

ABSTRACT

Proposed Title: An optimization approach for integrating different roof functions with environmental impacts constraint: “A hybrid framework”

A. Indication of project:

The project is carried as a research project.

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D. Project Summary:

Introduction:

Integrating different roof functions such as green roofs, cool roofs, and PV systems is of building practitioners’ interests in order to meet certain criteria in terms of energy efficiency, cost effectiveness, and environmental effect. This research presents an enhanced system for integrated roofs to optimize desired roof performance. It consists of an optimization model as a core that its input is fed primarily by energy simulation in conjunction with literature findings and field measurements.

Energy analysis carried out through roof energy simulation plays a major role in this framework. The proposed framework incorporates the quantitative connection of various roof design technologies on energy and cost savings with respect to environmental impacts. All these connections are included in the mathematical optimization model.

Methodology:

To gain a comprehensive understanding of how different roof configurations interact with different outcomes including 1) energy savings, 2) environmental impacts and 3) costs, a none-linear mathematical model is proposed. The proposed mathematical scheme is capable of incorporating behaviors and interactions between several parameters used in roof function selection. An objective function is employed in this mathematical model to minimize total cost associated with different roof function installation and operation.

In other words, the proposed mathematical model predicts the best combination of different roof types in a building to satisfy energy and environment restrictions. The more rigorous framework of the proposed mathematical model can also incorporate different parameters associated with different climate conditions (Figure 1).

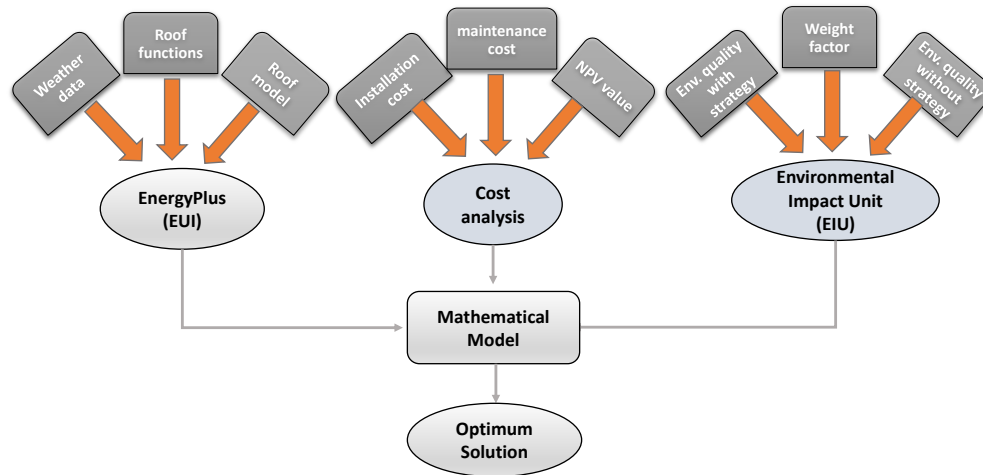


Figure 1: Proposed analysis framework

Results/Future work

1. The proposed framework for selecting optimal roof functions for a building presents a promising approach to estimate the necessary proportion of the certain roof types.
 2. The simple mathematical model can be readily used, or coded into a computational engine and can give the optimal solution in an instance.
 3. The flexibility of the proposed mathematical model, enables the incorporation of further roof parameters.
- Here is the list of future steps for this research:
 - Limiting the portions of the roof that needs to be covered by certain roof functions to certain limits. This will give an integer programming model, however, will consider roofs geometric limitations.
 - Considering the possibility of multiple roof types in one area, such as green PV or Cool PV systems.

References:

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