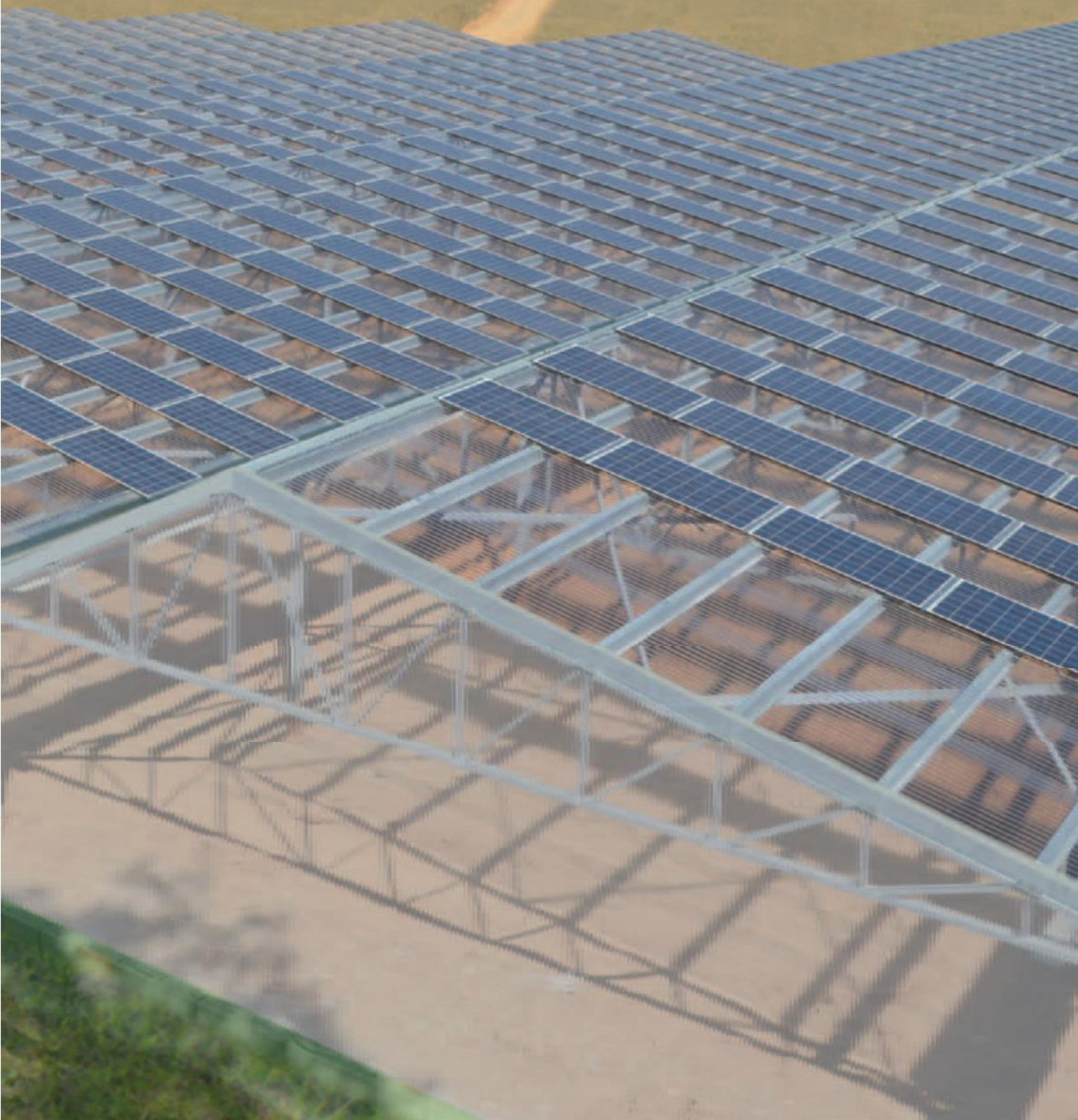


SunFarm[®]

photovoltaic greenhouse



The development of the photovoltaic field has pushed a big quantity of companies to research innovative solutions which stimulate the agrarian companies to invest in this field; a route has been opened with the realization of important photovoltaic generators on agricultural areas that have made discuss about the risks of subtraction of the areas destined to alimentary production; Another has been undertaken with the research of devices which allowed a perfect compatibility between the two productions, the electric and the fruit and vegetables .

