



# Achieving near Zero and Positive Energy Settlements in Europe using Advanced Energy Technology

H2020 - 678407



GA no. 678407

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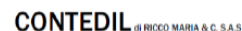
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**PROMITHEASNET**

**11<sup>TH</sup> INTERNATIONAL SCIENTIFIC CONFERENCE ON ENERGY AND CLIMATE  
CHANGE**

Projects and Funding Opportunities on Energy and Climate Change

**12 OCTOBER 2018, Athens, Greece**





# The ZERO-PLUS project

- **ZERO-PLUS: “Achieving near Zero and Positive Energy Settlements in Europe using Advanced Energy Technology”** is an EU funded project in which a comprehensive, cost-effective modular system for Net Zero Energy (NZE) settlements is being developed, implemented and demonstrated in a series of case studies across the EU.
- **Coordinator:** National and Kapodistrian University of Athens
- **Consortium:** 16 partners from the academia and the industry
- **Funding:** H2020
- **Total budget:** 4 171 947,50 euros
- **Duration:** 48M i.e Oct. 2015- Sep. 2019
- **Website:** <http://www.zeroplus.org/>



# Who we are

## Case study owners

(AETHERIA, OPAC38, Contedil, JRHT)



CYPRUS, Peyia



FRANCE, Voreppe



ITALY, Granarolo dell' Emilia



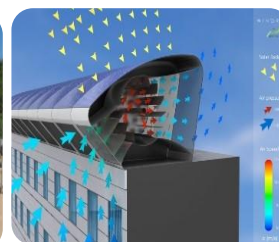
UK, Derwenthorpe

## Technology providers

(ARCA, ANERDGY, ABB, FIBRAN)



FAE HCPV



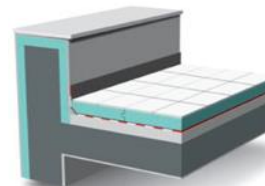
WindRail



SolarBlock biPV



REACT+



FIBRAN XPS



freescocoo HVAC

## Research partners

(NKUA, BGU, TUC, ECO, TUM, Cyl, UNIPG, OBU)

Monitoring and Evaluation of the Settlements' Performance

Design and Optimization of Modular Envelope Components

Energy Production and Management of Individual Buildings

Integrated Design and Optimization of the NZE Technologies to be implemented at the Settlements Level – Creation of Simulation and Monitoring Protocols

Market Analysis and Model for Business Growth

Construction Management, Cost Management and Implementation of the Innovative Technologies

Integrated Design and Optimization of the Zero Energy Settlements



# Energy, environmental & socioeconomic objectives

## KPIs

- Operational energy usage of **0-20 kWh/m<sup>2</sup>** per year.
  - At least **50kWh/m<sup>2</sup>** renewable energy generation per year
  - Reduction of the **cost** of NZE settlements by at least **16%**, compared with current nZEB costs.
- 
- **Transition** from single NZE buildings to NZE settlements
  - Form an comprehensive market analysis and business plan
  - **Reduction** of the EU's **carbon footprint** by **77 kgrCO<sub>2</sub>/m<sup>2</sup>** for all ZERO-PLUS case studies



# The ZERO-PLUS concept

## TARGET

Provide the market with an innovative, yet readily implementable system for NZE residential neighborhoods that will significantly reduce their costs.



**16% reduction of initial investment**

## 3 PARALLEL STRATEGIES

Increasing the efficiency of the components directly providing the energy conservation and energy generation in the NZE settlement.

Reducing the costs through efficient production and installation processes.

Reducing operational costs through better management of the loads and resources on a district scale rather than on the scale of a single building.



