ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

97-32

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14th European Photovoltaic Solar Energy Conference - Barcelona - June 97

1997 - June

SOLGREEN
FLAT ROOF SYSTEM FOR "GREEN ROOFS"

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In co-operation with the SOFREL team member Enecolo AG, CH-8617 Mönchaltorf

Abstract: More and more communities are heavily concerned by air pollution and the lack of green areas in town and are therefore encouraging or even forcing people to use "green roofing" technology on their flat roofs.

Mounting PV on such roofs requires a new approach, in particular to address the new problems posed by the vegetation and its care.

SolGreen offers a modern and cost effective solution to these problems, and can be installed on both new and existing green roofs.

The main characteristics of this system are:

- wide latticed metallic base, buried to use the weight and structure of the organic layer as a load and an anchor for the PV panels
- non-intrusive feet system, to allow easy maintenance and keep the vegetation level below the panels
- optimized tilt angle, and therefore a good trade-off between maximized energy production and maximal green area
- fast attaching system, which reduces the mounting costs, both for framed modules and laminates.

The paper shows design proposals for the SolGreen green roof integration system. This concept is still in the developing phase, and one or two pilot installations will be built in the next 12 months to test and further optimise the system.

Keywords: Building Integration – 1: Roofing Systems – 2: PV Materials – 3

Introduction

More and more flat roofs are topped with a layer of vegetation and an increasing number of town councils in Switzerland and the European Union now even stipulate green roofs because of their numerous advantages:

- ✓ longevity of the roof (water tightness, resistance to thermal and mechanical shocks, protection against UV, hail etc.),
- ✓ increased thermal protection in winter and summer (greater inertia which favours breaking down incident heat),
- ✓ better acoustic insulation inside the building due to the mass of the vegetation layer,
- ✓ preservation of certain ecosystems, possibly reconstitution of biotopes that have disappeared,
- ✓ in urban surroundings, vegetation binds dust and, in summer, creates humid microclimates that attenuate heat peaks,
- ✓ vegetation layers prolong rainwater drainage and thus prevent overload of sewerage plants.

Besides technical and environmental advantages, these roofs offer, like conventional flat roofs, numerous integration possibilities for photovoltaic systems. Uninterrupted large surfaces provide optimal insolation conditions and allow rapid and low-cost integration of simple PV structures. This article presents a system developed by the Solar Energy and Building Physics Laboratory (LESO-PB) and Enecolo AG for the integration of photovoltaic elements on green roofs with respect for aesthetics, security and comfort.

Green Roof Structure

For a green roof, several layers of material are usually added on top of the waterproofing layer:

- ✓ an anti-root layer to protect the water tightness layer from damage caused by roots,

- ✓ an accumulation and drainage layer for water storage and drainage, made from synthetic foam chips or gravel,
- ✓ a filter mat to separate the accumulation and vegetation layers,
- ✓ a vegetation layer with variable height, depending on the vegetation and landscaping.

Two types of vegetation-topped roofs exist: on the one hand those with intensive vegetation (type hanging garden), and on the other those with extensive vegetation (plants lower than 30 cm, with feeble growth). For obvious reasons (shading), we concentrated our efforts on roofs with extensive vegetation.

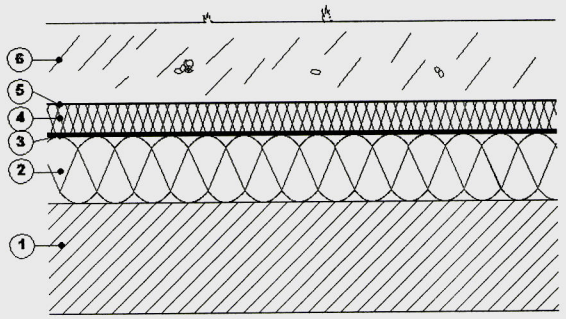

Figure 1 Cross section of a green roof
1. Underconstruction 2.Insulation 3. Water tightness layer 4. Drainage mat 5. Anti-root layer 6. Vegetation

Conditions

A PV integration system for green roofs has to take into account the particularities of the roof structure and the vegetation layer. Our main concern was to:

- ✓ allow easy maintenance of the green roof,
- ✓ avoid shading caused by vegetation,
- ✓ allow quick and solid mounting,
- ✓ produce an elegant and discreet system,
- ✓ best use of floor area at our disposal.

The SolGreen System

The central idea in the development of this system was that it should use a light and elegant support covering a minimum area to leave a maximum surface for the vegetation layer. Any solution using concrete blocks or other bulky ballast was discarded from the start.

The adopted solution consists in a purpose-bent square-sectioned tube of stainless steel. The use of stainless steel provides a good resistance and durability to the system, and relatively little of it is needed to produce a light, elegant and low-cost structure that leaves a maximum area for the vegetation. Apart from its shape, the originality of the system resides in the fact that the forces of resistance to uprooting are distributed over the vegetation layer. In fact, the different green roof layers constitute the ballast needed to keep the supporting structure on the floor.

The roots of the vegetation layer form a compact and dense network and with a homogenous structure that solidly links the supporting enhance their wind resistance. The two ends of the SolGreen structure are placed directly on the water proofing layer and then covered with a drainage mat or a rigid layer (net, geotextile, ...) on which the vegetation layer is deposited. (Fig2)

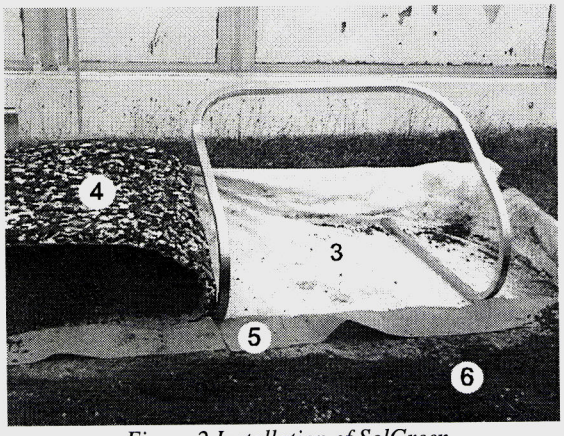

Figure 2 Installation of SolGreen

The photovoltaic module is attached to the SolGreen base with stainless steel clamps. This is quick and easy to do and neither screws nor glue are needed in addition.

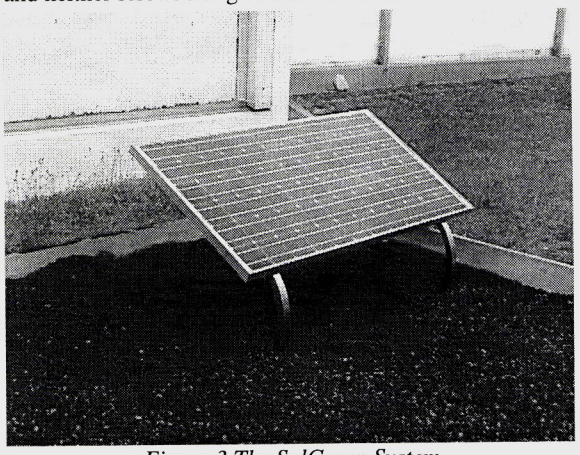

Figure 3 The SolGreen System

Further development

Future development work on the SolGreen integration system will include:

- ✓ the development of a rigid layer which should distribute the resistance to uprooting over the whole area for use on green roofs with a non-rigid drainage layer,
- ✓ the validation of the system through wind resistance measurements.

A patent for SolGreen is pending.

Acknowledgements

This project was possible thanks to the Swiss Federal Office of Energy who funded the project in the framework of its research programme.