# PLUG-N-HARVEST, Plug-n-play passive and active multi-modal energy Harvesting systems, circular economy by design, with high replicability for Self-sufficient Districts & Near-Zero Buildings

Plug-n-Harvest is a 4-year project, funded by the EU's Horizon 2020 programme. The main strategic goal of the PLUG-N-HARVEST proposal is to design, develop, demonstrate and exploit a new modular, plug-n-play concept/product for ADBE(Adaptable/Dynamic Building Envelopes) – suitable for a variety of residential and non-residential buildings – which is able to provide high (maximum possible) energy use reductions and high (maximum possible) energy harvesting from RES (Renewable Energy Sources) both at the single-building and the district scale while requiring medium-to-low installation costs and almost-zero operational costs. Moreover, by appropriately exploiting its modular and plug-n-play attributes, the PLUG-N-HARVEST system will be designed and implemented considering circular economy principles, which will allow implementing new business models based on leasing and renting modes and, by this, leaving the door open to massive implementation of such solutions.
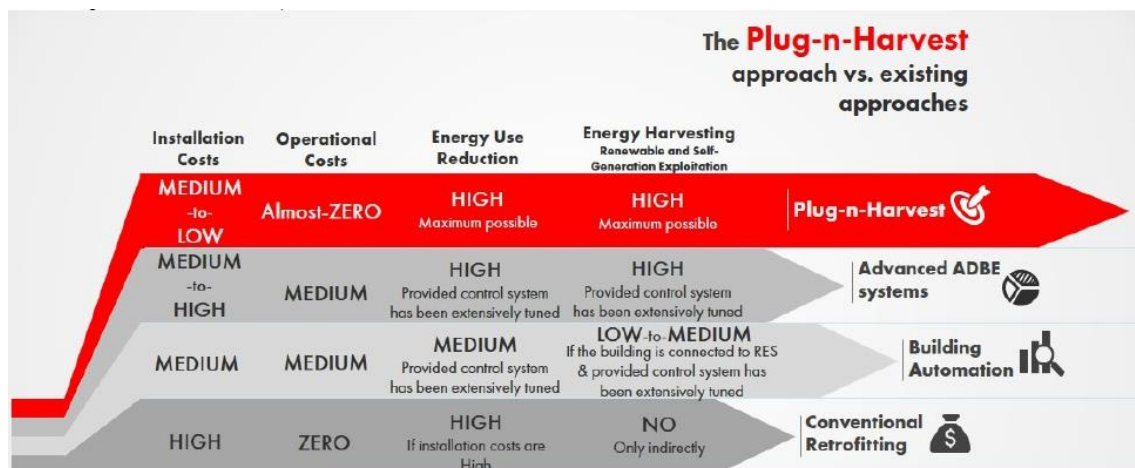


## How does it work

PLUG-N-HARVEST system aspires transforming static building envelopes to active ones by deploying off-the-shelf energy harvesting, storing and thermal comfort affecting elements able to dynamically adapt to available exogenous energy assets. In order to enable maximum-exploitation of the available, free environmental energy in a user and micro-climate (indoor and outdoor) oriented manner, PLUG-N-HARVEST enhances its operational capabilities by imposing intelligence, adaptation, cognition, security and safety ICT (Information and Communications Technology)-based mechanisms at a building and district level.

The foreseen architectural topology comprises four main functional layers according to their responsibilities and origin:

(i)   Adaptive Dynamic Building Envelope (ADBE): consisted by flexible façade design (aluminum, steel etc.) suitable for application on different building structures, which contains high insulation layers and energy-harvest enabling elements, such as (building integrated) photovoltaics, battery storage, guided natural ventilation or decentralized ventilation systems,

(ii)  Interconnected Elements Ecosystem (IEE): interconnection of existing and new sensing and controllable elements within a unified network,

(iii) Security and Safety Mechanisms (SSM): consisted by safety and security preserving elements forming an encrypted, ICT-based shield for the acceptable operation of the developed digital modules of PLUG-N-HARVEST, and;

(iv)  Energy Management Systems (EMS): consisted by interoperable ICT-based energy management tools at building (IMCS) and district scale (DRFFO and OEMS).

**The innovation**

The implementation of the PLUG-N-HARVEST solution leads to the generation of important key exploitable results and the novel knowledge produced paves the way for the enhancement of energy harvesting and energy management systems. The benefits generated by the implementation of the system will promote the establishment of more holistic and energy efficient methodologies for residential and commercial buildings, districts and smart cities. The attribute of PLUG-N-HARVEST to offer optimal coordination of different RES and storage systems both at the building and at the district level while being cost-effective is expected to offer the ground basis for new active energy harvesting approaches. Moreover, the data generated during PLUG-N-HARVEST project lifetime will form a valuable asset and will lead to useful conclusions and directives.

**Further information**

For further information about the project, please refer to **http://www.plug-n-harvest.eu/**