# The ZERO-PLUS Case Studies



- **Derwenthorpe, York, UK.** Derwenthorpe is a mixed tenure community in the outskirts of York which when complete in 2019, will consist of around 489 new family homes. Through ZERO-PLUS **three typical UK homes** will be transformed into near zero energy homes. In addition to the three dwellings that are part of the project, other parts of the settlement will be used to support the renewable energy targets of the project. (*warm Temperate climate, fully humid, warm summer, Cfb- Koeppen-Geiger climate classification*)
- **Granarolo dell' Emilia, Italy.** It is part of a housing development area ( $\sim 9600\text{m}^2$ ) already under construction. **Two single family villas** will be built following the guidelines given by ZERO PLUS. The total area dedicated to the demonstration case study i.e the two NZE buildings and their near proximity is close to  $2760\text{m}^2$ . (*Temperate and Mediterranean climate- Cfa*)
- **Voreppe, France.** Two buildings comprising 18 and 14 **social housing** units will be constructed as well as a building of 20 dwellings. The ZERO PLUS building is a building with **18 apartments** on 4 floors. (half-oceanic and half-continental climate- H1C/Cfb)
- **Peyia, Cyprus.** The settlement is located in the western part of Cyprus. **One villa** ( $175\text{m}^2$ ) will be built according to the ZERO PLUS guidelines. (*mild Mediterranean climate, generally warm and temperate- Csa*)



UK, Derwenthorpe



ITALY, Granarolo dell' Emilia

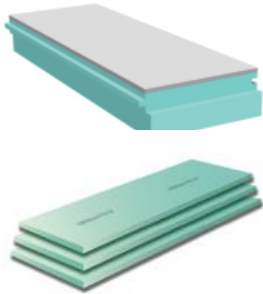


FRANCE, Voreppe



CYPRUS, Peyia

# The ZERO-PLUS technologies



**Advanced Envelope Components (FIBRAN).** Innovative, composite cool- thermal insulating material based on the new generation of extruded polystyrene (XPS) will be installed on the building envelope. The final layer is either a) a ceramic tile (for flat surfaces) with cool material properties or b) a coating with cool and photocatalytic properties (vertical surfaces)



**Advanced HVAC (Solarinvent).** Freesco VAC module is a compact system for ventilation, cooling, dehumidification and heating of buildings, based on a new solar Desiccant Evaporative Cooling concept & hosting in one casing every component used for the operation.



## Energy management Systems (ABB):

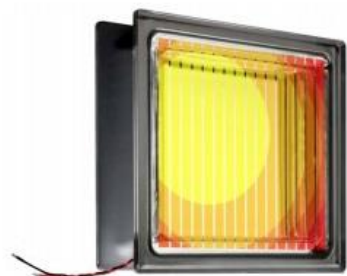
Integrated solar inverter and storage system. Its is a fully optimized energy management system, embedded on the device that allows the highest self-consumption capability all the way up to self-sufficiency.



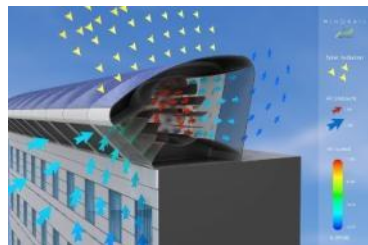
# The ZERO-PLUS technologies - continued



**FAE –HCPV (IDEA).** The High Concentrating Photovoltaic (HCPV) systems exploit the property of optics (lenses or curved mirrors) to focus a wide area impacted by the sun radiation on a small area occupied by one or more high efficiency photovoltaic cells (up to 44% of conversion rate) to generate electricity. The FAE HCPV module system has been designed integrated with active cooling for combined heat and electricity generation.



