



# AgriPV Systems

short pay-back even without subsidies!

CERTIFIED DOUBLE GLASS MODULES ACCORDING TO EN12600 FOR OVERHEAD MOUNTING



**MADE IN EUROPE**  
Slovakia and Germany

Design in cooperation with:  
**ZIMMERMANN**  
PV-AGRI

**GRID PARITY**  
next generation photovoltaic

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2nd edition

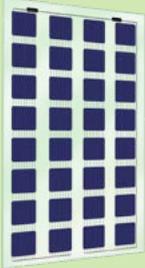
# Double glass modules

CERTIFIED DOUBLE GLASS MODULES ACCORDING TO EN12600 FOR OVERHEAD MOUNTING

All Bifacial Modules (extra yield from the back)...

## ...for AgriPV greenhouses

47%  
Transparency

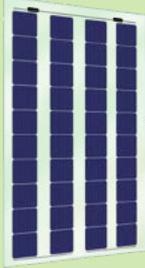


**AG-B32**

GLASS-GLASS

size I

40%  
Transparency



**AG-B40**

GLASS-GLASS

size I

40%  
Transparency

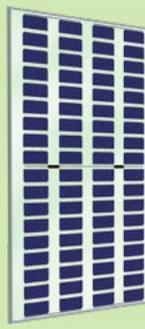


**AG-B48**

GLASS-GLASS

size II

50%  
Transparency



**AG-B72**

GLASS-GLASS FRAME

size II

## ...for PV fences

12%  
Transparency



**AG-B60**

GLASS-GLASS

size I

12%  
Transparency

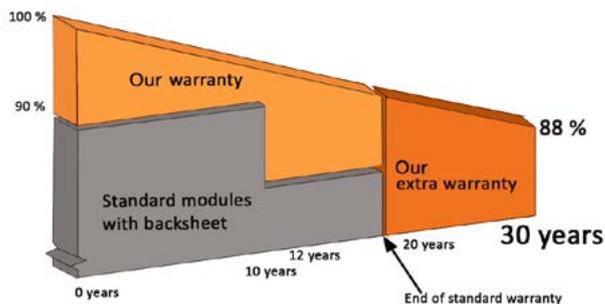
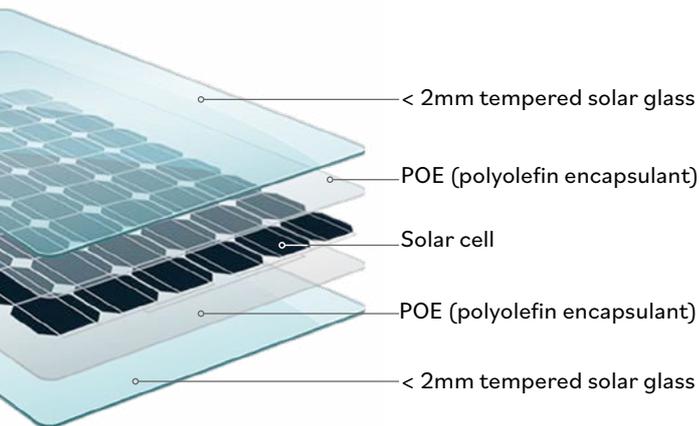


