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DEFINING ENERGY- AND COST-SAVING POTENTIALS AND THEIR APPLICATION IN OPTIMAL BUILDING REFURBISHMENT

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Abstract

In this paper, we develop a rigorous theoretical framework and a practical implementation for the evaluation of the energy- and cost-saving potential of buildings. The goal is to promote sustainability in the context of building energetics by achieving the most efficient, optimal exploitation of the financial resources available for refurbishments. The practical realization of this concept requires the evaluation of the optimal refurbishment cost that maximizes the net energetic or financial savings during the life cycle of the building. On the one hand, too small a refurbishment cost might lock-in a substantial amount of energy and cost savings potential. On the other hand, refurbishment costs that are too high due to unnecessarily implemented energy-saving measures are likely to waste financial resources. The key concept behind the theory is the novel definition of the reference value used for the computation of the energy- and cost-saving potentials. From a mathematical point of view, the reference value is obtained by two subsequent optimizations. First, a constrained, single-objective optimization is used to evaluate the best energetic state of the building as a function of the refurbishment cost. Second, a simple unconstrained search must be performed to obtain the minimum value and the minimum place of the one-dimensional cost function. The proposed framework automatically provides personalized solutions corresponding to the actual technical characteristics of the building. These solutions are optimal under the given circumstances of the actual refurbishment, resulting in either the highest possible energy- or cost-saving amounts during the life cycle of the building.

Key words: efficiency, energy saving, cost saving, potential, optimization

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