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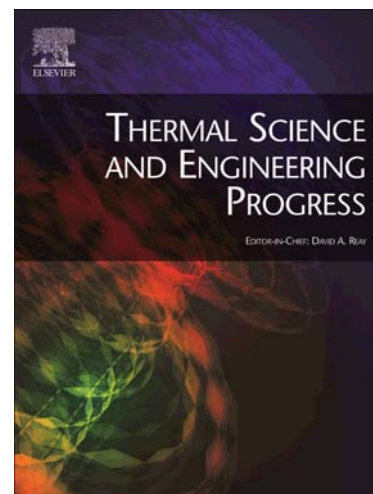
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# A multi-criteria application to select energy retrofit measures at the building and district scale

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## Abstract

The rapid growth of urbanization stresses the necessity of new sustainable paradigms for transition strategies toward energy efficient cities. Particularly, the building sector plays a fundamental role in driving urban energy consumption and GHG emission reduction.

Improving the energy efficiency of existing buildings has a great potential, however selecting among the multiple available retrofit solutions may result difficult for a decision maker.

This work is an application of the PROMETHEE (Preference Ranking Organization Method for Enrichment Evaluation) method in order to provide a guideline for ranking different alternatives of building retrofitting at the building and district level. To this end, the case study of Turin has been selected for outranking five different retrofit alternatives. First, the retrofit alternatives were applied to a district and second, the same procedure was tested at the building level. The double scale approach provides guidelines to both municipalities and citizens. The proposed model supports building and district designers, energy planners and decision makers for ranking complex design energy retrofit options.

**Keywords:** PROMETHEE, District and Building Scale, Energy Retrofitting

Highlights:

- The PROMETHEE method is applied to outrank building retrofit alternatives
- Two case studies at the different scales of urban and building are proposed
- The study highlights the importance of citizen preferences in decision-making

## 1 Introduction

Most of the European building stock pre-dates the energy regulation and is responsible of 40% of energy consumption, with a potential of 90% emission reduction up to 2050 [1]. Lots of efforts are nowadays devoted to the definition of proper retrofitting strategies in the built environment sector. Wide ranges of solutions are available in order to reduce the energy consumption of a building [2] involving both the envelope and the energy system. Nevertheless, for either a citizen [3] or a municipality may be difficult select a proper retrofit option. When a decision needs to be taken, a

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