

- **Category** Works on farm constructions
- **Case Study** Double purpose greenhouse

**Client:** CeRSAA Albenga, Camera di Commercio di Savona  
**Project:** Engineer Silvia Napoletano  
**Constructors:** Errebi Serre snc, Albenga  
**Date:** 2008



Double purpose greenhouse with panels CIS (Copper Indium Selenium)

## ●●● Context

The work is located in the plan of Albenga. This area is the biggest plan of the region Liguria and was formed by the sediments of the torrents Arroscia, Neva, Pennavaira and Centa. The surface is about 45 km<sup>2</sup>.

This zone is identified as “strategic” by the Provincial Plan because of its prominent feature of “high specialization district” centered on crop production. The main cultivation are horticulture, floriculture and aromatic plants that characterized the landscape even with an high number of greenhouses.

## ●●● Description

The work consist of an installation of different solutions of semi-transparent photovoltaic panel on three greenhouses of the Centre (CeRSAA). The study aims at testing the sustainability and the effectiveness of a “double purpose” greenhouse which could produce more energy than the amount which is consumed without impairing productive capacity and use flexibility. The experience of CeRSAA also offer a study on the quantity and quality of lighting necessary to grow ornament, fruit and horticultural species. Results obtained show that no significant reduction of the productivity of plans grown is observed both from a quantitative and a qualitative point of view replacing 20% of the total surface originally covered by glasses with photovoltaic panels which can project thin shadow cones on the soil.

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The three type of photovoltaic system installed are:

**Case 1 – CIS panel – copper indium selenium**

Case2 – SILICIUM panel (*work in progress*)

Case3 – CIGS panel - copper indium gallium diselenide (*work in progress*)

### ●●● **Evaluation Case 1 – panel CIS**

The installation onof the elements able to obtain a complete architectural integration. In particular this system has been realized replacing the pre existing windows (60x150cm, thick 4mm) with a sandwich-solution made by two glass sheets with 20 stripes of photovoltaic the greenhouse allow the replacement cells (5x60cm distance 5cm from each other) between. This stripes has been laid down in alternate row screening about 20% of the roof surface. With this system the photovoltaic surface is 48,6 m<sup>2</sup> for a production of 4,1KWp.

From the start date (29th May 2008) to 29th June 2010, the system has produced 7466 KWh while the electric equipments of the greenhouse has consumed 422 (5,6% of production).

The whole complex of greenhouse of CeRSAA (about 9.100m<sup>2</sup> of indoor surface) has consumed, in the same period, about 16.600KWh, so the photovoltaic system fulfill about 40% of electirc requirement of the complex.

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Assembling phases



**Works data:**

- Wuerth Solar
- span width m 9,20
- greenhouse lenght m 24,00
- eaves heigh m 3,50
- tilt angle 30°
- orientation E-SE
- n. panels PH 108
- surface PH m<sup>2</sup> 48,6
- KWp 4,1
- start date 29/05/2008
- n.2 inverter Solar Star A2000 (IT)

The table below shows an estimate of *gross saleable production* (PLV – Produzione Lorda Vendibile) considering the electric production as addition to agrarian production and compares the data of photovoltaic greenhouse (serra FV) with another identical greenhouse except for the photovoltaics system (serra C).

**Stima del risultato produttivo agricolo (PLV,Produzione Lorda Vendibile) per produzioni in serre fotovoltaiche**

Ambiente di coltivazione	Coltura	Produttività (€/m <sup>2</sup> )*	KWh/anno	KWh/anno/m <sup>2</sup>	produttività totale (€/m <sup>2</sup> )**	incremento (%) produttività agricola
Serra FV	ciclamino	18	3.456,50	15,71	25,09	39,4
Serra FV	pomodoro	20	3.456,50	15,71	27,09	35,4
Serra FV	basilico	48	3.456,50	15,71	55,09	14,8
Ambiente di coltivazione	Coltura	Produttività (€/m <sup>2</sup> )*	KWh/anno	KWh/anno/m <sup>2</sup>	produttività totale (€/m <sup>2</sup> )**	incremento (%) produttività agricola
Serra C	ciclamino	18	-	-	18	0
Serra C	pomodoro	20	-	-	20	0
Serra C	basilico	48	-	-	48	0

\* Colla, 1995\*\* Superficie della serra: 220 m<sup>2</sup>; tariffa incentivante: 0,451 €/KWh

● ● ● **Potential for transferability**

- Frequent applicability
- Great impact for the landscape of agriculture both in Liguria and for the partners MED with the same productive characteristics.
- Importance for the conversion of a big number of greenhouses currently neglected, unproductive or uncompetitive
- Easy and complete architectural integration

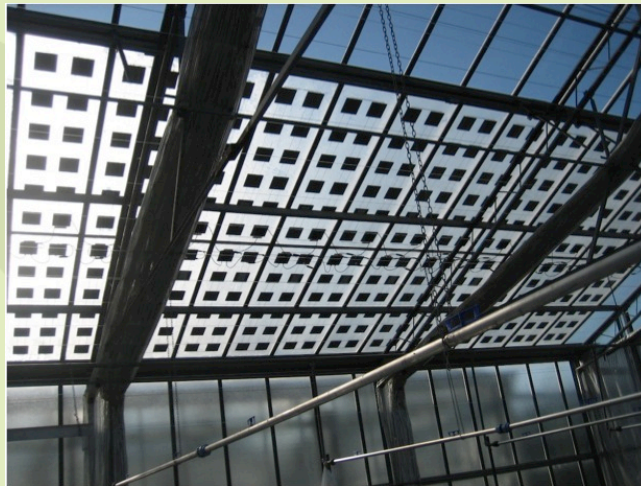
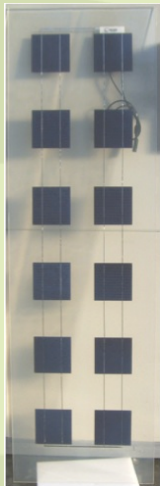
**References**

<http://www.cersaa.it/>

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●●● *Work in progress*

**Case 2 – SILICIUM panel**



**Case 3 – CGIS - copper indium gallium diselenide panel**

