & Environment: Boost environmental sustainability and EU industrial competitiveness in the renewable energy sector through reduced CO2 emission and jobs creation

CONSORTIUM

POWDER2POWER is led by PROMES-CNRS research laboratory and brings together a complementary well-balanced consortium of 9 partners and 1 third-party spanning 6 European countries, including:

- 5 public research and higher education institutions,
- 2 industrial companies, and

Funded by

• 3 SMEs.





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