





**Table 1. Performance features of the experimental module LSC**

Characteristical data of the LSC module	Units	Value
Tension VMMP	V	24.29
Electricity IMMP	A	0.58
Electricity ISC	A	0.63
Power PMMP	W	14.1
tension VOC	V	30.16

**Table 2. Recorded values for the LSC prototype during a three days monitoring in June**

Day	Month	Daily Radiation [Wh]	Average Power [W]	Energy produced [Wh]
27	June	5557	10,87	79,74
28		6278	8,70	87,00
29		6617	8,59	85,88

### Electrical scheme

The plant in question is stand-alone, with island operation. All the electrical loads need to be fed with alternating current at 230V, therefore the facility is equipped with an inverter able to supply the 230V to the loads drawing the necessary energy from the batteries. In detail, the generator of this photovoltaic system, made of photovoltaic modules and their connections and mechanical supports, is composed of a total of 32 prototype modules with monocrystalline silicon cells, installed at 3 different orientations and inclinations, as shown in the following summary table.

The different PV modules are connected in series of two modules each, thus forming a total of 16 strings. These strings are then grouped into three different sections, each of which is characterized by a uniform application type and is constituted by the electrical connection in parallel of the strings that compose it. The entire system is then equipped with a monitoring system able of measuring the voltage and current produced by each string, in addition to the main environmental data.

The electrical needs for the bike shelter are related to: monitoring system for data collecting (solar radiation, temperature of the modules and air temperature, voltage and electricity); Personal computer with 19" touchscreen IP65 to visualize the energy produced and a multimedia description of the project; Back LED lighting of the Eni logo; Local LED lighting (positioned in the frame structure); N°3 electrical bikes.

### System monitoring and remote control

The photovoltaic plant in question is equipped with an acquisition and monitoring system able to measure the following parameters: current strength of each string, the tension of each string, operating temperature of 3 photovoltaic modules, ambient temperature, radiation on the 3 different orientation planes under which the modules were mounted. The criteria selected for the analysis are: comparison between the integrated production of the LSC modules and the one estimated for traditional PV panels, definition and selection of significant days and tracking of the power supplied under different irradiation conditions, keeping the data coming from different panels orientations separate (bicycles side, motorcycle side, vertical wall), distinction of the strings according to the presence or absence of a back reflective panel, analysis of the historical production of the best performing strings.

The Eni photovoltaic shelter can nominally produce about 500 watts of electricity generated by 192 yellow transparent photovoltaic slabs, each of which is made of a plastic material with a minimum amount of dyes patented by Eni.

### FUTURE DEVELOPMENTS

From the point of view of the type of component for the realization of the PV module, the initial choice fell on a frame with steel profiles with standard press-bents. The selected frame therefore guaranteed the same durability and mechanical strength of a traditional window frame with also the possibility to be easily opened for slabs repositioning. The next step is focused on a new fiberglass component structure which guarantees lightness, higher thermal and electrical insulation and minimum interference with the LSC energy performance in terms of minimum shading effect on solar cells.

Furthermore we are investigating the possibility of producing new components based on LSC technology. Nine concepts for different building components based on LSC technology have been defined. These components have been chosen for the potential diffusion in the built environment as well as for the possibility to be integrated in current building technologies. The dimensions of the LSC plates is based on a 50x50 cm module made in PMMA that can be aggregated to arrive at the desired

dimensions. Each component will be studied and analyzed with reference to the current building regulations paying particular attention to the elements of the structural frame.

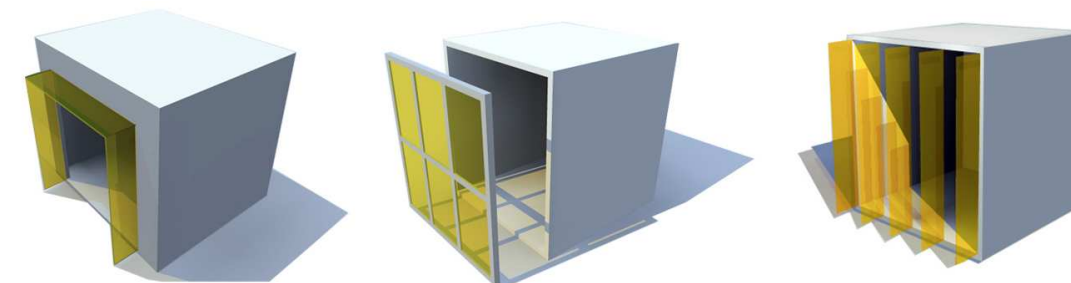


Figure 5 Some concept design for the future application developments.

### CONCLUSION

The shelter, which is still in the monitoring phase, showed that the LSC are far less sensitive to the orientation than traditional photovoltaic panels; LSC are therefore able to exploit the diffused light and to work even in low lighting conditions (cloudy sky, sun low on the horizon).

This part of the research as well - as the building of the bike shelter - points out the necessity to create a new, strong expressive identity for the LSC, where color is directly related to the production of electrical energy. The appropriate use of color in the design of buildings and the relationship between colors and energy production will be a central theme in the continuation of the research.

### REFERENCES

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