– SCERRI –
AN INNOVATIVE PV WATERPROOFING MEMBRANE ON FLAT ROOF WITH VHF-TECHNOLOGIES MODULES

K. Nagel[1], E. Bura[1], F. Morini[1], B. Margna[1], I. Zanetti[1], D. Chianese[1]
P. Goulpié[2], F. Rummens[3], L. Van de Vel[3]
C. Forrer[4], H. Zumstein[4], A. Testoni[5], E. Leonardi[6], M. Martignoni[6]
[1]Institute for Applied Sustainability to the Built Environment (ISAAC)-University of Applied Sciences of Southern Switzerland (SUPSI)
Via Trevano, CH - 6952 Canobbio; Phone: +41 58 666 63 20, Fax: +41 58 666 63 49
Internet: http://www.isaac.supsi.ch & http://www.bipv.ch, E-mail: kim.nagel@supsi.ch
[2]VHF-technologies (Flexcell), [3]Renolit
[4]AET-Electric utility of Canton Ticino, [5]AEM- Electric utility of Massagno - Ticino, [6]Canton Ticino

At the foot of 3 castles, protected by the Unesco world heritage, an innovative photovoltaic waterproofing membrane was installed on a flat roof in Bellinzona in Switzerland. The modules are produced by VHF-technologies (Flexcell) a Swiss PV producer and they have been laminated into a waterproofing membrane made by Renolit, a Belgian manufacturer. VHF-technologies is one of the few companies able to produce this kind of technology and one of the first concurrent to Uni-Solar company. The aim of the project is to analyze the behavior and the energy yield of this 1kWp Building integrated PhotoVoltaic (BiPV) system composed with flexible single-junction amorphous silicon modules.
Keywords: Building integrated PV (BiPV), Flexible substrate, Roofing systems

1 INTRODUCTION

Since 1970 a large number of buildings with flat roofs has been constructed. About 25% of European flat roofs are covered with single ply roofing systems. The use of thin-film photovoltaic modules integrated into waterproofing membranes has a large potential and various advantages: first of all it is easy to install, also the application of the PV membrane resemble the traditional membrane and are well-known by flat roof installers; moreover it does not need either ballast loads or additional structures; finally it has better electrical properties compared to crystalline modules when isolated.

2 "SCERRI" PLANT SPECIFICATION

2.1 BiPV modules

Flexible amorphous silicon (a-Si) single-junction modules from VHF-technologies company were used in this project as an innovative application. Each modules has a unstable power of 78Wp. After the normal degradation under illumination of amorphous silicon thin films, named "Staebler-Wronsky effect", the modules are planning to reach 58Wp.

Table I: Modules specification

Module specifications	**FLX – TO60**
Technology	**a-Si single-junction**
Power [W]	**58 (stabilized)**
Umpp [V]	**32.8**
Impp [A]	**1.8**
Dimensions [mm]	**820 x 3280 x 1.5**
Specific Weight [Kg/mq]	**2.1**

2.2 BiPV systems

The modules are laminated into a waterproofing membrane from Renolit company. The PV membrane is applied, as a second layer, on the fully completed membrane on the 130m² flat roof. The fastening system between both membranes was created by means of hot air welding. The thermal insulation under the membrane has a slight inclination of 2% to allow the water drain. Contrary to traditional system, the BiPV system is insulated. The plant "Scerri" is composed of 18 modules in parallel with a power of 1kWp. The previous yearly production is 975kWh. The PV active surface is 31m². The PV plant has been grid connected since the end of July 2008.

Table II: System specification

System specifications	**Scerri**
Technology	**a-Si single-junction**
N° of modules	**18 in parallel**
Power [W]	**1044 (stabilized)**
Umpp [V]	**32.8**
Impp [A]	**32.4**
Active surface [mq]	**31**
Inverter	**SMA 1100LV**
yearly production [kWh]	**975**

Figure 1: "Scerri" BiPV plant, the location is near three castles named a World heritage site by UNESCO in 2000.

3 MONITORING

The study includes the monitoring of system parameters (PV module temperature, power, voltage, current and so on) and major meteorological parameters (ambient temperature, irradiance, wind speed and direction).

For comparison reasons, near to the main PV plant four other small open-rack plants will be installed: one a-Si triple-junction module from Uni-Solar, two a-Si single-junction modules from VHF-technologies (one flat and one corrugated) and one c-Si module.

Figure 2: For comparison reasons, near to the main PV plant four other small open-rack plants will be installed.

4 GOAL OF THE PROJECT

This research aims to analyze the behavior and the energy yield of the VHF-technologies modules, when thermally insulated.

During another study from ISAAC, named CPT [1], better thermal behavior of a-Si triple-junction modules from Uni-Solar was demonstrated compared to c-Si technologies. In fact, losses due to the quasi-horizontal position (lower irradiation and higher reflection) were compensated by the annealing mechanism and lower temperature coefficients. The improvement of the energy yield caused by the thermal insulation were confirmed.

Viewing these results, it will be interesting to analyzed the "Staebler-Wronsky" degradation and the annealing effects for the a-Si single-junction modules from VHF-Technologies.

Figure 3: The thermal behavior of the "Scerri" plant will be compared with the "CPT" plant, different producers and technology (single vs. triple-junction a-Si modules).

At the end, a comparison of the thermal behavior of these two plants, from different producers and technologies (single vs. triple-junction a-Si modules), will be realized.

5 RESULTS

- "Scerri" plant is the first example of BiPV system composed of a-Si single-junction modules from VHF-Technologies company laminated together with the roofing membrane.
- The system was grid connected at the end of July 2008.
- The data acquisition started some weeks ago. As soon as possible, first results will be available on our website www.bipv.ch.

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7 REFERENCES

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