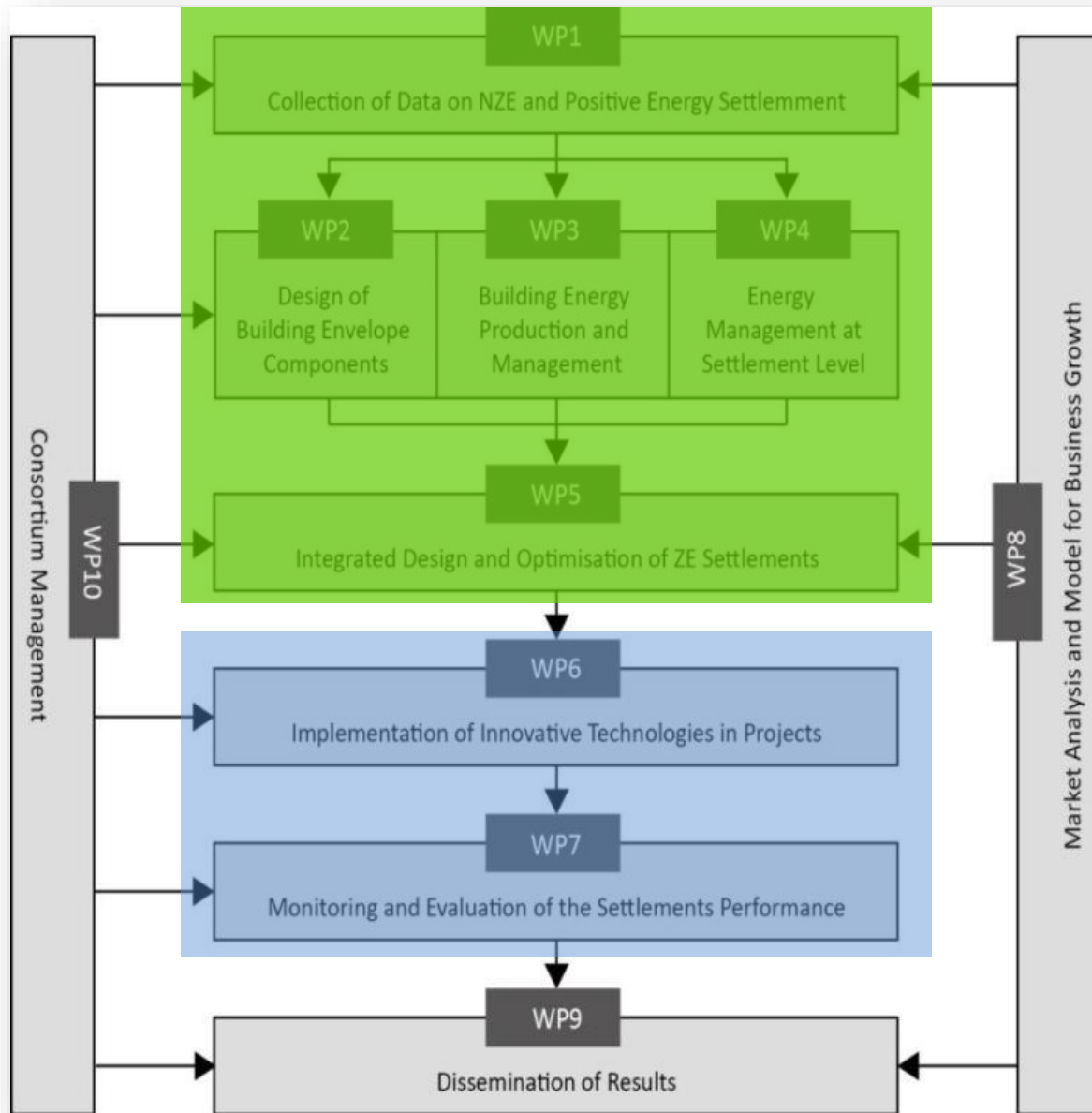
**BIPV (SBSkin).** precast, dry-assembled and prestressed translucent BIPV components, made of DSC-integrated glassblocks, for building façade and roof installations, with high energy saving and production performance.



**WindRail (ANERDGY)** a modular wind turbine system that harnesses the energy of the wind, by exploiting the pressure differences around the building, and the solar radiation to generate electricity. PV cells can be integrated to contribute to electricity or thermal energy



# Overall approach and methodology



# Technical and financial optimization of the ZERO-PLUS settlements

## Aims:

**Evaluation** of the energy interaction between the selected technologies and the total integrated energy performance of the settlement by using advanced simulation techniques.

