

International Conference on Sustainable Synergies from Buildings to the Urban Scale, SBE16

# Analyzing the Energy-Saving Potential of Buildings for Sustainable Refurbishment

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## Abstract

For the sustainable redevelopment of existing properties, it is important that the measures taken pay off economically as well. With the energy-scoring method presented in this paper, portfolios can be classified according to their energy-saving potential. Besides the various factors affecting the reduction of primary energy demand, the 3-tier model analyzes and correlates the economic efficiency. The result is an objective ranking of each object, from which property owners can deduce where they should ideally invest in order to optimize the energy efficiency of their building stock sustainably.

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Peer-review under responsibility of the organizing committee of SBE16.

**Keywords:** energy consumption; building stock; energy-scoring; sustainable refurbishment; sustainable buildings; classification of energy-saving potential; portfolio management

## 1. Motivation

The European Union attaches great importance to buildings as part of its strategy to achieve the climate targets for 2020<sup>1</sup>; after all, 40 percent of the energy consumption and one third of the CO<sub>2</sub> emissions in Europe are caused by the real estate sector.<sup>2</sup> In order to change this, existing buildings need to be energetically refurbished, as about one third of the stock is in fact older than 50 years<sup>3</sup> and therefore does not meet the current standards. However, it is difficult to decide where and how to realize energy savings in the most efficient and economical way – especially for property owners with a large and heterogeneous building stock. An analysis of the various buildings' saving potential helps to prioritize measures increasing energy efficiency.

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## 2. The epiqr energy-scoring method

The epiqr energy-scoring method pursues a holistic approach to the prioritization of properties to be refurbished and the determination of necessary investments. A uniform and objective procedure was designed to ensure that buildings could easily be compared and aligned. Considering economic aspects as well as the possible future use of renewable energies, the energy-saving potential of existing properties is analyzed. This facilitates for each building the identification and subsequent derivation of needs for action with regard to the improvement of its energy efficiency. One of the objectives of the epiqr energy-scoring is to minimize the effort and cost for the survey of the property, by focusing on the most impacting building components that can be identified with a quick visual inspection.

### 2.1. The 3-tier model

The scoring is based on a 3-tier model, which analyzes the various factors influencing the primary energy-saving potential and sets them in relation to each other.

- The three pillars on the first level represent the objectives of the energetic refurbishment leading to the diminution of primary energy consumption:
  - "Energy demand reduction"
  - "Renewable energy inclusion"
  - "Economic efficiency"
- The second level consists of the most significant variables for each of these pillars in the form of criteria (see Fig. 1).
- Each of these criteria is in turn composed of various indicators on the third level. The criterion "potential for use of renewable energies" is, for example, defined by indicators such as "solar thermal energy", "photovoltaics" and "wooden pellets - wood chips".

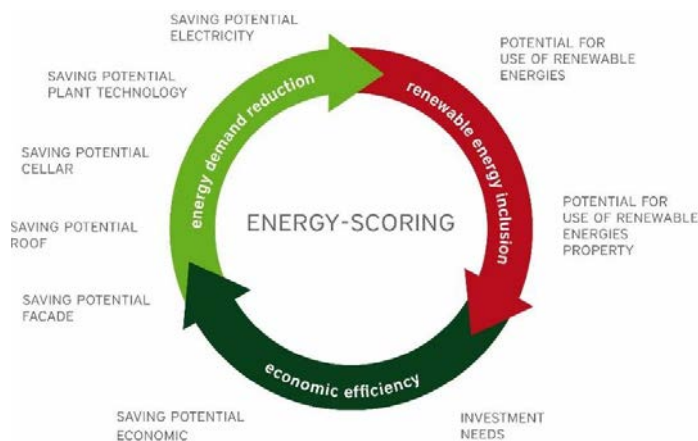


Fig. 1. The model's three pillars consist of different criteria.

In establishing these criteria and indicators, special attention was paid to their completeness, balance and non-redundancy. In addition, the indicators have been thus defined as to ensure validity, sufficient variability, reasonable expenses in the procurement of data and their sufficient influence on the result.

The various elements of the model are individually weighted according to their importance for the achievement of the objectives. To determine, for example, the potential for the use of renewable energies, solar thermal energy is with 20% weight less important than the use of wooden pellets weighted with 60% (see Table 1). A weighting can be performed on all three levels.

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