Today we can say, with certainty and based on technical and productive evidence that this is possible; in the case of projects like SunFarm® result of an important investment in research and study, impressive results have been achieved in terms of improvement of the product.

The research made by Work System has brought to the realization of biocompatible greenhouses, where the alternate distribution of light and shadow has hallowed an improvement of the agricultural product in terms of quality and quantity. This is possible with the use of photovoltaic modules integrated in strip structures able , for their shape, to regulate the environmental temperature and of the module itself generating a surface that can distribute the luminous efficacy to the culture as a function of the agricultural project adopted.

So never as in this case the synergy between the important capital investments, the tenacity and the intelligence of who believed it is possible to generate energy and produce good fruits has been rewarded.



Energy gives good fruits

The project SunFarm® accords with the agricultural production and the energetic by photovoltaic in a symbiotic relationship.

The design criteria of SunFarm® are the integration of the design criteria SunFarm®, are the integration of photovoltaic modules in a greenhouse system and shade where the density of light (PAR) is adjusted to reflect the culture planned' and the shadow is never persistent.

The shading generated by the photovoltaic can vary by the 15% up to 50% of the surface used in function of the microclimate necessary to agricultural production envisaged.





Agriculture is the product of a fertile soil but at the same time fragile, in nutrients climate and biodiversity. SunFarm® preserves and improves this delicate balance of elements, improving productivity and quality at the same time enhancing and streamlining production.

The skilful integration of photovoltaic panels in strip and translucent sheets on a light and functional structure, allows to dose radiation and generate an alternation of light and temperature and an optimal thermal regulation for a diverse range of agricultural products.

With SunFarm® the company gains a secure and steady income that can support the budget making it competitive on market by providing new economic lifeblood to safeguard its historical roots.



servizio SunFarm® has been designed to accommodate every type of vehicle opera and technology services to support the maximum automation of the process, every culture can be automated and controlled at every stage from planting to harvest.

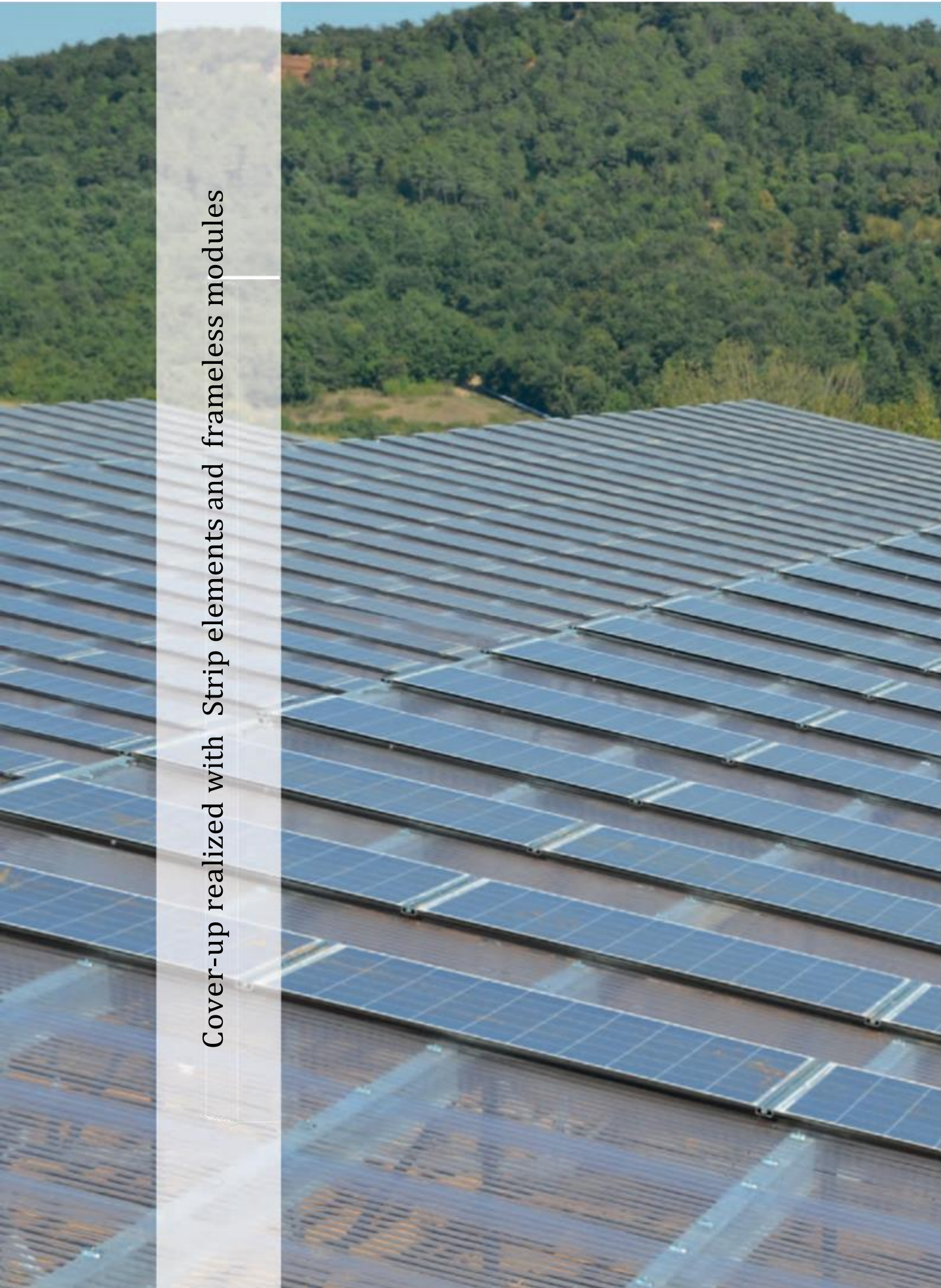
- enhancement of agricultural land with impeccable quality controls
- increase of the surface destined to the quality crops
- lowering of production costs for irrigation and chemical
- crop protection from atmospheric agents and major volatiles
- easy distribution of services of work
- maximum economic incentive
- incentives for agricultural
- reduction of maintenance costs of photovoltaic
- increase in electricity production

