

## Green Building for Positive Energy Districts in European Cities

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**Abstract :** Positive Energy District (PED) is a rather recent concept whose aim is to contribute to the main objectives of the Energy Union strategy. It is based on an integrated multi-sectoral approach in response to Europe's most complex challenges. PED integrates energy efficiency, renewable energy production, and energy flexibility in an integrated, multi-sectoral approach at the city level. The core idea behind Positive Energy Districts (PEDs) is to establish an urban area that can generate more energy than it consumes. Additionally, it should be flexible enough to adapt to changes in the energy market. This is crucial because a PED's goal is not just to achieve an annual surplus of net energy but also to help reduce the impact on the interconnected centralized energy networks. It achieves this by providing options to increase on-site load matching and self-consumption, employing technologies for short- and long-term energy storage, and offering energy flexibility through smart control. Thus, it seems that PEDs can encompass all types of buildings in the city environment. Given this which is the added value of having green buildings being constitutive part of PEDS? The paper will present a systematic literature review identifying the role of green building in Positive Energy District to provide answer to following questions: (RQ1) the state of the art of PEDs implementation; (RQ2) penetration of green building in Positive Energy District selected case studies. Methodological approach is based on a broad holistic study of bibliographic sources according to Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) further data will be analysed, mapped and text mining through VOSviewer. Main contribution of research is a cognitive framework on Positive Energy District in Europe and a selection of case studies where green building supported the transition to PED. The inclusion of green buildings within Positive Energy Districts (PEDs) adds significant value for several reasons. Firstly, green buildings are designed and constructed with a focus on environmental sustainability, incorporating energy-efficient technologies, materials, and design principles. As integral components of PEDs, these structures contribute directly to the district's overall ability to generate more energy than it consumes. Secondly, green buildings typically incorporate renewable energy sources, such as solar panels or wind turbines, further boosting the district's capacity for energy generation. This aligns with the PED objective of achieving a surplus of net energy. Moreover, green buildings often feature advanced systems for on-site energy management, load-matching, and self-consumption. This enhances the PED's capability to respond to variations in the energy market, making the district more agile and flexible in optimizing energy use. Additionally, the environmental considerations embedded in green buildings align with the broader sustainability goals of PEDs. By reducing the ecological footprint of individual structures, PEDs with green buildings contribute to minimizing the overall impact on centralized energy networks and promote a more sustainable urban environment. In summary, the incorporation of green buildings within PEDs not only aligns with the district's energy objectives but also enhances environmental sustainability, energy efficiency, and the overall resilience of the urban environment.

**Keywords :** positive energy district, renewables energy production, energy flexibility, energy efficiency

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