

# **Design and assessment of energy infrastructure in new decarbonized urban districts: a Spanish case study**

A. Sánchez Miralles; C. Mateo Domingo; F. Martín Martínez; F. Postigo Marcos; J.I. Linares Hurtado; L. De Rosa; M. Martínez Velázquez; R. Cossent Arín; T. Gómez San Román

## **Abstract-**

**New urban districts have great potential to reduce greenhouse gas emissions by electrifying energy demand in various sectors, such as transportation and buildings. This paper proposes a novel approach that combines different energy models to plan the infrastructure for supplying the energy demand of new, decarbonized, and highly electrified urban districts on a real-world scale. First, a model for energy management in buildings is used to plan and operate equipment for heating, cooling, and solar photovoltaic distributed generation. Second, a model that plans electric vehicle charging infrastructure determines the number and types of charging stations. Then, a large-scale distribution network planning model designs a cost-efficient electricity distribution grid to supply the district. A case study is presented for a new urban district in Madrid, Spain, to demonstrate how this approach can be applied to energy infrastructure planning in a real-world context. This case study presents different scenarios of energy efficiency performances in buildings and penetration levels of solar installations, electric vehicles, and heating and cooling systems. The results show that even in a high electrification scenario, improving energy efficiency in buildings through a district heating network based on heat pumps can lead to a lower peak electricity demand. This peak load reduction allows for integrating more electric vehicles, avoiding further investments in the electricity distribution network. In addition, the results confirm that a highly electrified scenario, which combines energy-efficient buildings with high integration of solar and electric vehicles, significantly reduces non-renewable energy consumption and greenhouse gas emissions.**

**Index Terms- Smart districts; Grid-interactive efficient buildings; Distribution network planning; Electric vehicles; Heat pumps**

Due to copyright restriction we cannot distribute this content on the web. However, clicking on the next link, authors will be able to distribute to you the full version of the paper:

[Request full paper to the authors](#)

If your institution has an electronic subscription to Energy Reports, you can download the paper from the journal website:

[Access to the Journal website](#)

**Citation:**

*Cossent, R.; De Rosa, L.; Gómez, T.; Linares, J.I.; Martín, F.; Martínez, M.; Mateo, C.; Postigo Marcos, F.; Sánchez, A. "Design and assessment of energy infrastructure in new decarbonized urban districts: a Spanish case study", Energy Reports, vol.11, pp.4631-4641, June, 2024.*