Towards Positive Energy Districts in smart cities

A data-driven approach using aggregation and disaggregation of energy balance calculations

Sustainable Places 2021

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Context

- Modern energy systems – shift towards more decentralized, sustainable and smart systems
- Important to understand the effect of DER interventions on energy balance and the impact on sustainability goals
- Use energy models to understand this impact
- Challenging
  - models rely on data availability, which is often scarce
  - modelling and simulating areas with a mixed topology, i.e. heterogeneous types of consumers and prosumers, and their energy interventions, as is the case with urban areas
  - Data on energy demand, production and savings has to be collected from different sources, on different aggregation levels

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Introduction

- This paper presents
  - A data modelling approach
    - to estimate annual energy balance of different types of consumer categories in urban areas
  - A methodology
    - to extrapolate energy demands from specific building types to an aggregated level and vice versa
- Case
  - model and calculate the energy balance and CO_2 emissions in two PED areas of the City of Groningen (Netherlands) proposed in the Smart City H2020 Making City project

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Estimating energy balance in urban districts – a data-driven approach

- Energy supply and demand always have to be in balance
- To understand the effect of (possible) energy interventions on an energy system balance (and other KPIs)
  - knowledge of energy supply and demand has to obtained
- This paper: uses Energy System Description Language (ESDL) toolsuite to model two districts in Groningen, using a combination of different data sources

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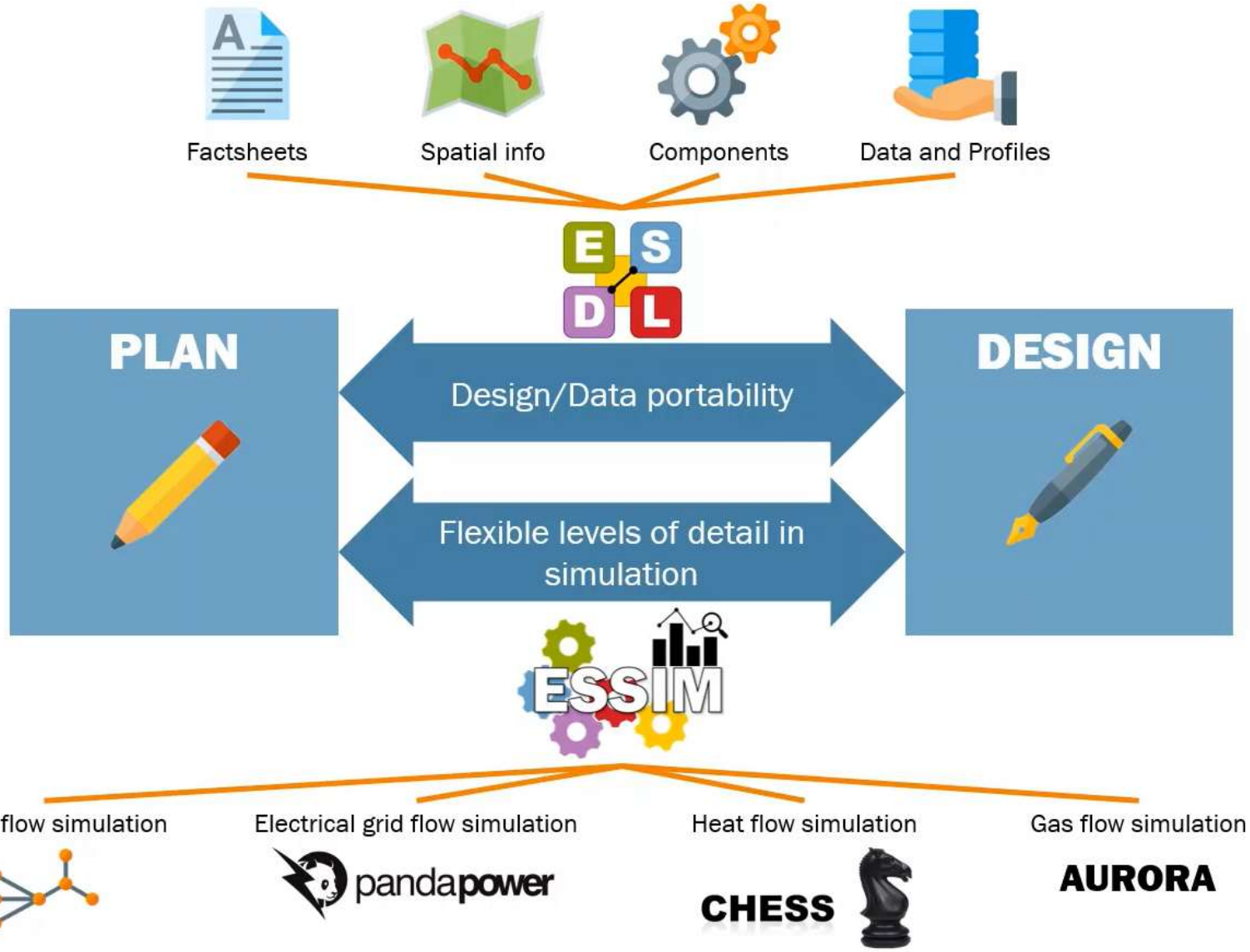
ESDL Toolsuite



