



# Harvesting Crops & Energy in the Italian Sunshine

Solyndra's unique PV solution allows for dual land use by supporting existing agricultural practices while simultaneously generating electricity



Taking a drive through the beautiful villages of the Valpolicella wine region in Northern Italy, you may come across a small town with the name of Villa del Conte. Situated on the low coastal plane, between the historic cities of Padua, Venice and Verona, this market town is the home of Azienda Agricola Zanchin, a market gardener growing flowers and vegetables for the domestic market.

The owner, Corrado Zanchin, has been growing crops in this region for decades. Experience has taught him that he has to innovate to survive. Thinking about the future of his business and the opportunity to

generate solar power from his land, he asked Ettore Cognolato at STC Engineering Srl to design and build a greenhouse with an integrated photovoltaic system.

A crucial requirement of the PV greenhouse was that the design complied with the regulations governing the Italian government's incentives for PV installations. "The project was challenging," says Cognolato. "Obviously, to run an efficient PV system you want to position your panels so as to maximize the exposure to sunlight. However, the areas of shade created by conventional panels are detrimental to plant growth and this was

## OVERVIEW

### SOLUTION AT A GLANCE

- Eligible for the Italian greenhouse feed-in tariff
- 3,456 panels cover a tunnel greenhouse roof area of 7,700 square meters
- DC System Size = 598 kWp
- 889,137 kWh annual yield – enough to power 296 households
- 16 km of cables and 6 x 100 kW Socomec inverters
- Location: Villa del Conte, Italy

### THE SOLYNDRA ADVANTAGE

- Parallel, spaced, PV tubes provide even lighting and shading support agricultural practices
- Projection of long, narrow shadows on the ground, thus avoiding large areas of slow-moving shade which interfere with the healthy plant growth
- Full roof coverage with Solyndra panels maximizes energy output per roof and generates a uniform 40% shading that equals the one generated through traditional nets or whitewashing
- 27% less installed weight than conventional crystalline panels

### EPC

- STC Engineering srl

### FINANCED BY

- Banca Antonveneta Group MPS

“The unique Solyndra module design allowed us to have even lighting and shading, and maximize energy efficiency without affecting the growth of the plants that the structure was designed to house.”

Ettore Cognolato, STC Engineering Srl

unacceptable to my client whose business depends on the health of his plants. I was commissioned to find a solution to this problem – and the solution was Solyndra.”

Ettore Cognolato’s engineering firm took a standard off-the-shelf greenhouse design and integrated Solyndra’s solar modules in its 7,700m<sup>2</sup> surface.

“The unique Solyndra module design allowed us to have even lighting and shading, and maximize energy efficiency without affecting the growth of the plants that the structure was designed to house. The fact that the panels weigh 27 % less than the average crystalline panel was another important factor.”

### ROSEMARY PREFERS SOLYNDRA

Across the country on the idyllic Ligurian coast are the headquarters of Centro Regionale di Sperimentazione e Assistenza Agricola (CeRSAA), the research centre for agricultural experimentation of the Chamber of Commerce of Savona. CeRSAA’s director, Dr. Giovanni Minuto and his team have been testing solutions for agricultural PV installations. They have been looking into alternative energy sources as a means to provide extra income to the Italian growers and to reduce the energy costs associated with agricultural production, specifically when it takes place under sheltered structures such as greenhouses and shading structures.

“What is important to us is the long-term sustainability of the agricultural sector,” says Dr. Minuto. “Many of our producers have large plots of land and additionally large structures which in themselves would be ideally suited as housings for PV installations. However, installing conventional photovoltaics and still maintaining the necessary conditions for the growth of various plant types is very problematic.” Conventional flat panels create large areas of shading which inhibit growth. Finding a solution to this problem would enable growers to generate an income stream that was previously not available to them while simultaneously reducing their energy costs and carbon footprint, a win-win situation for the sector.



Solyndra greenhouse test-site installation, CeRSAA, Albenga, Italy

The light is the same source of energy necessary for both the PV installation and the plants. You require an integrated solution, which offers the dual function of

ensuring both crops and panels receive the maximum amount of sunlight. This isn’t easy. Dr Minuto continues, “Essentially with conventional panels these two requirements are in competition with one another, because the panels, positioned to receive maximum sunlight will shade the crops below.” Solyndra’s cylindrical design allows panels to be placed in virtually any orientation with minimal impact on energy generation. The orientation flexibility is a crucial aspect in the design of integrated PV.

CeRSAA advocates the Solyndra solution for three reasons:

- Solyndra panels project long, narrow shadows on the ground, thus avoiding large areas of slow-moving shade which interfere with the healthy growth of the plants underneath.
- The panel configuration allows the filtering of a sufficient quantity of light to meet the photosynthetic requirements of a large variety of plants.
- The spacing between the cylindrical tubes allows air and water circulation, meaning that the modules can be utilized on shading structures without compromising the crops below. This affords a degree of flexibility across agricultural installations that other panels cannot provide.



“The Solyndra solution, which supports plant growth and provides both shade and a distributed power source is the best idea I have seen for what could ultimately be the ideal application of solar power – dual purpose agricultural land use.”

Dr. Giovanni Minuto, Director of CeRSAA

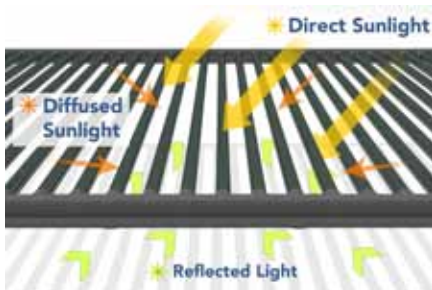
### A 360 DEGREE SOLUTION

The 598kWp installation at the Azienda Agricola Zanchin was designed and installed by STC Engineering and financed through Banca Antonveneta Group MPS. The patented Solyndra solar panels are manufactured using copper indium gallium diselenide (CIGS) thin-film technology. This allows for maximum, cost effective capture of sunlight across a 360 degree photovoltaic surface capable of converting direct, diffuse and reflected sunlight into electricity.

Collecting sunlight 360 degrees supports efficient collection of more light earlier and later in the day. This same feature also enabled Cognolato to mount modules on the entire roof surface of the greenhouse.

### 360° SUNLIGHT CAPTURE

~60% of light passes through to plants



The consistent power generation during the day allows for the use of a smaller inverter, which reduces costs and improves energy yield over time.

The Solyndra system offers two major advantages:

1. The diurnal cycle of the sun is optimally exploited.
2. Radiation reflected back from the surface of roofs is also converted into electrical power.

In agricultural applications, growers typically use a retractable white shade cloth during the hottest months of the year to fine tune the amount of direct sunlight that the plants receive for optimal plant

growth. A secondary benefit of this shade cloth is that it increases the power generated by the system due to the light reflected onto the underside of the PV tubes.

Dr. Minuto is convinced of the benefits to the agricultural sector: “our tests have shown no fundamental difference between the growth of crops below standard shading structures and those adapted to PV installation using Solyndra modules. This technology increases the ability of the nursery to remain competitive in the marketplace.”

While growers implement greenhouses to protect their plants and support their growth, Solyndra’s unique solar panels allow for dual use of land and reliably support existing agricultural practices whilst generating maximizing energy production per greenhouse-roof.

As the sun begins to set behind the cypress trees on the far end of Signor Zanchin’s property, we toast a glass of Prosecco to a future of the twin harvest of his beautiful flowers and the energy that makes their growth possible. Salute.

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