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# ADVANCING TOWARDS POSITIVE ENERGY DISTRICTS (PED) USING A LIFE CYCLE ASSESSMENT APPROACH

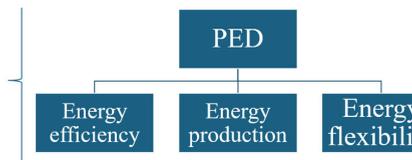
Līga PUZULE<sup>1\*</sup>, Māris ŠINKA<sup>2</sup>, Anatolijs BORODIŅECS<sup>3</sup>

<sup>1-3</sup> *Institute of Sustainable Building Material and Engineering Systems, Faculty of Civil and Mechanical Engineering, Riga Technical University, Kipsalas iela 6A, Riga, LV-1048, Latvia*

\* **Corresponding author.** Email address: [liga.puzule@rtu.lv](mailto:liga.puzule@rtu.lv)

**Abstract** – Cities and their inhabitants are among the largest consumers of energy and contributors to environmental pollution, accounting for 70 % of global greenhouse gas emissions. One of the European Union's key strategies for addressing this issue is the development of Positive Energy Districts (PEDs). Although some PEDs already exist, the concept remains an emerging field of study that goes beyond achieving neighborhoods with net-zero energy imports – or even net-positive energy production. It also emphasizes sustainability and the reduction of greenhouse gas (GHG) emissions. This article explores solutions for implementing PEDs, focusing on energy flow analysis and Life Cycle Assessment (LCA) to inform decision-making. Developing PEDs is a multifaceted process that involves improving building energy efficiency, assessing existing energy sources, exploring opportunities for on-site energy generation, integrating renewable energy systems, and ensuring efficient storage of generated energy. A significant aspect of LCA is calculating embodied emissions for all PED-related implementations, particularly in existing districts where substantial improvements are needed to meet PED goals. In such cases, LCA plays a crucial role in ensuring not only net-zero energy imports but also meaningful GHG emission reduction. Although LCA is not yet widely applied in the development of PEDs, this article highlights its importance in addressing key aspects of achieving climate neutrality goals when transforming urban areas to PEDs. Existing districts with nearly zero or zero-energy buildings have lower embodied emissions when transformed into PEDs, due to the high energy efficiency of the buildings. However, they achieve smaller overall emission reductions because of their already low baseline impact. This underlines the importance of establishing a clear baseline and defining expected outcomes when creating PEDs, ensuring the achievement of net-zero or net-positive energy imports and supporting progress toward climate neutrality.

**Keywords** – *Buildings; climate neutrality; energy efficiency; energy flexibility; energy production; urban areas; zero emissions*



LCA framework for implementing Positive Energy District (PED)

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