SunFarm® preserves the identity and nature of the land in the confrontation with the rules of agribusiness.

The basic criteria of SunFarm® are the integration of photovoltaic modules designed with a protective system and shading where the density of light , measured in PAR (Photosynthetic Active Radiation) is modulated in function of culture provided by the system Strip.



Cover-up realized with Strip elements and frameless modules





greenhouse SunFarm® for the production of basil in pot







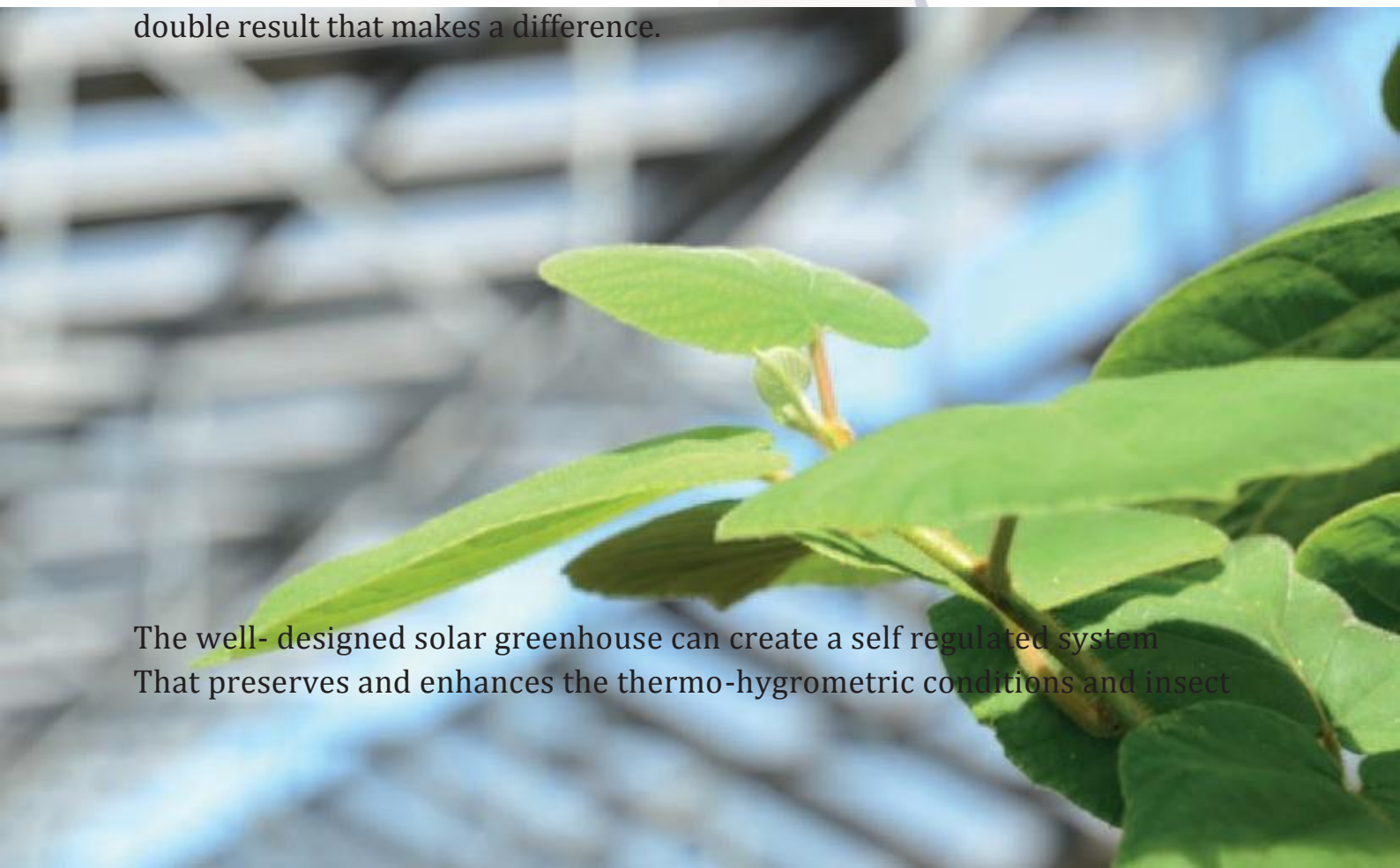
SunFarm® guarantees production of outstanding quality safety and competitiveness

