# SUNSETS
# Modular Control Systems for Maximising Solar Energy Utilisation and Grid Service Provisions by Residential PV Systems coupled with Thermal Storage

*Project duration: from 02.2021 to 01.2024*
*Report submitted: 08.2022*

## Publishable Summary

SUNSETS develops and demonstrates innovative solutions and technologies, enabled by digitalisation, for a solar photovoltaic (PV)-dominated near zero energy building (NZEB)-based local energy community (LEC). These solutions aim to increase PV penetration and enhance LEC's energy efficiency.

SUNSETS's advanced building energy management system (EMS) maximises, at the building level, the value of solar energy surplus by optimally dispatching building's loads and energy (electricity and heat) storage. Solar energy self-consumption is enhanced and energy efficiency is improved by employing innovative thermal storage devices to use the, otherwise curtailed, solar energy surplus. The new thermal storage technologies include the smart residential electric boilers (Smart Boilers - SBs) developed by UoP, which will be coupled with the residual heat from heat-to-electricity (H2E) conversion based on Azelio's pioneer Thermal Energy Storage (TES) technology. Smart boilers currently undergo a vigorous testing, certification and validation process that is the necessary step before full commercialization, not only as a part of a future NZEB, but also as an independent product.

Innovative solutions and technologies enabled by an interoperable cloud-based IoT platform digitally connect all NZEBs to the LEC controller which coordinates the NZEBs in order to provide ancillary services to the grid: voltage support, harmonic compensation, congestion relief. Grid's flexibility and resilience is increased, despite fluctuations of unpredictable demand and intermittent local generation based on solar energy. At the LEC level, advanced optimization algorithms for the LEC controller manage LEC's energy, considering storage availability, while aiming for the energy efficiency enhancement by using solar energy surplus. Based on advanced forecasting, the LEC is self-adaptively clustered to efficiently use resources for different services.

Simulations are used for the evaluation of the benefits of the developed solutions, both in technical and financial terms. However, real-life demonstrations confirm the aforementioned statements. The NZEB ability to provide ancillary services to the grid is demonstrated in the appropriate testbed in Sweden. The SB operation is demonstrated in laboratory and industrial environments in Greece, whereas the efficiency improvement by combining H2E technology with SB to exploit the heat losses is presented in virtually interconnected demo-sites based in Sweden and Greece.

## Project consortium

Coordinator and all contact details:

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|---|---|
| Full name of organisation | University of Patras |
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Participating countries and financing:

| **Country** | **Number of organisations involved** | **Project costs in EUR** | **Public funding in EUR** |
|---|---|---|---|
| Greece | 2 | 250 000 | 250 000 |
| Sweden | 2 | 475 365 | 382 885 |
| *Total* | *4* | *725 365* | *632 885* |

## Funding agencies involved and contracts

| **Funding Agency** | **Contract N° and Title** |
|---|---|
| General Secretariat for Research and Technology (GSRT) | 5161150 |
| Swedish Energy Agency (SWEA) | Grant Agreement 51197-1<br>Title in Swedish: "Modulära styrsystem för ökad solenergianvändning och nättjänster från solcellssystem med termisk lagring" |