Is Amsterdam a Positive Energy District?

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Mayors and City leaders are very interested on innovative actions, practices, and ways to capture SDGs (Sustainable Development Goals) alignment within their local strategies and to foster equity and sustainability for their communities. Positive Energy Neighborhoods and Positive Energy Districts can act as lighthouses within a city transformation: They are concepts to showcase best practice in energy transition measures. However, research shows that it is notoriously difficult to define the character of so called “PEDs” exactly.

SIMPLY Positive [1] – an international research project in the field of positive energy districts – tries to tackle this issue with a clear definition for existing neighborhoods and districts in different countries and climates, which can be adjusted based on their special local context. Amsterdam is one of four so called “focus districts”, showcasing the application of positive energy balance assessments based on available data.

The system boundaries (Fig. 1) of this assessment are approached from spatial, temporal, and functional perspectives:

1. Spatial means an actual physical boundary of included energy services and supplies.

2. Temporal system boundaries can be interpreted as the balancing period and are typically set to one operational year.

3. Functional system boundaries are used to identify specific energy functions, uses, or demands to be included or excluded according to function, rather than spatial proximity.

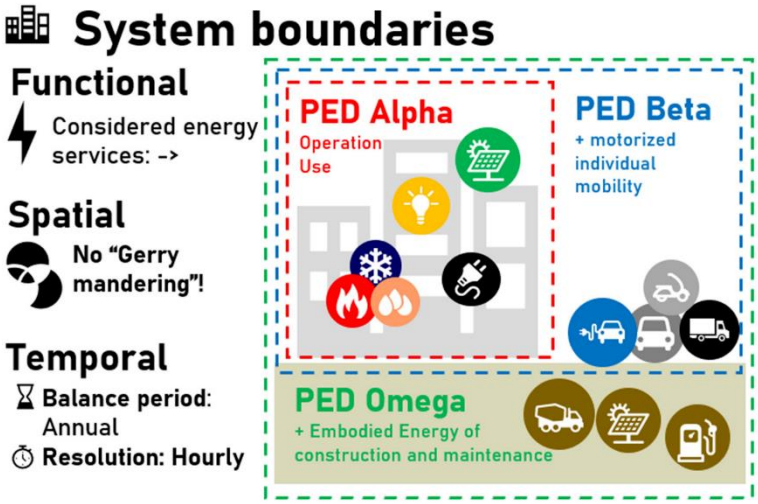
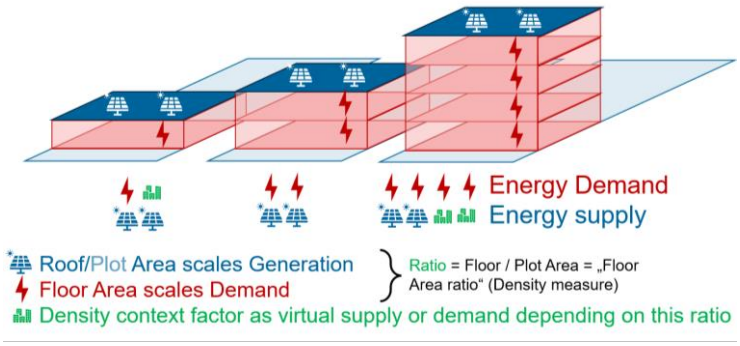


Fig. 1. Types and extent of defined system boundaries.

The functional system boundaries, along with the encompassed energy services, can be roughly categorized into three groups: (1) involving operational energy and user electricity, (2) addressing mobility aspects, and (3) accounting for embodied energy and emissions. This approach defines three distinct variants or layers, represented as PED Alpha at the innermost level, focusing solely on operational energy, then expanding to PED Beta, which incorporates private daily mobility, and extending further to PED Omega at the outermost layer.

