Making City: Modeling (future) neighborhoods of Groningen

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Due to the pursued energy transition of the Netherlands, changes within the Dutch built environment are expected. Goals defined in the Dutch climate agreement include insulation of housing, energy savings, and replacement of grey electricity and natural gas with renewable energy sources. The aim of the Dutch Regional Energy Strategy (RES) program is to govern the energy transition in a more decentralized way. Inside a RES, multiple governance levels jointly lay out the regional choices for renewable-energy implementation. Hence, municipalities contribute to their local Regional Energy Strategy (RES). Additionally, municipalities play a central role in the development of the so-called neighborhood-oriented approach to reach goals set for the built environment. Within the responsibilities of the local municipalities, there are multiple aspects and stakeholders to consider to make these neighborhood-oriented approaches workable. Therefore, it is essential to understand the energy system as a whole, and create valid scenarios that can aid municipalities with the immense tasks layered out in front of them.

This research focusses on the municipality of Groningen and is part of the work package "New long-term urban planning towards 2050" (WP1.5.3) of The Making City Project. The Making City Project is a Horizon 2020 project that aims to address and demonstrate the transformation of the urban energy system towards smart and low-carbon cities, based on supporting long-term energy planning, with a key focus on the Positive Energy District (PED) concept. The purpose of PEDs is to achieve urban areas that net energy production over a year.

Within this research several specified neighborhoods within the municipality of Groningen are studied. The different selected neighborhoods have different proposed solutions for the heat and electricity demand, depending on the location, current state of the neighborhood, and its buildings (e.g. age of houses, insulation levels, proximity of buildings to heat grid). As a result of the mentioned aspects, the current and future energy demand will differ per neighborhood.

The goal of the research is to gain insight in the (techno-economic) possibility and achievability of the renewable-energy scenarios proposed by the municipality of Groningen. To achieve this goal, a coherent picture is required of the current parameters of the individual neighborhoods, and the possible renewable-energy solutions proposed within the scenarios. The scenarios themselves need to be formulated unambiguously, mainly based on the technical parameters per neighborhood.

The complexity of the energy transition and its interrelations requires an integrated and transparent overview of the energy system, including the interconnections of the neighborhoods. Specifically, it is important to provide insight in the multiple indicators defining a sustainable scenario (e.g. production, impact on the planet, costs, impact on the energy grid, and spatial impacts). Therefore, a modeling-based approach is used to review and expand on the current and future scenarios for the energy transition in the selected neighborhoods in Groningen. The modeling-based approach will use several proven models combined with methods for indicating clear scenarios to verify the scenarios on achievability in a wide range of indicators. The different modeled scenarios are the result of a continuous interaction between the modeling team and representatives of the municipality and/or citizens.

The effect of the different scenarios will be evaluated for an extended timeframe, and a sensitivity analysis will be performed to indicate the most sensitive variables. Major criterions for evaluation are, for instance, the hourly energy balance, costs associated with the corresponding technologies, and environmental aspects, such as CO2 emissions and spatial impact. Furthermore, the results and intermediate steps need to be communicated in a clear and transparent fashion to make them understandable for a wider public. This is achieved by presenting key scenario components on a high-level, geographic map of the neighborhood. Additionally, one of the utilized models is Excel-based, allowing accessible insight in the model assumptions and impacts. The Excel-based descriptions of the different scenarios will be shared with the relevant stakeholders, such that the stakeholders themselves could examine the effect of changing certain parameters.