

# Optimizing the use of plastic materials from Walloon buildings for material and environmental innovation

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## Abstract

The construction industry is one of the largest consumers of plastic materials, contributing significantly to global plastic waste and CO<sub>2</sub> emissions. This study focuses on optimizing the recycling and reuse of plastic materials in Walloon buildings, contributing to circular economic practices by proposing concrete solutions. Wallonia, through its circular strategies, aims to utilize recycled plastics as an alternative to virgin raw materials in construction, addressing both material scarcity and environmental impacts. The research is conducted in different phases: starting with a comprehensive literature review and the identification of the barriers to recycling plastics in construction, including policy gaps and technical challenges; the second concerns the assessment of plastic deposits in buildings within the Borinage region, providing a detailed and reproducible methodology using GIS-based mapping, material flow analysis, and lifecycle assessment to evaluate recycling potential. Preliminary results show a lack of data on plastic waste in buildings and significant challenges in policy, quality control, and economic feasibility. Future work will explore the techno-economic feasibility of energy recovery from plastic waste and its integration into sustainable building practices in Wallonia.

**Keywords:** *Plastic Materials, Building construction, Circular Economy, Recycling, Sustainable Development, Energy Recovery*

## 1. Introduction

Serious environmental concerns arise due to the large volumes of plastic garbage produced and discarded as a result of massive urbanization, soil artificialization, and consumerist lifestyles (Jawaid et al., 2023) influencing substantially the ecological ecosystems and eventually the inhabitants. Annually, more than 300 million metric tons of plastic waste are generated at an increasing rate (Singh & Sharma, 2016) with less than 10% of them to be incinerated, 7% recycled, and the rest landfilled (EPA, 2015) with buildings to be the second largest consumer (Zhao et al., 2022). In the current context of environmental concerns and the adoption of sustainable development practices, it is striking to note that natural resource

consumption has tripled in the last fifty years (UNEP & IRP, 2024). By estimation, roughly 1/2 of global raw materials concerns the building industry and at least 2/5 of the total CO<sub>2</sub> emissions (Miller, 2021) worldwide, therefore, reviewing the recycling channels is imperative for adaptation and mitigation strategies (Nyika & Dinka, 2022).

A particular concern in European environmental ambitions is plastic recycling. Belgium's target is to set up solutions for all housing, while Wallonia, for its part, develops the 'Circular' recycling strategy with plastics to become an alternative to virgin raw materials (Scuvie, 2024). Along with five priorities, Wallonia develops its dynamics against a backdrop of resource scarcity in the domain of construction materials, being prioritized in its local initiatives (Marique, 2023).

The significance of this study **advocates plastics recycled for construction and building materials for prospects and seeks considerations from regulators and relevant actors to enhance the success of such undertakings as green options**. This work aims to address the **challenges related to the recycling/reuse of plastic materials in the construction sector in Wallonia**, through a structured approach in several phases. As part of the global strategy of the WIN4C (Walloon Initiative for Circular Materials), the study aims at promoting the initiatives of **circular economy in the scientific and practitioners' communities**.

## 2. Methodological Approach

### 2.1. Phase I. Barriers' identification of recycling plastics in building construction

The first phase of this study identified the major objectives of the recycling processes of plastics in construction by combining a qualitative approach based on interviews with the experts of the field and other actors to cross with the literature findings of local and international levels of focus

on the plastic materials. The scope of this stage has basically been the comprehensive understanding of the influencing criteria of integration of recycled plastic materials in the architectural and construction conceptions to evaluate their reuse and their limitations.

## 2.2. Phase II. Development of an assessment of plastic deposits in the area of Mons Borinage

This phase is concentrated on the detailed assessment of the available plastic deposits in the buildings of Borinage, a pilot area selected for its architectural diversity and representative potential targeted the basis for the set-up of a robust methodology, including:

- Regional screening of residential, industrial, commercial and public infrastructure buildings.
- Buildings' categorization.
- Cartographical territorial analysis and the identification of the relevant zones for recycling.

## 3. Results

The two previously developed phases of the study resulted in the following statements so far:

- A significant lack of data in studies of plastic materials and their waste, bringing a limited comprehension of the recycling potential and its potential for the circular economy's standards.
- The difficulties and challenges of the applications for plastic materials' recycling and the lack of relevant policies for their reuse in contemporary constructions.
- The risk management for the diverse operational actors concerning security, quality and the financial and legal challenges.

For the second phase, the study brings together the identification of the dominant built typologies of Borinage for the quantitative estimation of plastic materials'

volumes to encourage a replicable methodology in other geographical scales as well.

## 4. Conclusions

The preliminary results of the work carried out so far made possible to diagnose the main obstacles of recycling and reuse of plastic materials in building construction and to develop the methodological foundations for the characterization of the plastic materials' deposits. Combined with the analyses scheduled in the next steps, the study will contribute to the development of innovative and green solutions for circular management of the plastic materials in Walloon buildings in an integrated scientific, technical and educational objective of the sector.

## 5. Perspectives and future work

As future work, the study aims at the:

- Quantification of the plastic materials in the identified building stock with the aid of specific audits for the assessment of their quality and quantity.
- Characterization of plastic materials, analysis of their physical, chemical and mechanical properties and identification of possible application
- Actors and stakeholders' implications of the relevant ecosystem relevant to the materials' circularity.
- Scientific and technical valorization of the results with the dissemination and the discussion of the developed methodology for the exchange of knowledge and best practices in an interdisciplinary frame for further investigation.
- Assessment of the feasibility of energy recovery from plastic waste in the construction sector, analyzing its potential integration into Wallonia's energy and sustainability strategies.

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