This begs the question: Can a whole city be a Positive Energy District? Or in other words, can it achieve a positive energy and emission balance for the entire sectors of building operation, mobility and its embodied emissions? The short answer is no, but there is more to it than acknowledging that cities are energy sponges and will never be self-sufficient: The question is not IF they can reach a positive balance, but rather, which part of the city can achieve how much and how this affects the total combined energy and emission balance of the city and how much renewable energy it will require from elsewhere. Municipal energy and emission goals are connected to regional and national decarbonization strategies in terms of sufficiency, and they are also connected to sectoral and district goals in terms of effort-sharing and allocation. This is where the Positive Energy District method of defining quantitative energy and emission balances can provide a piece of the puzzle: Based on sectoral goals and scenarios outlining the possible performance of different types of the building stock, the bottom-up building savings and renewable potential assessments can be combined with top-down scenarios for municipal and sectoral targets to arrive at quantitative targets as a function of density, location and possibly other factors. This makes comparing and communicating decarbonization efforts transparently and prepare the incorporation of these energy and emission targets in district development and purchase contracts, certifications, and legally binding building-codes and other regulations.

One example of trying to quantify the effect of important contexts is that of density: As can be seen in the following figure, for all its benefits to the urban fabric (i.e. shorter trips, more available goods, and services) it has a detrimental effect on an urban district's – and by extension city's – energy and emission balance. This physical fact can be offset by including it in the energy balance as a virtual context factor proportional to the density, offsetting the downsides of high-density districts and increasing the effort for low-density districts in return.



Relation between Energy Demand and District floor area, as well as local renewable Energy Supply and roof and plot area. The resulting ratio can be used to quantify the energy imbalance resulting from density that can be corrected for with a context factor.

Within SIMPLY Positive project, Amsterdam was defined as a focus district to be analyzed as a PED in operation. Due to the complexity of the built area and considering the requirements for the initial dataset for chosen analysis method the focus district was reduced to smaller part of Amsterdam territory (Fig. 2).

Fig. 2. Focus district in Amsterdam

The main objectives and goals in PV installation in the focus district are set for each sub-part of the focus district as represented in Table 1. Other objectives are set as: windows modernization (U-value = 5.8 W/m²K → 1.1 W/m²K → 0.6 W/m²K); walls insulation (U-value = 1.25 W/m²K → 0.588 W/m²K → 0.4 W/m²K); roofs insulation (U-value = 3.5 W/m²K → 0.4 W/m²K → 0.25 W/m²K).

Table 1. Objectives and Goals for PV in the focus district

Name of FD part	Current situation	Objective	Goal
Bijenkorf	137 panels, 45 kW	100 kW	220 kW (50% of roof area)
Euronext	0	90 kW	180 kW (50% of roof area)
Canal Houses	176 panels, 56 kW	80 kW	100 kW (40% of roof area)
Beurs van Berlage	0	150 kW	310 kW (60% of roof area)

Amsterdam focuses thereby on urban PV maximization, where a very realistic PV and PV-T potential for the whole city is established. Within the presentation we will show the identified available data and the context for Amsterdam's PED energy balance assessment, and how this might differ to the other focus districts of the project, being based in Italy, Romania, and Austria. Only with a clearly formulated and operational theoretical framework of effort-sharing is it possible to interlink and motivate on an international level the pursuit of highly innovative and ambitious project solutions and their replication.

The detailed information about applied methods could be found in [2], [3] as well.

References

[1] "SIMPLY Positive - Supporting innovative and ambitious cities and municipalities on their pathway to Positive Energy Districts through easy, clear and understandable guidelines, targets and strategies". http://simplypositive.eu/

[2] Schöfmann, P.; Zelger, T.; Bartlmä, N.; Schneider, S.; Leibold, J.; Bell, D. Future District—Path to Positive Energy Districts in Vienna; Berichte aus Energie- und Umweltforschung; Austrian Research Promotion Agency: Vienna, Austria, 2020; p. 203.

[3] Schneider, S., Zelger, T., Sengl, D., & Baptista, J. (2023). A Quantitative Positive Energy District Definition with Contextual Targets. *Buildings*, *13*(5), 1210