

PROSUMER COMMUNITIES PILOTING SMART CITIES DEVELOPMENT: THE CASE OF THE FIRST NEAR-ZERO ENERGY SMART HOME OF GREECE

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Keywords: Prosumer; Sustainability; Smart Cities; Smart Home; nZEB; Energy Transition; Energy Storage

1. Introduction - Concept of Smart Homes / Smart Cities

Urban areas are responsible for the vast majority of the global GHGs, due to increased energy requirements, while trends towards urbanization are strengthened over time. The concept of smart cities provides new opportunities for the energy sector, where the energy efficiency and savings, as well as RESs further penetration in cities, can be significantly benefited from new technologies and approaches. Synergies achieved by multiple small-scale prosumers in microgrids, the induction of supportive legislations for energy communities, the trend of deregulation of energy markets, the emerging smart grid and ICT technologies, along with the trend of electrification of transportation systems and the upcoming generalized introduction of electric vehicles (EVs) in cities, are promising factors towards self-powered zero-emission smart cities [1, 2].

For the widespread of distributed renewable energy production in smart cities, in order to meet their environmental and energy objectives, the promotion of the small-scale so-called prosumers (residential/commercial) is crucial, i.e. an active concept of the classic passive consumer, who can also produce his own energy, see Fig. 1(a). EU is doing serious efforts towards this direction by promoting the liberalization of energy markets with the new “target-model” approach, as well as, the creation of energy communities/cooperatives and the improvement of buildings’ energy performance towards nearly zero-energy buildings. [2]. The near-Zero Energy Smart Home of CERTH/ITI, located in Thessaloniki, is the first house in Greece that combines enhanced construction materials and intelligent ICT solutions creating a future-proof, sustainable and active testing, validating and evaluating environment, see Fig. 1(b). In this paper, a techno-economic analysis of the CERTH/ITI nZEB is presented and discussed.

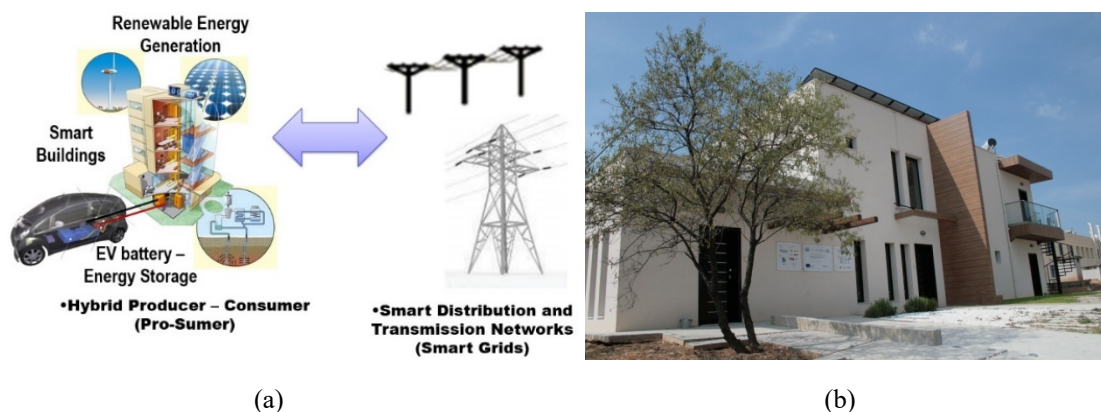


Fig.1. (a) Concept of prosumer; (b) The first nZEB Smart Home in Greece

2. Techno-Economical Aspects

A commonly agreed energy calculation methodology and a consistent definition for ZEB concepts, is crucial before being fully implemented in the national building codes and international standards. A ZEB definition is mainly related with the following criteria:

(i) metric of the balance; (ii) balancing period; (iii) type of energy use included in the balance; (iv) type of energy balance; (v) accepted renewable energy supply options; (vi) connection to the energy infrastructure; (vii) requirements for the energy efficiency, the indoor climate and in case of grid connected ZEB for the building-grid interaction [3].

In this study the main technical parameters, as well as the energy and environmental performance of the nZEB of CERTH/ITI, are presented and discussed. Then ZEBs current economic attractiveness is examined, by calculating the NPV of different nZEB scenarios in comparison with the NPV of buildings that comply with current regulations in Greece. A construction analysis for this specific reference scenario is implemented and the influence on the E-level (a dimensionless unit which expresses the allowed primary energy use for a building) is calculated. Furthermore, the NPV and the discounted payback period for all the nZEB scenarios, where sustainability prevails, are thoroughly examined.

Concluding remarks

The building sector is responsible for the vast majority of the total GHG emissions that cities produce. The challenge, which is now pressing, is to eliminate the energy-consumption building target to zero. In this direction, the energy efficiency and the rise of prosumers are expected to play a major role and, in that respect, EU's EPBD directive 2010/31/EU aims to increase nZEBs penetration in all state members including Greece. From our performed analysis it may be indicated that, investing in a nZEB in Greece is economically attractive and profitable, since multiple scenarios for all nZEB types proved to have a positive NPV.

References

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