International Conference on Civil Engineering,
Architecture and Urban Management in Iran
Tehran University
DECEMBER-2018

Comparison between green roofs and cool roofs through urban heat island mitigation and energy consumption reduction

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Abstract

The reduction of energy demands for space cooling, as well the mitigation of Urban Heat Island effect (UHI), require adequate solutions at building and urban scale. The intensification of the Urban Heat Island effect (UHI) is a problem that involves several fields, and new solutions are required to mitigate its amplitude. The construction sector is strictly related with this phenomenon; in particular, roofs are the envelope components subject to the highest solar irradiance, hence any mitigation strategy should start from them and involve their appropriate design process. For this purpose, cool materials, i.e. materials which are able to reflect a large amount of solar radiation and avoid overheating of building surfaces have already been deeply analyzed both at building and urban scales, their benefits have been shown especially in hot climates. However, green roofs also represent a possible way to cope with UHI, even if their design is not straightforward and requires taking into account many variables, strictly related with the local climatic conditions. Energy saving, thermal insulation, shading and evapotranspiration features highlight the key role of green roofs in overall thermal performance of buildings and microclimatic conditions of indoor environments.

The present paper compares cool roofs and green roofs as a solution of UHI mitigation, and a key factor to reduce energy consumption in building sector.

Key words: Green roofs, Cool roofs, Urban Heat Island, Energy efficiency

1. Introduction

Innovative energy solutions and passive techniques for improving the energy performance of buildings have become an environmental and economic issue. The envelope of many existing buildings is inadequate to reduce heat losses in winter, or to contrast the solar heat gains in summer [1]. In particular, the behavior of the roof surface highly affects the peak load and the energy cooling demand in conditioned buildings, as well as the indoor thermal comfort in non-conditioned buildings [2]. On a city scale, this effect contributes to the increase in the urban air temperature, i.e. the well-known phenomenon called Urban Heat Island effect [3]. The process of