**Minimization** of the life cycle cost of the energy and environmental systems and techniques.

**Optimization** of the global energy and environmental performance of each of the settlements.

## Methodology steps:

1. **Optimization and sensitivity analysis**, so as to identify the optimized, innovative systems and techniques, minimize their life cycle costs and optimize the global energy and environmental performance of each one of the four settlements.
2. Selection of the **optimum technical sizing / units** of each technology.
3. Integration of the optimized, innovative systems and techniques **in the final design** of the buildings and the settlements.

# Road so far



✓ **Optimization** of the energy and environmental performance at **building scale**. Using advanced simulation techniques, all residential typologies across the four case studies were assessed.

✓ **Design and Optimization** of the **NZE** Technologies to be implemented at the **Settlement** scale

✓ **Initial cost assessment of the ZERO PLUS case studies**

Target: Reduction of the cost of nZE settlements by at least 16% compared with current costs

Development of a methodology for the assessment of the cost reduction of the Zero Plus building

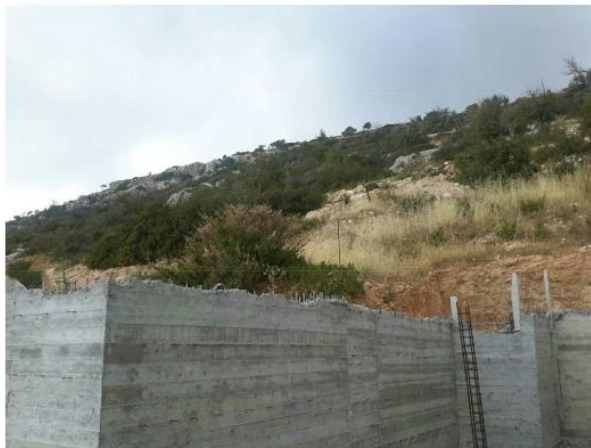
Initial selection of the energy technologies and techniques at building and at settlement level

✓ **Technical and financial optimization** of the integrated architectural and engineering design developed for each one of the four involved settlements:

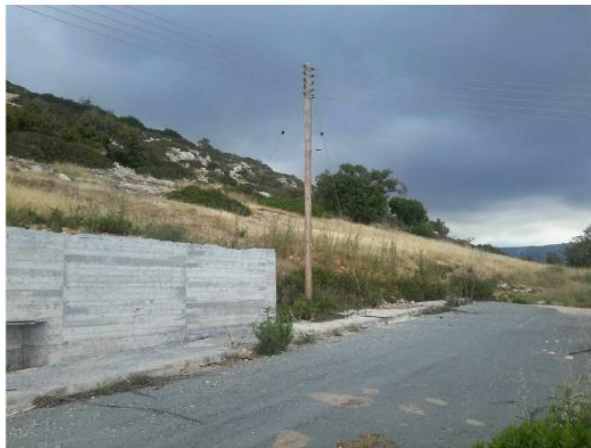
- Full and detailed simulation of the energy and environmental performance of each settlement
- LCC analysis regarding the specific contribution of each of the selected innovative components in order to estimate the optimum economic sizing.