**AG-B72**

GLASS-GLASS

size II

2 mm tempered solar glass with extremely durable anti-reflective coating



## Outstanding features of our modules

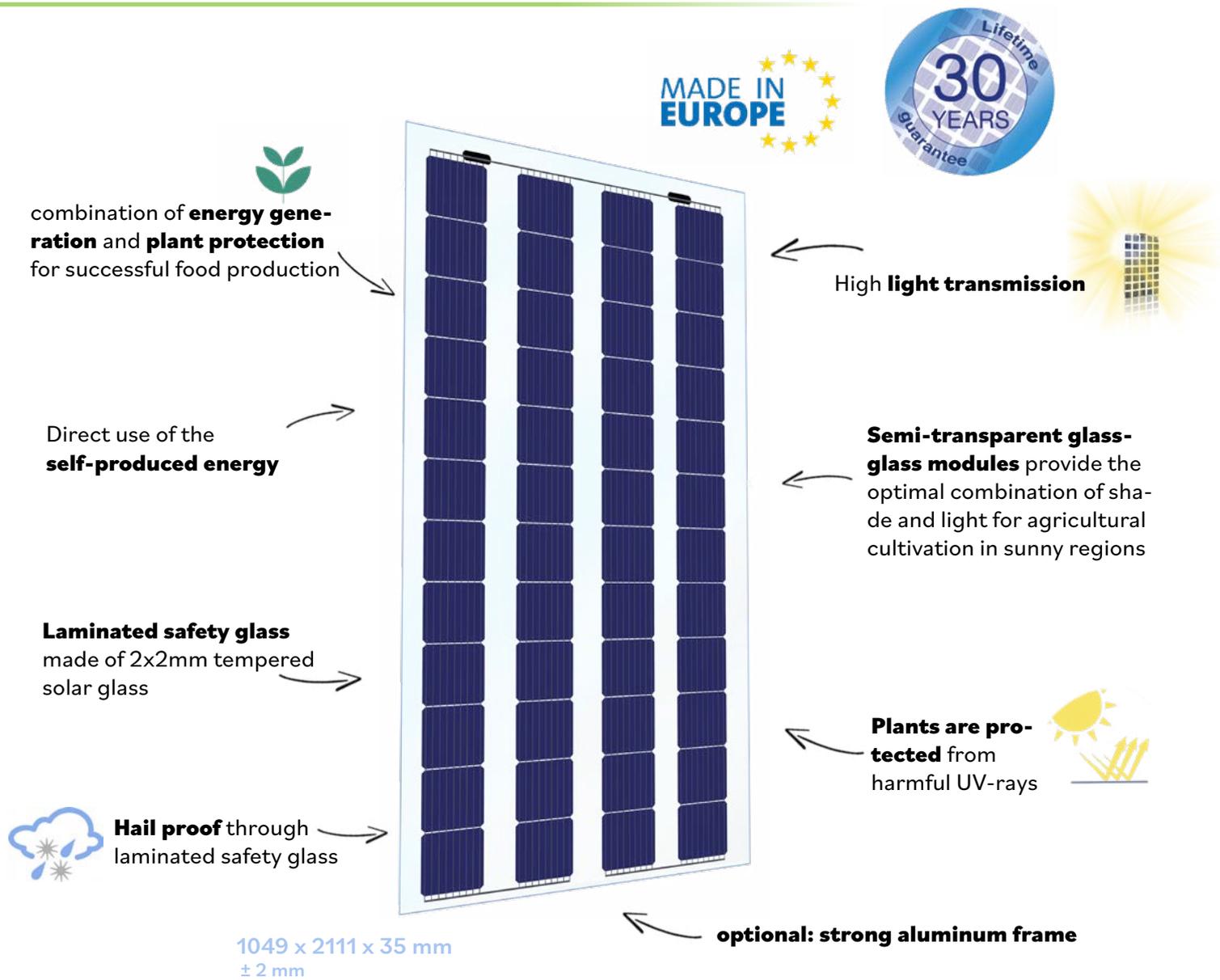
- Slim Module Design - Ultra Thin - Ultralight
- Highly transparent double glass design
- Excellent wind/snow resilience performance
- Resistant to environmental influences
- Easy cleaning
- Highest resistance to microcracks
- Fire resistance
- Excellent low light performance
- Extended warranty
- Positive power tolerance (plus sorting)
- PID free



Test report  
EN12600



# Our Premium Greenhouse Module



Construction in cooperation with:



# Case study: Generation of solar energy for water pumps

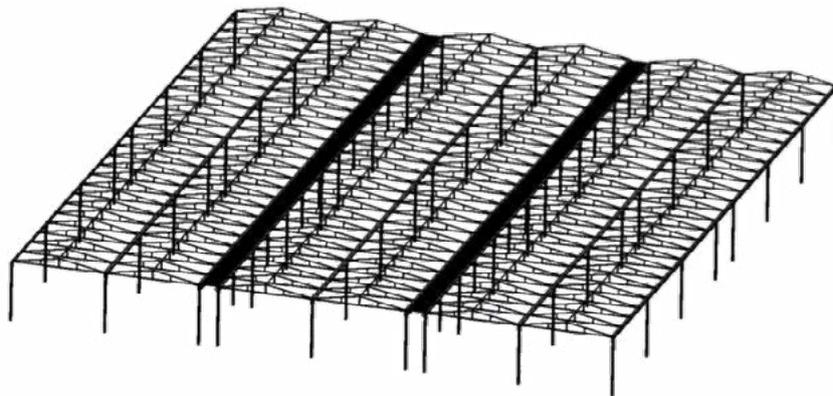
## Heliopolis University (2014)

- 15 kWp with 84 Almaden Premium Glass- Glass Modules M40
- 40% Transparency provides optimal light transmission for plant growth
- 3-4 harvests a year
- Direct use of electricity for water pumping and desalination



## Wahat Desert, Egypt (2014)

- 53 kWp with Almaden Premium Glass- Glass Modules M40
- 40% Transparency provides optimal light transmission for plant growth
- 3-4 harvests a year
- Energy generation is sufficient for running 2 Lorentz pumps with 15 HP and 25 HP
- The water which is moved from great depth (pump 1) is directly pumped into the desalination system (pump 2)



## Resistant modules against any climate!



### Cold temperature with snow:

Low temperatures are prevailing in countries of the northern hemisphere but also during the night in desert areas. All materials have to withstand temperatures below 30°Cel. as well as fast changes to high temperatures up to 85°Cel..



### Salt water:

Salt and also air-borne chemicals are very aggressive and a threat to the modules materials. Glass is the first choice to withstand these threats.



### Desert climate:

Desert areas include very high temperatures of up to 85°Cel. in the inside of the module. Temperatures change in fast cycle. In many cases the material doesn't withstand these changes over their lifespan of 30 - 50 years. As a result, Almaden's modules loose very little power compared to other cells.



### Hot and humide climate:

Is a special threat to modules. A chemical reaction with most foils like EVA takes place and as a result citric acid builds up. Consequently, the temperature rises and the acid boils, which destroys the modules over months and years. Almaden established a unique technique in order to oppose these threats and protect the cells.

# Unique technical features

- AgriPV offers a unique solution: a combination of energy generation and plant protection for successful food production
- The plants and fruits are protected from harmful UV-rays
- Direct use of the self-produced energy for water pumps, water desalination as well as cooling systems or systems for the production process. Alternatively the input can be fed into the home- or local network
- Protection from evaporation reduces the need for water up to 80%
- AgriPV increases the yield depending on the plants
- Semi-transparent glass- glass modules provide the optimal combination of shade and light for successful agricultural cultivation in hot regions
- Another way of using our greenhouse construction is to cover aquaculture ponds



**AgriPV is an innovative solution to solve one of the biggest problems of mankind: hunger and a lack of energy**



AgriPV combines the production of food (agricultural and horticultural use) with the generation of electricity by photovoltaic on the same area.

GridParity has been involved in this economically interesting field for many years. After all, the same area usually generates far more than double the benefit.

The myth that agricultural yields are declining has already been refuted in several projects.

# Practical example: AgriPV system in fruit-growing in Kressbronn, Germany

## Unique advantages in fruit growing

Commercial fruit growing is facing major challenges as a result of climate change. In order to avoid negative effects on harvests, new strategies must be developed against rising temperatures and increasingly frequent extreme weather events such as hail and heavy rain. Today, commercial fruit growers are increasingly using films and hail

protection nets to prevent quality and yield losses. PV technology, which has been developing dynamically in recent years in the form of semi-transparent highly elevated modules, can make a major contribution to preventing such climate damage. Such AgriPV installations also help to reduce evaporation and the use of sprays.



*AgriPV system in fruit growing*



*Classic hail protection with nets*

The goal for a fruit production in the AgriPV system is a safe and high quality pome fruit production with additional electricity production. The generated electrical energy should be used in the upstream and downstream areas of fruit production, for example by using electrified agricultural

machinery, operating irrigation systems or when storing the harvest in the electrically operated cold store. By generating electricity at the same time, such systems can also be amortized relatively quickly.



