R& D on Thermal Storage in POLYPHEM Project

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https://www.polyphem-project.eu

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Principle

<table>
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<tr>
<th>Concentrated Solar Energy</th>
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<td>Air Brayton cycle</td>
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<td>Thermal Energy Storage</td>
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<td>Organic Rankine cycle</td>
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<td>Power generation « on demand »</td>
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**TES Objective**

Connecting two thermodynamic cycles for:
- Matching the temperature difference between both cycles
- Enhancing flexibility in power generation

**STE-TES State of the art**
- Two-tank configuration
- Metallic walls
- Molten salt is the storage medium
- Foundations with a insulation layer + natural convection system

**POLYPHEM’s approach**
- Single-tank
- HTF + filler as storage media
- Concrete walls
- Foundations with only concrete

**Studies on fillers**
- Natural materials versus Bricks
- Compatibility studies
  - contributing to defining testing procedures
- Thermal ratcheting simulation

**Tank Design**
- Optimization of tank walls formulation
- Size of tank
- Engineering design
- Required instrumentation of the tank

**Foundation Design**
- Optimization of foundation formulation
- Engineering design
- Required instrumentation in foundations
- Comparison with current commercial solution (expanded clay)

**Modelling and integration**
- Preliminary thermohydraulic model
- Simulation of TES integration in the prototype plant
  - control strategies
- Scheme and layout of TES subsystem in prototype plant
- Test matrix and required instrumentation

**Lab-test of thermocline**
At in-house MicroSol-R (CNRS-PROMES)
- Simulation Models
- Fillers

**Expected outcomes**
- Cost reduction
  - (28 €/kWh for small-scale STE)
- Larger tank sizes
- Concrete-only foundations

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