→ **Construction of the case studies**

# Peyia, Cyprus- Construction site.



PH1



PH2



PH3





# Voreppe, France- Construction site





# Granarolo dell' Emilia, Italy- Construction site

## Villa 1



## Villa 2





# Derwenthorpe, York, UK- Construction site

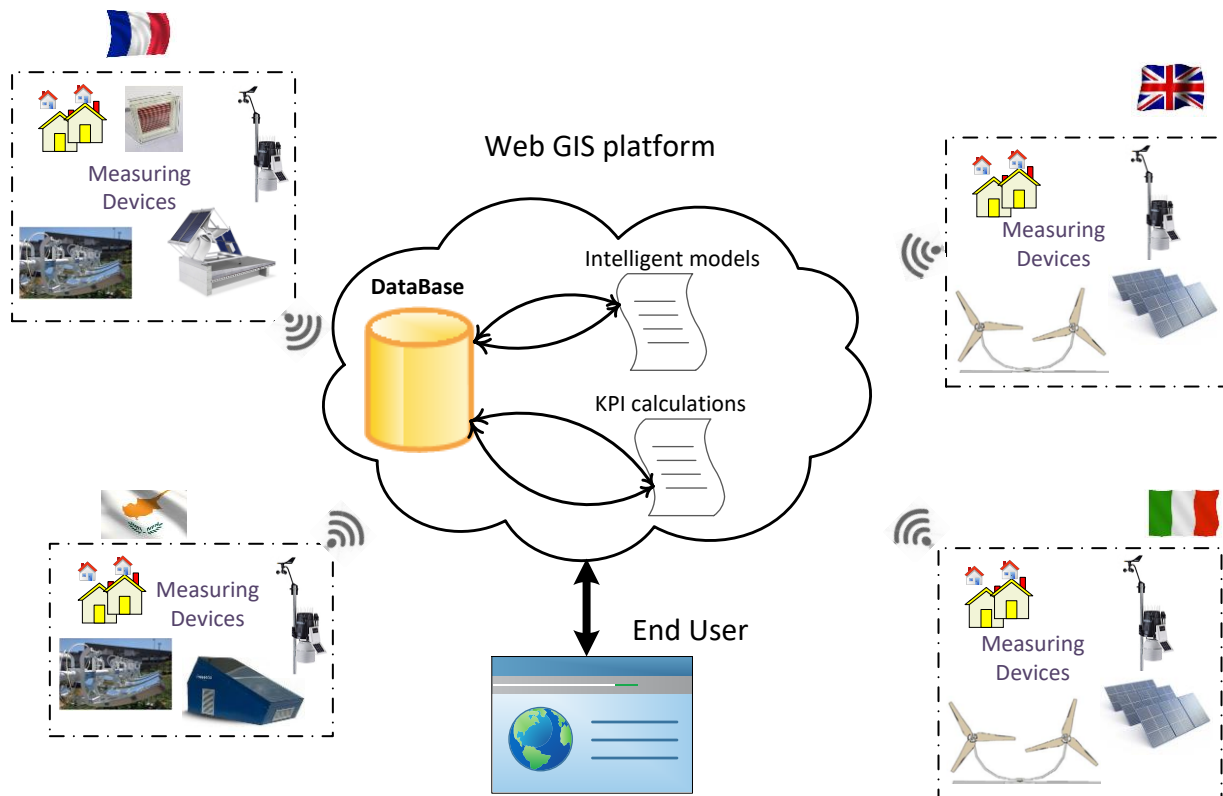




# Monitoring and Evaluation of the Settlements' Performance

Fundamental component is the Web-GIS Platform

- Intelligent models for evaluation of IEQ
- Intelligent models for analysis of energy demand, production and predictive maintenance
- Fault detection of sensors
- Generation of 15-day report for Problem Identification





# WP7: Monitoring and Evaluation

## T7.5 Analysis of the energy and environmental performance of the settlements, verification of simulation tools and generalisation of experimental results

### Assessment of Zero-PLUS Settlements energy & environmental performance

### Guidelines for designing and implementing NZE Buildings and Settlements in Europe.

D7.6 High quality data sets collected during monitoring of the 4 settlements (M46)