The greenhouse is an artificial environment with delicate balances, the elements that contribute to the success of a project greenhouses are many: light , temperature, humidity, ventilation, irrigation, fertilizers.

The agricultural structure that you can develop with the agricultural facilities SunFarm® can be extremely varied and depending on environmental conditions, climate and the mix of crops choices.


The facility is capable of integrating, in addition to the photovoltaic generator, any form of automation in service of agricultural production, this allows you to achieve a productive and extraordinary quality of the product without having any effect on the cost of production because the greenhouse while protecting culture with a perfect and controlled microclimate it produces electricity that can depreciate the cost of the investment, creating an additional income; a double result that makes a difference.

The well- designed solar greenhouse can create a self regulated system That preserves and enhances the thermo-hygrometric conditions and insect



Life in the phases of pollination.

Land and agriculture are valuable assets, SunFarm® is an opportunity of agricultural development and employment.



Getting an income producing photovoltaic generator integrated into greenhouse structures is a great opportunity for the development of crops of excellence by improving the company's competitiveness.

Make the investment for the protective structure entirely by the photovoltaic system is an incredible opportunity to create "asset" fundamental to the modernization and development of the farm.

This is an opportunity when the solar greenhouse project is in perfect harmony With the cultures provided without competition between the two productive projects.

The SunFarm® fully meets this symbiotic need maintaining every prudential margin to protect the crop, leaving unchanged the power data of the photovoltaic generator.

In SunFarm® the arrangement of the modules allows for a perfect distribution of light to the plant ensuring a high degree of lux-PAR and a perfect balance of light and shadow can make significant improvements in the management of climate favoring the accretion process.

The use of crystalline polycarbonate with light transmission higher than the 90% with the block 100% of ultraviolet rays and the cut of infrared frequencies associated with an interlayer of light and shadow on the floor of the culture, are able to facilitate the management of the values and of environmental

parameters of temperature, humidity and ventilation.

'A perfect symbiosis'

The solar greenhouse SunFarm® has achieved the perfect symbiosis; photovoltaic modules are arranged in rows oriented south-north, and may adjust the amount of incoming light in the greenhouse.

You can change the lay-out always following the needs of the cultivated plants,

This type of greenhouses guarantees an amount of PAR always consistent and in relation with the production envisaged and offers a high degree of aeration as it is with ventilated ridge and branches placed at north.

The Photovoltaic on greenhouses is an opportunity that may involve risks when the cutting of the total radiation is carried out without the proper knowledge and without the possibility of change ,during its lifetime, the overall structure of the photovoltaic generator.

A good project for solar greenhouse provides an accurate calculation of the radiation conveyed to the plant and the photovoltaic modules; when the analysis is perfect you can count on a double revenue in absolute absence of competition, but with an overall improvement of performance due to the alternation of light and shade which is a manufacturing support if properly designed.

