



### **ET4PCM - Electrical tomography for phase change monitoring**

Heating/cooling demands represent more than half of energy consumption in households and drive most of energy-related GHG emissions in the residential sector. To achieve decarbonisation goals heating/cooling demands must be supplied with heat pumps driven by renewable electricity. However, the mismatch between energy availability and heating/cooling demand needs to be reconciled with low-cost, efficient and flexible energy storage. Latent thermal energy storage (LTES) with phase change materials (PCMs) is becoming a key enabling technology for low-carbon heating/cooling. However, smart control of LTES systems require monitoring of the liquid fraction, which determines the total stored energy. The present research proposal, ET4PCM, aims to develop a first-of-a-kind, smart, non-invasive, versatile impedance sensor to evaluate in real-time the liquid fraction evolution of PCMs in LTES.

The ET4PCM sensor will provide detailed information regarding phase distribution evolution during freezing/melting of PCMs in macrocapsules (spherical or cylindrical shells). The project planning contemplates four key tasks, which correspond to the subobjectives: SO1) Characterization and enhancement of electrical properties of PCMs, SO2) design of the electrical sensing system, SO3) experimental implementation and validation of the proposed sensing system, and SO4) Validation of ET4PCM technology in a real LTES. The research approach involves experimental, numerical, and theoretical research activities. I, Dr. Carolina Mira-Hernández will develop the ET4PCM project under the supervision of Pr. Simone Mancin at University of Padua (UNIPD), who is renowned expert in LTES. In addition, I will spend 3 months during a secondment at the start-up COWA, where I will deploy the ET4PCM sensor in a realworld LTES, and I will have a non-academic placement at HEXXCELL, a consulting company on predictive analytics, where I will develop “in silico” smart control tools for LTES.

**UNIPD Supervisor:** Simone Mancin

**MSCA Fellow:** Carolina Mira-Hernández

**Department:** Department of Management and Engineering

**Coordinator:** Università degli Studi di Padova (Italy)

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