



POLYPHEM
THE FUTURE OF SMALL-SCALE CSP PLANTS

POLYPHEM

Small-Scale Solar Thermal Combined Cycle



The POLYPHEM project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 764048.

Key figures

Call H2020 - Secure, Clean and Efficient Energy

- **LCE-07-2017-** Developing the next generation technologies of renewable electricity and heating/cooling
Specific challenge: **Concentrated Solar Power (CSP)**
- Grant Agreement No 764048

- **9 partners**

CNRS/PROMES (F)

Fraunhofer ISE (D)

CIEMAT (E)

CEA/LITEN (F)

KAEFER Isolierteknik (D)

AALBORG CSP (DK)

ORCAN Energy (D)

ARRAELA S.A. (E)

EURONOVIA (F)



KAEFER

AALBORG CSP
- Changing Energy



euronovia

- **Coordination: CNRS/PROMES**

- ✓ Coordinator: A. Ferriere

- **Duration: 48 months**

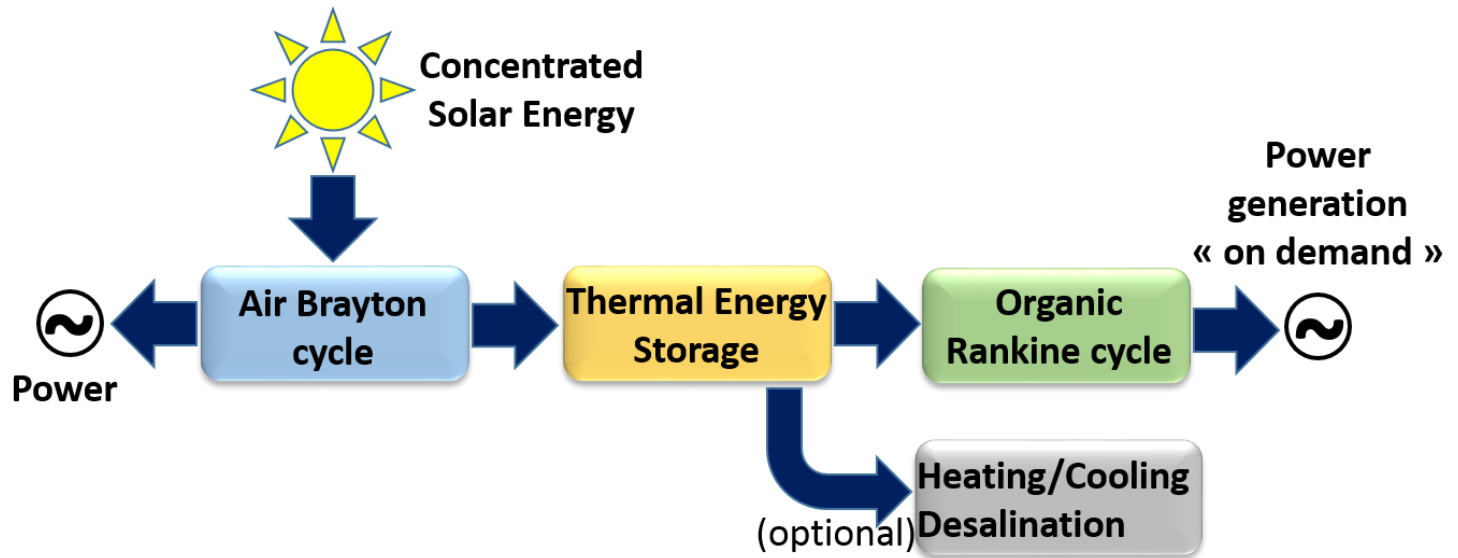
- ✓ Start: 01/04/2018

- ✓ End: 31/03/2022

- **Total grant (100% EU): 4 975 961 €**

Principle

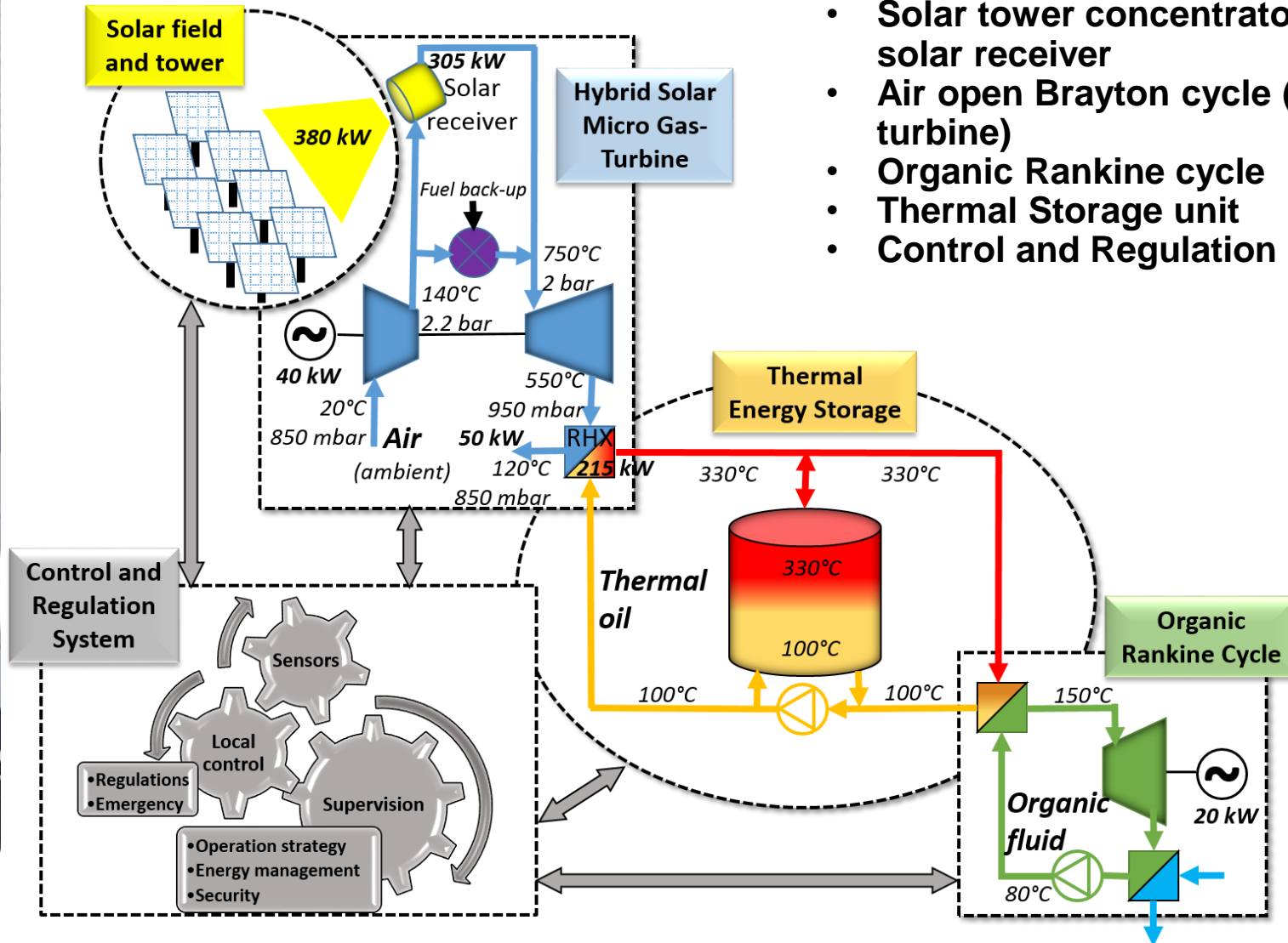
Small-scale combined cycle for flexible and firm capacity solar power off-grid generation and other energy services



Concept

Technological bricks:

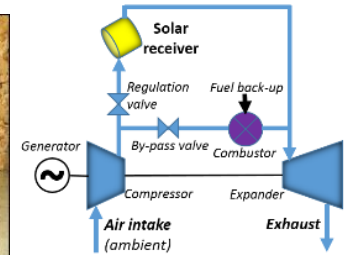
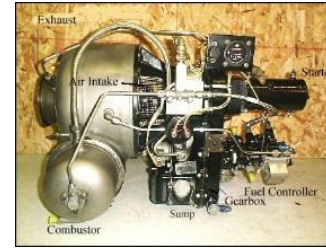
- Solar tower concentrator and air solar receiver
