



ABSTRACT

We need to renovate our aging building stock to reduce our greenhouse gas emissions. Therefore, we need to assess the whole life cycle of buildings to produce better conclusions on the renovation strategies to adopt. However, current life cycle assessment approaches fail to consider the broad range of parameters that compose a building. This project aims to develop a parametric LCA approach for buildings, enabling a quantification of the influence of each parameter.

The approach developed is applied to the case of residential retrofitting as a case study.

ACCRONYMS

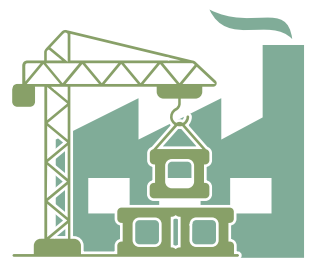
- GHG - Greenhouse Gas
- LC - Life Cycle
- LCA - Life Cycle Assessment
- env. - Environment.al

BACKGROUND

CONTEXT



We need to drastically reduce our GHG emissions to mitigate the effects of climate change.



The Construction Sector is responsible for around 40% of GHG emissions, globally.



The building stock of the EU consists mostly of old buildings that need renovation.

AIM

This project aims to develop a parametric LCA approach for buildings, enabling a quantification of the influence of each parameter.

SCOPE

The method presented in the flow chart below is applied to residential buildings built in Belgium between 1950 and 1970.

PROBLEM STATEMENT



An increased operational energy efficiency can result in higher LC GHG emissions due to the production of materials.

We need to consider the whole life cycle when studying buildings.



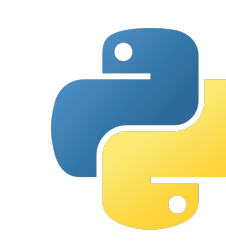
Using case studies as a method can be slow and presents comparability issues.

We need to adopt a parametric approach.



The most impactful decisions regarding the env. footprint are taken in the early design stages.

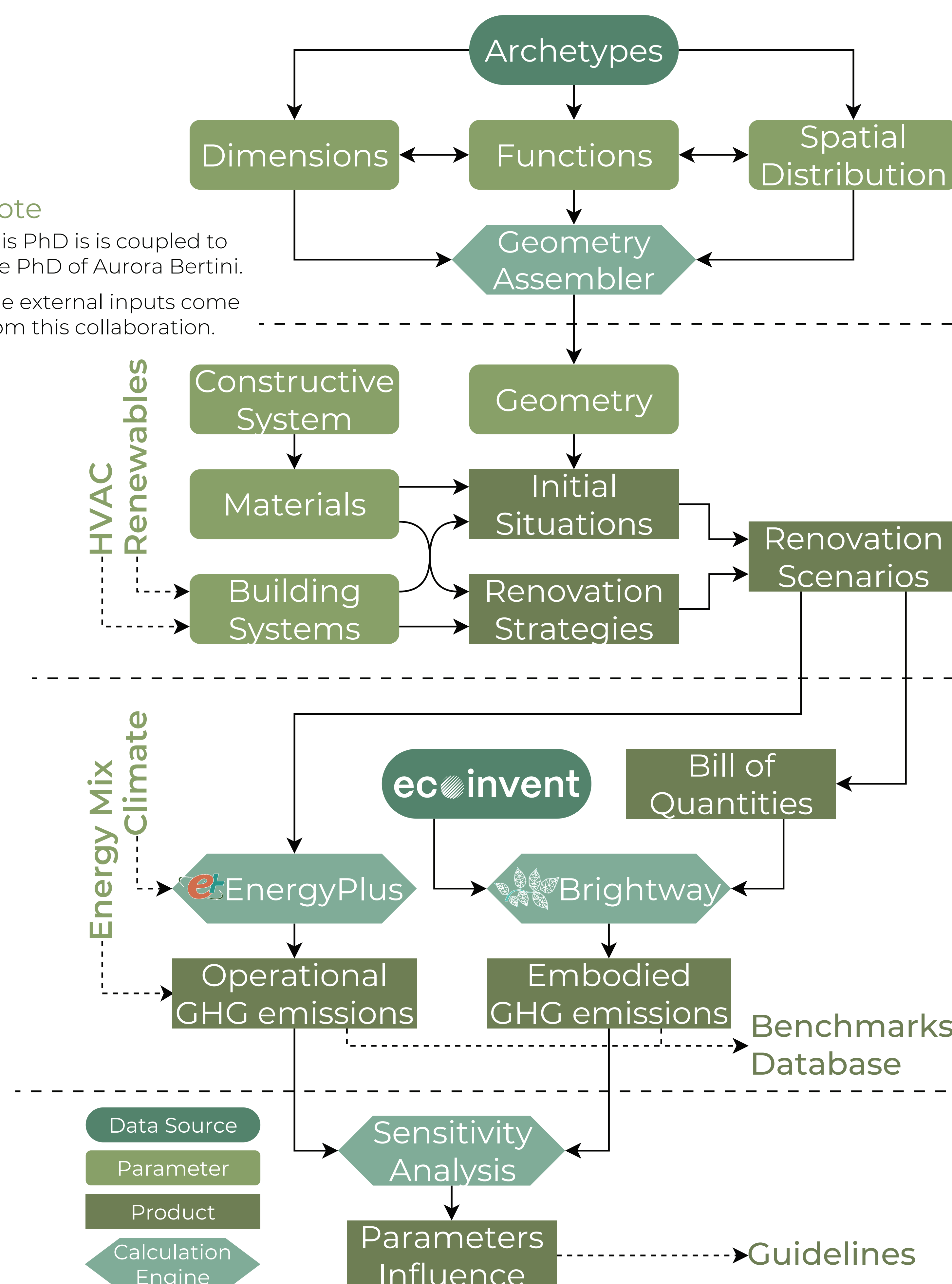
We need to understand the influence of parameters decided by building designers.



This method is implemented through a custom Python engine.

METHODOLOGY

Note
This PhD is coupled to the PhD of Aurora Bertini.
The external inputs come from this collaboration.



Generating geometries

Functions usually found in the studied building type are attributed ranges of realistic dimensions. The frequent spatial distributions encountered are used to articulate the spaces and generate the geometries.

Assembling scenarios

Initial situations are modelled with the combination of a geometry, materials and building systems. Only materials and building systems are modified in a renovation strategy.

Analysing scenarios

The results of the calculations are used to populate a database that can be used as a source of benchmarks for researchers.

Analysing results

Quantifying the range of influence of each parameter enables generating guidelines that can be used in early design stages.