



# DenCity: A methodology for cost-optimal lightweight construction for roof stacking

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## INTRODUCTION

Accommodating populations in cities became increasingly a complex task. With the mounting local and global migration seeking better opportunities in cities, current urban agendas have put forward the concept of compact cities as a promising solution towards sustainable urban development. Roof stacking is considered an approach towards increasing cities' density. The application of optimum roof stacking construction is merely based on subjective evidence based on architects' or owners requirements. Accordingly, this research aims to develop a methodology to increase urban density through cost-optimal lightweight roof stacked residential modules. The methodology embraces multi-stage, multi-objective approach for optimization, and is validated through monitored and calibrated case study that represents the prevailing housing typology for roof stacking.

## KEYWORDS

Urban Densification; Zero-Energy; Decision Support; Optimization

## OBJECTIVE / HYPOTHESIS

- Determination of the potential for increasing urban densities through roof stacking
- Identification of the sustainable indicators for decision making on roof stacking method selection
- Identification of influential variables on roof stacking energy, cost and weight of construction
- Development of optimization methodology for cost optimal lightweight construction
- Validation of the developed methodology through case study

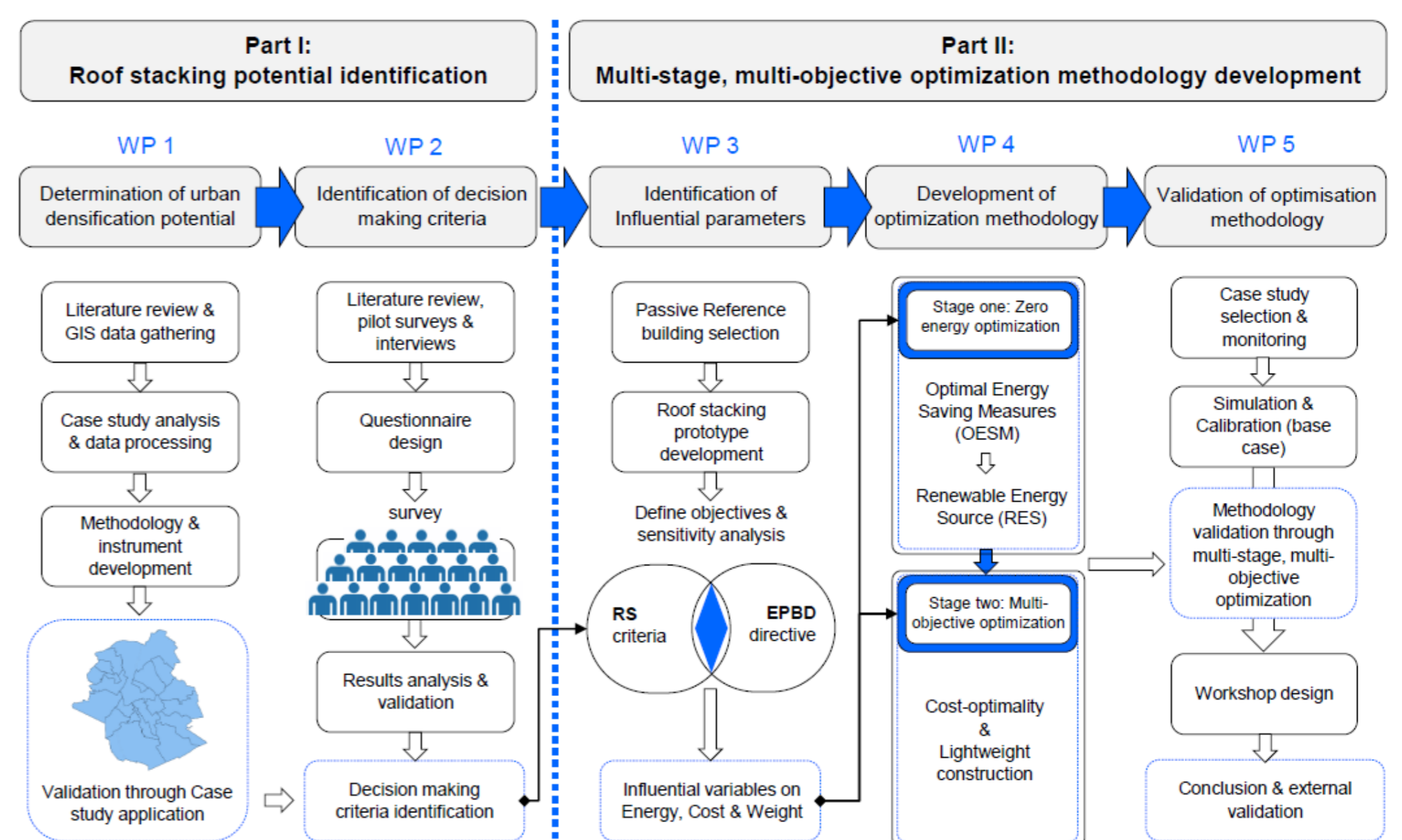
## AUDIENCE

- Small and mid-size architectural offices who works on roof stacking projects for single or multi-family housing prototypes
- Researchers and academics in the field of architectural engineering with interest in building performance and multi-objective optimization
- Urban planners and policy makers with interest in urban densification approaches

## RESEARCH QUESTION

- How to overcome conflicting building's measures to achieve multi-objective performance?
- What are the optimum roof stacking measures to achieve cost-optimal lightweight modules?
- What are the most influential building parameters that influence the energy, cost and weight of construction?
- What are the criteria on which the architects decide on selecting roof stacking construction method?
- How to estimate the potential of existing cities to hold more population by building on rooftops?

## METHODOLOGY



## RESULTS

The potential for densification has been mapped for Brussels Capital Region. This method is based on the combination of three consecutive levels of decision making for roof stacking: urban regulation, engineering, and architectural levels. This three-level approach secures the inclusion of the applied policies at the city level (top-bottom approach), technical support by specialists in the fields of urban planning, architecture, and civil engineering (intermediate level), and the participation of society (grass roots approach) in the decision making process. We strongly note the need to adapt current urban policies and regulations in a reasonable way to encourage roof stacking project and promoting its financial, social, and environmental benefits at both the individual and societal scale.