The structure pitch irregular with a long south and a short north improves and increases significantly the amount of available light and strings of photovoltaic modules Strip . They are so arranged so that the solar radiation reaches each point of the greenhouse, preventing any persistence of shade and giving the possibility to the plant to accumulate a quantity of photons active for the process of photosynthesis perfectly adequate and never in excess; this means perfect symbiosis and never competitive.

Application examples of SunFarm®

The essay that follows is the starting point of a systematic analysis of the performance of the work that SunFarm has launched with a campaign of measurements of structures made in Italy.

The analysis compares the instrumental data with those available in literature In terms of PAR and temperature.

The table takes in account 12 types and shows that they are under SunFarm® an ideal environment for growth.

This environment is obtained thanks to the modulation of the solar radiation resulting in the correct relationship between the transparent surface ,which has a transparent surface, which has a desirable transmittance value , and modulation of the radiation due to the skillful arrangement of panels shading.

Thermal range and parameters DLI for the development of some crops

Thermal range and parameters for the development of some crops

Specie in DLI of good quality	Temp. minimum biological (°)	Temp. optimal night (°)	Temp. optimal day (°)	Temp. max biological (°)	Temp. optimal substrate (°)	U.R. (%)	Intensity brightness necessary (Lux)		PAR necessary $\mu\text{mol m}^{-2}\text{s}^{-1}$		PAR SunFarm® ore 13:00 15 sett Toscana 34%-66% FullSun 2) medio min max			DLI SunFarm® FullSun 3) luglio - novembre		DLI SunFarm® luglio-novembre rettificati eliofania Toscana 4)	
							min	max	min	max	min	max	min	max	min	max	
tomatoe 10 -18	8-10	13-16	26-30	30-35	15-20	55-60	10.000	40.000	190	760	781	307	1.025	21,44	13,76	20	12
cucumber 10 - 18	10-13	18-20	24-28	28-32	20-21	70-90	15.000	40.000	285	760	781	307	1.025	21,44	13,76	20	12
strawber ry	6	10-13	18-22	25-30	12-15	60-70	20.000	40.000	380	760	781	307	1.025	21,44	13,76	20	12
pumpkin 18 - 26	10-12	15-18	24-30	30-34	15-20	-	40.000	60.000	760	1.140	781	307	1.025	21,44	13,76	20	12
Green beans 12 - 18	10-14	16-18	21-28	28-35	15-20	-	30.000	40.000	570	760	781	307	1.025	21,44	13,76	20	12
pepper 12-18	10-12	16-18	22-28	28-32	15-20	65-70	30.000	40.000	570	760	781	307	1.025	21,44	13,76	20	12
eggplant 18-26	9-10	15-18	22-26	30-32	15-20	65-70	40.000	60.000	760	1.140	781	307	1.025	21,44	13,76	20	12
lettuce 11 -15	4-6	10-12	15-18	25-30	10-12	60-80	12.000	30.000	228	570	781	307	1.025	21,44	13,76	20	12
Basil 10 - 18	2-3	15	20-25	30	10-12	60-80	20.000	40.000	380	760	781	307	1.025	21,44	13,76	20	12
cyclamen 10-18	-	14-16	14-16	-	13	60-80	20.000	40.000	380	760	781	307	1.025	21,44	13,76	20	12
Vervein 12-18	-	20-21	18-19	-	18	40-70	30.000	40.000	570	760	781	307	1.025	21,44	13,76	20	12
Begonia 12-18	-	16-18	18-19	-	18	40-70	30.000	40.000	570	760	781	307	1.025	21,44	13,76	20	12

- 1 PAR Photosynthesis Active Radiation is the instantaneous measurement of the part of photonic flow used by the vegetation in micromoles (μmol) per square meter for second namely: $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$
2. Values for sunny day in par , with shaded cover to 34% - criterion shadow cabinet
3. DLI Daily Light Integral is measured in $\text{mol}\cdot\text{m}^{-2}\cdot\text{d}^{-1}$ - light (mol) per square meter (m^{-2}) per day (d^{-1})
4. Sunshine duration data of the Air Force - CNMCA (1956-1985)

5. Mole of photons means a number equal to the Avogadro: $6.02214129 \times 10^{23}$ photons \cdot moles⁻¹

Some features of SunFarm®

The module SunFarm® is constituted by a structure reiterable truss pitched irregular elongated to the south: is made of steel profiles (UNI7070-Fe430/S275) hot-dip galvanized.