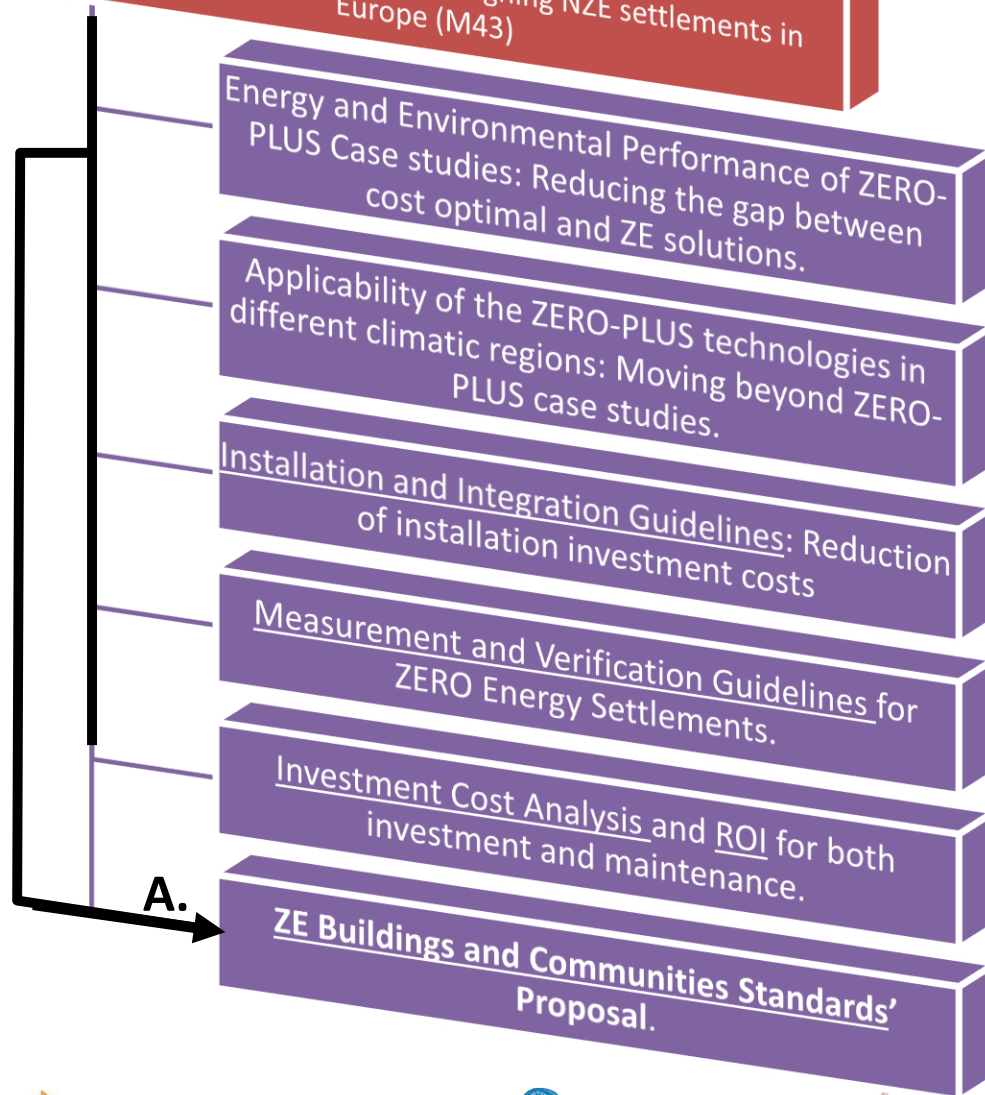
D7.7: Report on the Energy Performance Analysis of the 4 settlements (M46)

D7.8: Technical guidelines for designing NZE settlements in Europe (M43)

CEN/CENELEC-ZERO-PLUS liaison

# Guidelines for designing and implementing NZE Buildings and Settlements in Europe.

D7.8: Technical guidelines for designing NZE settlements in Europe (M43)



## B.

A specific section on **necessary NZE Buildings and Communities Standards** will be **developed and submitted to CEN.**



# THANK YOU

<http://www.zeroplus.org/>

## Coordination Team

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