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Methodology

- How to
  - determine the impact of individual energy interventions on the global level?
  - extrapolate individuals energy interventions on other buildings on the global level?

- Urban area divided into clusters of different consumer categories to estimate energy demands based on
  - E.g. surface area, building type and energy interventions

- Based on aggregate data, and cluster parameters, energy demand is determined – disaggregation

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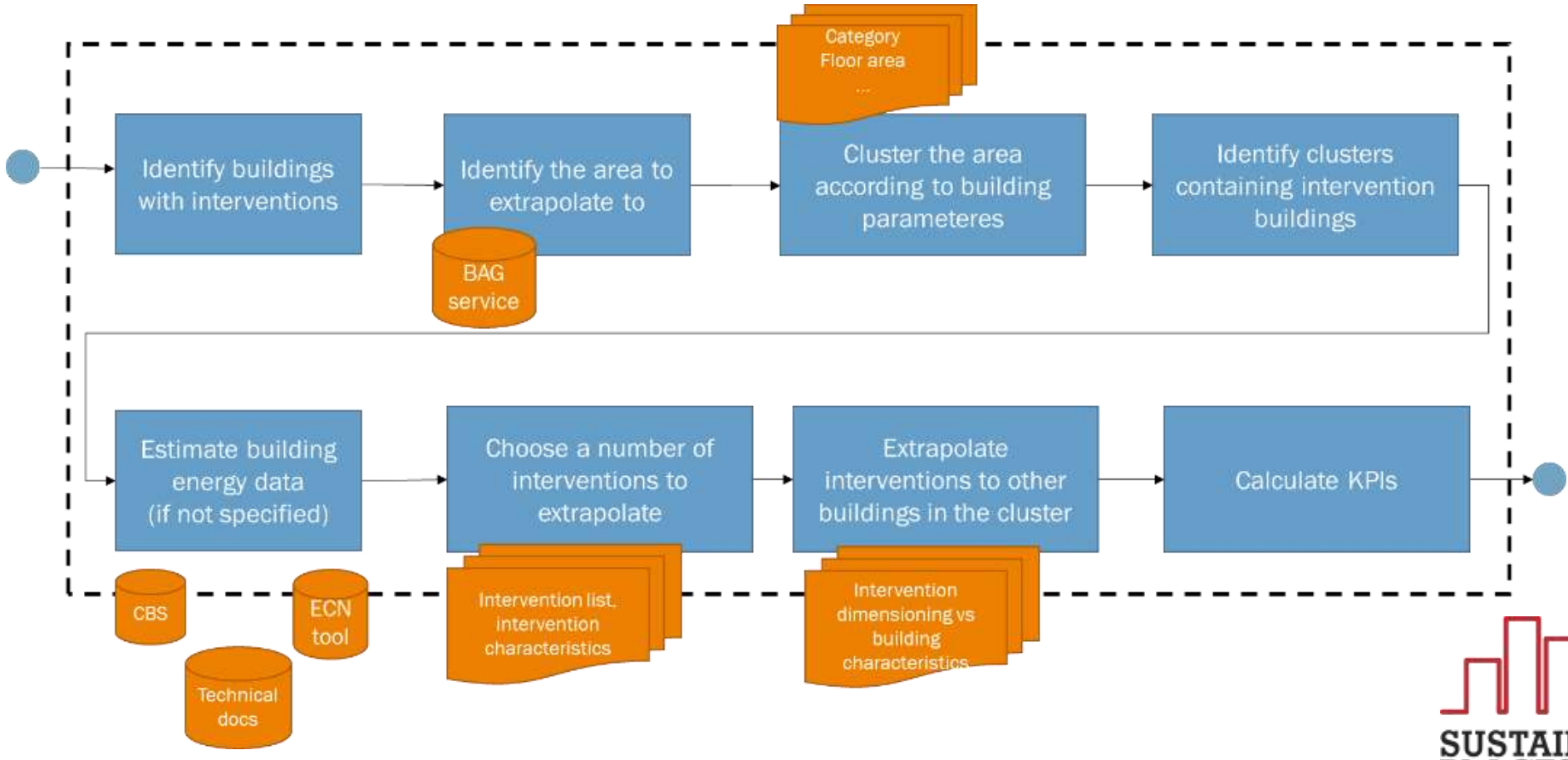
Local to global: Aggregation and disaggregation of energy data (to PED level)