# Solar power over orchards - double harvest

Growing vegetables or fruit and generating solar power on the same area at the same time - that is the wish of many farmers worldwide. And so it comes as no surprise that many pilot projects are now in the pipeline. Solar power instead of hail nets above the apple or-

chard - in Kressbronn on Lake Constance, Germany's first agri-photovoltaic system went into operation above an existing fruit crop. This benefits the apples, the environment, the soil and the climate.



The Agri-PV pilot plant above the apple orchard of Obsthof Bernhard consists of a metal framework with solar modules mounted on it. These are particularly stable Almaden double glass modules with a transparency of approx. 40%. Due to the special installation, the trees receive sufficient light despite the partial shading. The generated green electricity is fed into the grid of the energy provider Regionalwerk Bodensee. Kressbronn is



the easternmost municipality in Baden-Württemberg on the northern shore of Lake Constance and is located on the border with Bavaria. „Agri-photovoltaics offers a huge opportunity for agriculture, sustainability and energy supply,“ said Minister President Kretschmann, who came to the inauguration of the plant. „The project aims to find out, for example, how agri-PV systems in specialty crops help during weather events such as hail, heavy rain or night frosts, or how crop yields develop.“ The system is also expected to reduce the use of pesticides, plant diseases and pest infestations.

## Examples of BerryPV



# Technical structure soft fruit cultivation and garden products (onions, celery, etc.)

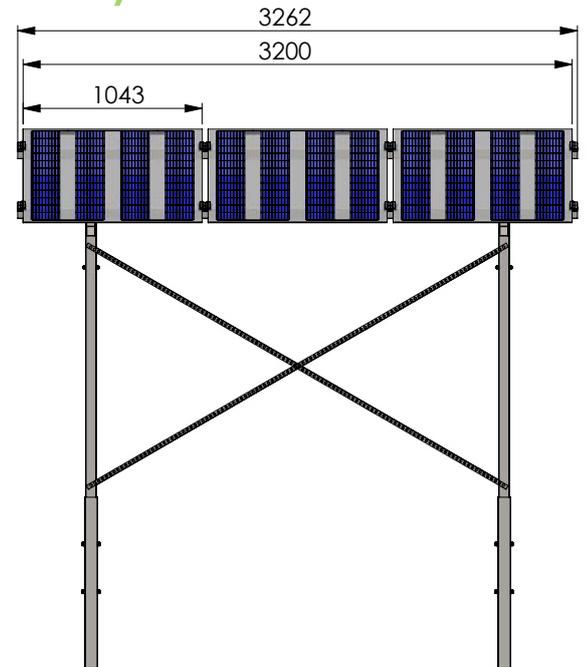
**Height support: variable from approx. 2.20 to 2.6m**  
**Height center: support + approx. 30cm**



