A Study of Rooftop Gardens in Singapore

In Singapore, continuous efforts in making the country a “garden city” have resulted in lush greenery throughout the island. However, the greenery has been kept at the ground level. The rooftops of many buildings have been left untapped as possible areas for rooftop gardens. One of the potential measures to mitigate the Urban Heat Island effect is the use of plants for roof and sky-rise gardens and it has gained popularity around the world. The study of rooftop gardens, which is a collaborative effort of the National Parks Board (NParks) and Centre for Total Building Performance (CTBP), explores rooftop gardens in Singapore through four perspectives: field measurements, energy simulation, life-cycle costing, and perception studies of building professionals and end-users.

Methods and Findings

Field measurements were conducted on a rooftop garden of a commercial building (Figure 1). The results of the field measurements reveal that the installation of rooftop gardens would significantly provide thermal protection to buildings and improve the surrounding environment. The main thermal benefits of vegetation on the building roof include reduction of temperature and heat gain of the roof, and solar radiation absorbed by the roof. Figure 2 illustrates the comparison of surface temperatures measured with different kinds of plants, only soil, and without plants. The measured thermal improvements due to the presence of rooftop gardens are summarised in Table 1a.

Energy Simulations

The simulation results reflect that the installation of plants or soil layer would significantly reduce the energy consumption required in a five-storey commercial building under the Singapore climatic condition. The data on the reduction of energy consumption due to the installation of plants and soil layer on the roof are summarised in Table 1b.

Life-cycle Cost Analysis

This study reveals that by incorporating energy savings into the life-cycle cost analysis, it gives a
Figure 2: The comparison of surface temperatures measured with different kinds of plants, only soil, and without plants on 3 and 4 November 2001.

better picture of the cost effectiveness of roof gardens. It can be concluded that by considering the energy savings, the extensive green roof costs no more than the conventional flat roof.

Perception Studies of Building Professionals and End-users

The perceptions of building professionals on the benefits and barriers of green roof development were investigated. The results suggest the general acceptance of green roof development among professionals in the building industry. Public attitudes towards rooftop garden provision in Singapore were also investigated. The discussions focused mainly on the usage rate of rooftop gardens, perception of the role and importance of rooftop gardens, and facilities and design features desired for rooftop gardens.

CONTACT DETAILS

Dr WONG Nyuk Hien
Department of Building
School of Design and Environment
National University of Singapore
4 Architecture Drive
Fax: (65) 6775 5502
Tel: (65) 6874 3423
E-mail: bdgwnh@nus.edu.sg