The foundation systems may be in piles or in plinths in reinforced concrete with anchor plates secure with elastomeric liquid membrane ; purlins , eaves, the ridge are of profiled steel sheet and galvanized.

The ventilation of the structure is ensure by a large window placed in the North and the ventilated ridge CVBD™ finely adjustable.

The horizontal and lateral cladding are made of high quality , polycarbonate capable of transmitting sunlight profit up to 90% with an effective reduction of dripping condensation and energy savings up to 50% compared to the other materials.

The polycarbonate adopted blocks the UV radiation , 100% harmful for plants and people and support a decay over the year due to radiation not perceptible to the naked eye.

The SunFarm® can be equipped with many accessories such as:

- Sliding doors and panic
- washing system of the panels with rainwater recovery
- cooling system of photovoltaic modules with heatsink
- microclimate control and all known parameters
- control of production data and forward electricity in remote
- automation of ventilation systems and cooling and heating

Possible configurations:

calculation on Latina's ground - solar radiation kWh/m² 1600

Surface ground	1.000 mq	1.000 mq	1.000 mq	1.000 mq
Nominal power	32,9 kWp	49,3 kWp	51,3 kWp	66,3 kWp
Type of module	Crystalline silicon 235Wp	Crystalline silicon 235Wp	Thin film 135Wp	Crystalline silicon 235Wp thin film 135Wp
Degree of shade and distribution of modules	23% pvm5Sx2 ₁	34% pvm5Sx3 ₁	50% pvm5x3S+3x3N ₁	50% pvm5x3S+3x3N ₁
kWh produced for year	32.200	48.200	58.000	70.300
Culture provided	Vegetables fruit experimentation	Vegetables plants in pot	Cuttet flowers fruits spread	Cuttet flowers fruit spread
surface for MW	30.400 mq with 422 modules BD72	20.300 mq with 282 modules BD72	19.500 mq with 270 modules BD72	15.200 mq with 210 modules BD72
DLI	18 - 28	12 - 19	9 - 14	9 - 14

1. 5Sx3 - sono 5 pannelli fotovoltaici posti sulla falda a Sud per Strip, lungo tre linee
2. 3x3N - sono 3 pannelli fotovoltaici posti sulla falda a Nord per Strip, lungo tre linee



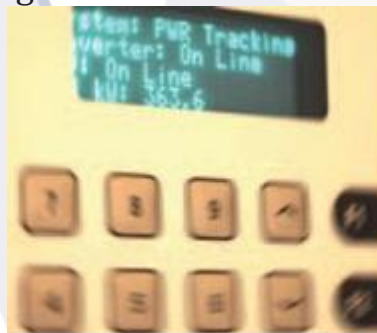
The areas of application of the prevailing agricultural photovoltaic structures SunFarm®

- potted plants
- nursery and spread
- cut
- vegetables
- experimentation
- production
- creating workspaces

SunFarm® awareness of safety in total control

Our system allow control of the nutrient solution , drainage and sterilization, handling network and photoperiod with the Strip, obscuration and irrigation. We inspect the washing system of the photovoltaic modules and cooling; we command in security doors and windows .

In electricity generation we are able to provide any data of production and control of the state of the plants ; we manage alarms by sending reports in local and remote ;we provide the information necessary for the maintenance and the statistical processing ones .



Many investors have seen in renewable energy a chance to make money from capital rates of return of more than 20% compound; their attention is primarily focused on ground systems, in agricultural areas and multi Mega-Watts with the highest rate of return possible characterized by incidences, maintenance and employment close to zero .

The static and the lack of maintenance relate to the high contribution margin have attracted the attention of financial investors, however, and despite everything , have contributed to the launch of the industry.

The same type of consideration cannot be made for the greenhouse investments or agricultural photovoltaic structure which are certainly not low-cost, high maintenance requirements and have a strong commitment to employment and their nature require a major attachment to the land and to the product, giving strength to the farmer in times of difficulty or severe uncertainty .

The legislature repeatedly called and made aware of the contingent market is arranging with incentive tools designed to support these forms of investment.

In the light of this new course the solar greenhouse can become the starting point of the redemption of the entire agricultural sector; the photovoltaic generator can become the driving force propelling the agricultural enterprise , the defensive bulwark against the aggressions of foreign markets; a healthy vitamin can generate economic security in a consistent manner and in contrast to the agricultural compulsive model we have observed for too long.





WORK SYSTEM s.r.l.