**Turnkey solution**  
 incl. frame according to static calculation, modules, inverter, cabling and assembly



## BerryPV



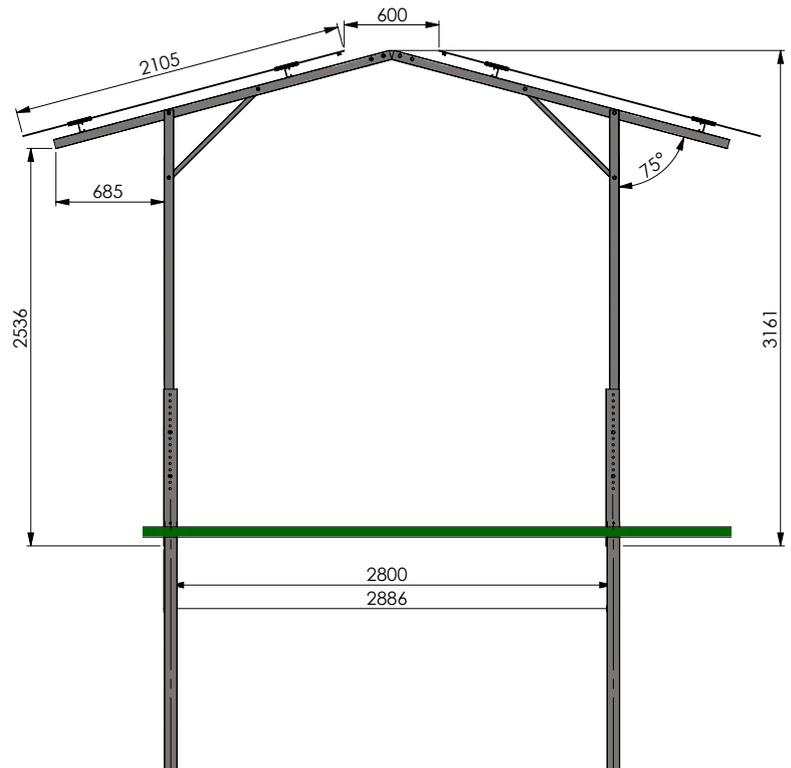
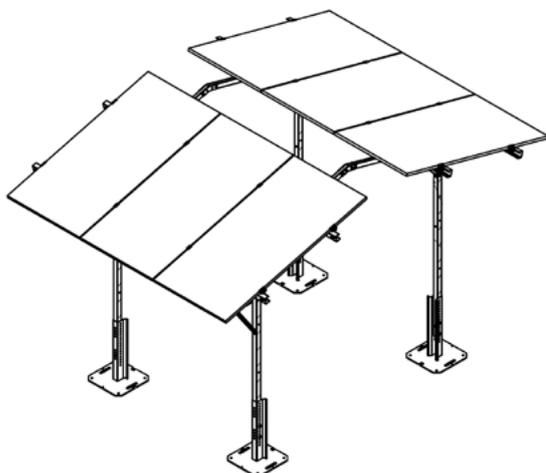
**Large plants up to 10 MWp and more**

Strong steel profiles are rammed into the ground. Depth according to the static calculation



**Height adjustable according to plant size**

## small garden unit with base plates



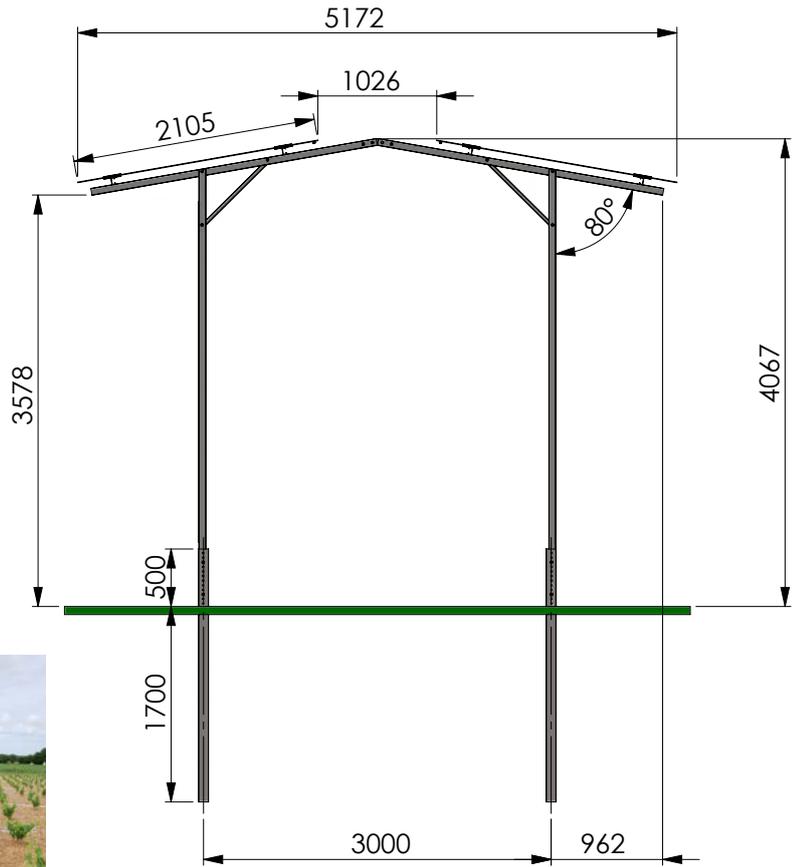
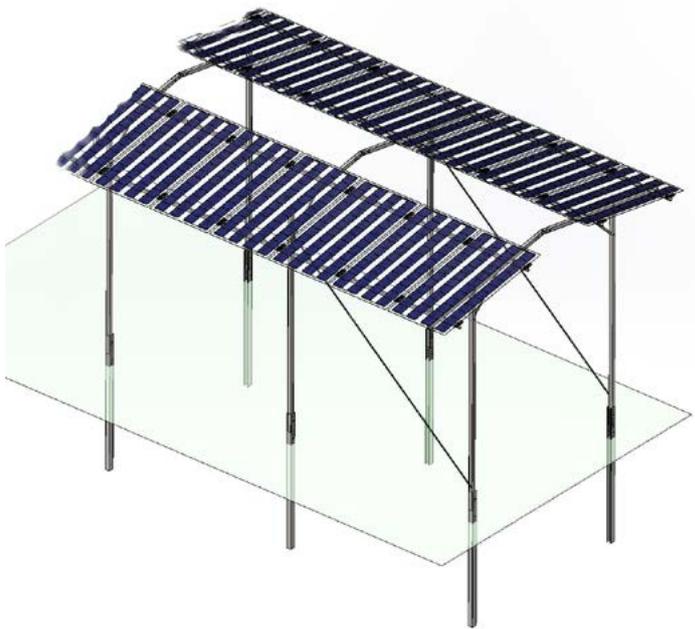
# AgriPV for orchards technical structure

