Photovoltaic – Panels on Green Roofs, the German Experience

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IN Europe, greened roof technology has become increasingly important over the last 20 years (Koehler et al., 1993). It is one way to return open space to paved and sealed areas of the inner city. Such roofs become important for residents in areas of high urban density. However, such greened roofs provide benefits far beyond their aesthetic component.

A number of groups (Koehler et al., 2001) have pointed out that greened roofs offer energy savings as well, contributing to sustainable urban development. In temperate climates, a greened roof functions as heating and cooling, while in the tropics, greened roofs play an important role in cooling the building. Soil on the roof retains rainwater, which is in turn evaporated by the plants of the roof garden, which provides natural cooling through the removal of heat from the building through enthalpy. One of the major problems of growing urban areas is the creation of "inner city heat islands". Green roofs can help alleviate this problem.

Photovoltaic cells, on the other hand, are one of the most promising technologies in the continuous struggle to reduce carbon dioxide emissions. They are available in a variety of panels, and have been tested in various array densities and solar angles over the years.

By combining the best of both of these technologies: photovoltaics and appropriate ecology - there is a positive interaction between the two which will also provide a sustainable architecture.

THE RESULTS

- Green roofs reduce the operation temperature of the PV system, thus increasing efficiency and energy yield.
- PV array offers shading for green roof thus improving the growth of plants and increasing the number of species.

Green roofs are notably cooler than conventional bituminous roofs: While lower temperatures lead to higher voltages at silicon based photovoltaic panels, the electricity generation of PV on green roof is higher than on conventional roofs. The well-shaded vegetation of the roof with the photovoltaic panels is significantly higher than on those roofs without the panels. Occasionally, the vegetation must be controlled to ensure that the panels are not shaded.

The values of climatic parameters in the tropics – radiation, temperature and precipitation – are approximately double as compared to those prevailing in temperate zones such as Europe. Therefore, the efficiency of the photovoltaic panels is expected to be higher in the tropics.

CONCLUSION

The results of the first Rio Conference in 1992 suggested the need for a change in architecture; energy conservation is an issue of ever increasing importance. Many studies have proven that a realistic approach in reducing the primary energy can be achieved without an accompanying lifestyle trade-off for urban dwellers. We need to implement all of these small steps to realise a definitive change of course towards a true solar city. ■

Note:

The main content of this paper is an extract of a paper entitled "Photovoltaic – Panels on Green Roofs" Positive Interaction between two elements of sustainable architecture" presented at the World Climate & Energy Event, Jan 6-11, 2002, written by Manfred Kholer, Marco Schmidt, Micheal Laar, Ulrike Wachsmann and Stefan Krauter of various organisations.