Spatial Analysis of Residential Combined Photovoltaic and Battery Potential: Case Study Utrecht, the Netherlands

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Introduction
This study aims to analyse and identify the spatial potential of combined PV and battery systems at neighbourhood level. We use the city of Utrecht in the Netherlands as case study to demonstrate the methodology. PV potential, demand data and socio-economic factors like household composition and house values were used to explore the self-sufficiency rates for 88 different neighbourhoods.

Method

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Patterns</th>
<th>Output</th>
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</thead>
<tbody>
<tr>
<td>PV roof potential</td>
<td>Roof orientation</td>
<td>PV yield pattern</td>
</tr>
<tr>
<td>Roof slope</td>
<td>Battery par.</td>
<td>Self-consumption rate</td>
</tr>
<tr>
<td>Historical patterns</td>
<td>Annual demand</td>
<td></td>
</tr>
<tr>
<td>Inhabitant distribution</td>
<td></td>
<td>Spatial level</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dwelling</td>
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<tr>
<td></td>
<td></td>
<td>Zipcode 6</td>
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<tr>
<td></td>
<td></td>
<td>Neighbourhood</td>
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</tbody>
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The self-consumption rate is defined as the ratio between the direct consumed electricity and the total produced electricity. The self-sufficiency rate is defined as the ratio between the direct consumed electricity and the total consumed electricity. PV potential analyses and used battery storage algorithms are explained in previous studies [1,2].

Conclusions

- Large difference in PV potential and energy consumption between neighbourhood
- High self-consumption values are indicated in most neighbourhoods, representing limited PV potential.
- Net import of electricity is required for each neighbourhood under the full PV roof potential.
- Areas identified were relatively small battery capacities increase self-sufficiency.
- Neighbourhoods which could act as potential battery sites for providing electricity to adjacent neighbourhoods are indicated.
- The obtained knowledge is valuable for local governments and developed method can be easily adapted to other areas.
- Energy storage policies should focus on neighbourhoods with high PV potential and relative low energy consumption

Self-consumption rate

Self-sufficiency rate

Color-coded potential self-consumption rate (SCR) (top) and influence of battery capacities (bottom) for each neighbourhood. The white areas are neighbourhoods containing less than 100 households, and are excluded. The battery capacity was normalized with the number of grid connections per neighbourhood.

- Excluded data

Color-coded potential self-sufficiency rate (SSR) (top) and influence of battery capacities (bottom) for each neighbourhood. The white areas are neighbourhoods containing less than 100 households, and are excluded. The battery capacity was normalized with the number of grid connections per neighbourhood.