**Höhe Stütze: variabel von ca. 3,30 bis 4m**  
**Höhe Mitte: Stütze + ca. 30cm**



**Turnkey solution**  
 incl. frame according to static calculation, modules, inverter, cabling and assembly

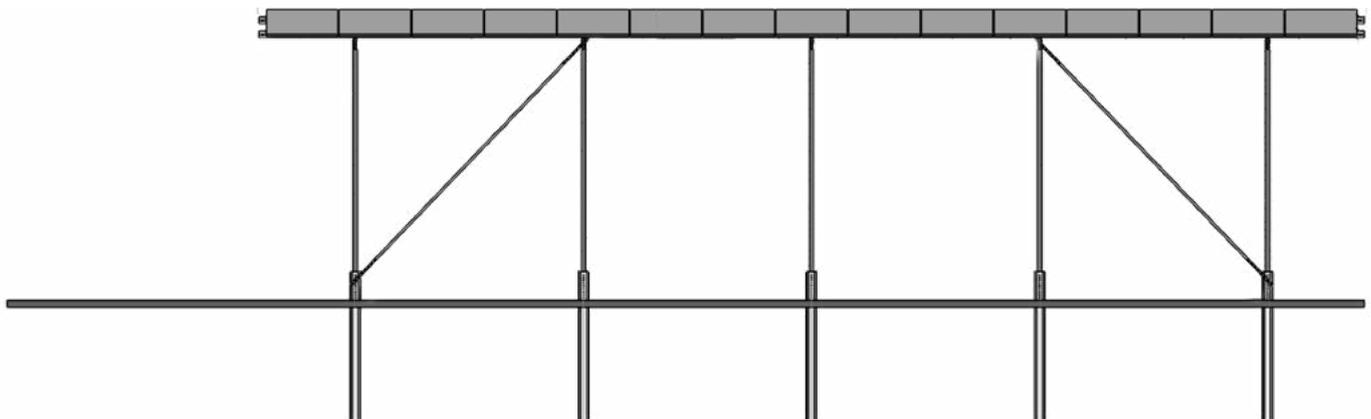
## PomePV



Strong steel profiles are rammed into the ground. Depth according to the static calculation

**Height adjustable according to plant size**

### Large plants up to 10 MWp and more



# AgriPV for the future of fruit growing



In the first construction phase, over 1100 Almaden M50 double glass modules with 40% transparency were installed. In further construction phases, more powerful modules or modules with higher transpa-