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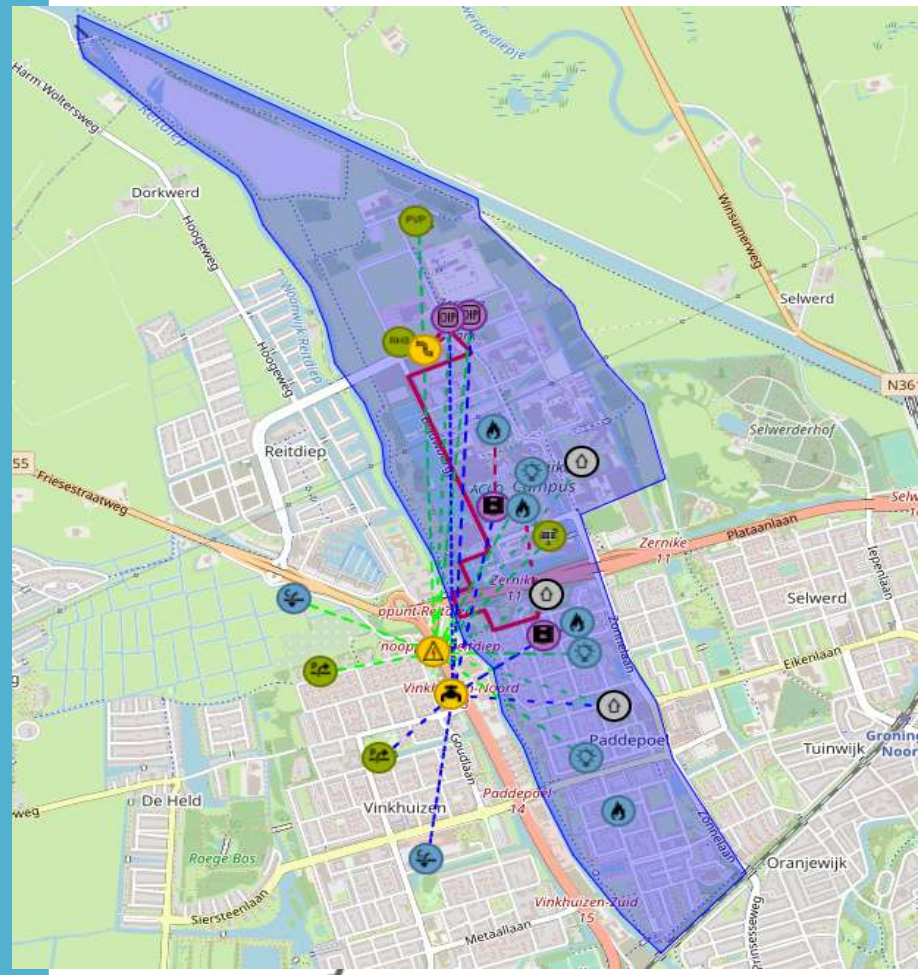
Use case H2020 Making City
Approach on two PEDs in LHC Groningen (NL)



Discussion and conclusions

- Energy models are used to understand different energy transition pathways
- Estimating energy demand and production requires knowledge of different parameters of urban areas, on different aggregation levels
- This paper presented data modelling methodology to extrapolate energy demands from specific building types to an aggregated level and vice versa

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Thank you

Get in touch for more information!

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Project information available on the
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