- Air open Brayton cycle (gas-turbine)
- Organic Rankine cycle
- Thermal Storage unit
- Control and Regulation System



Challenges/Technical objectives

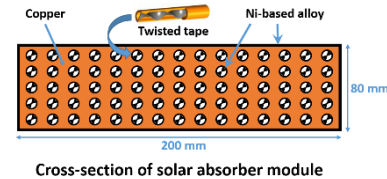
- **Hybridize and test micro gas-turbine**

- ✓ Model: Garrett GT30-67
- ✓ Main operation mode: 100% solaire



- **Develop and test a pressurized air solar receiver**

- ✓ Patented technology of solar absorber, by CEA/CNRS
- ✓ Selection of materials (thermo-optical and mechanical characteristics)
- ✓ Design of manifolds



- **Develop and test a thermocline thermal storage system**

- ✓ Concrete tank
- ✓ Preferred filler material: concrete

- **Design and test heat exchangers for exhaust heat recovery and for the evaporator of the organic Rankine cycle**

- **Develop the control system**

- ✓ Smooth the running regimes
- ✓ Safety of the installation

- **Develop and validate a techno-economic model of the technology**

Targets

- Capital cost <math><5\text{€}/\text{W}</math>
- Electricity generation cost 21 c€/kWh
(DNI 2050 kWh/m²/y)
- Operation mode 100% solar
- Flexible electricity generation
- Solar receiver thermal efficiency >80%
- Solar receiver cost 0,4 €/W
- Thermal storage cost 28 €/kWh