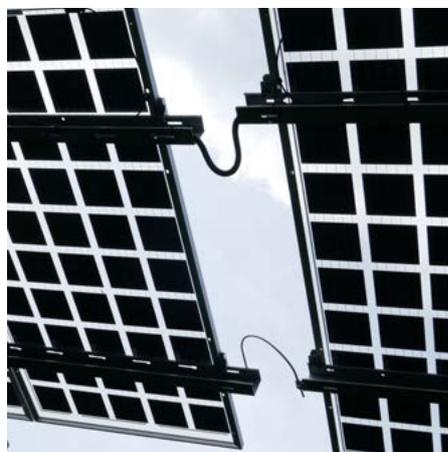
rency are to be used. An even denser module arrangement with 2 modules on each side is also to be investigated. In this case, the rainwater is to be collected and used for direct plant irrigation.



easy fixation of tension wires.



Integration of irrigation hoses

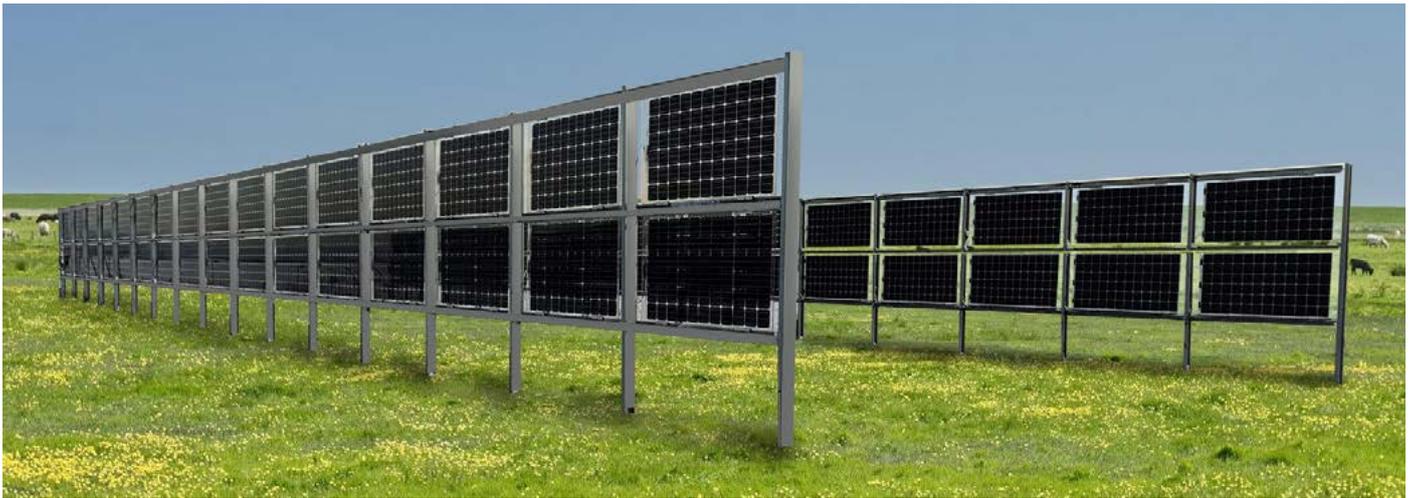


Simple electrical connection of the module tables



Safe mounting of inverters

# AgriPV fence system



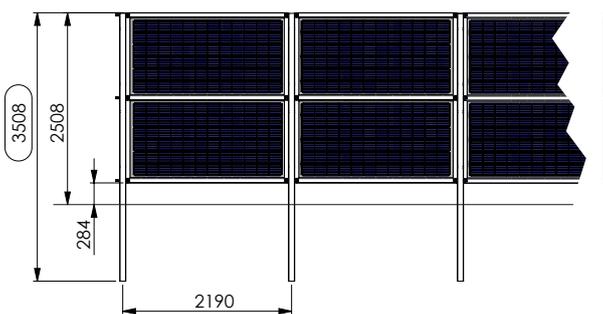
## Innovative vertical installation system

The steel profiles are driven into the ground to ensure stability. The system includes only three parts and is therefore quick and at the same time stable to assemble. Available as single and double row system. AGORA premium double-glazed bifacial PV modules are used for best yield.

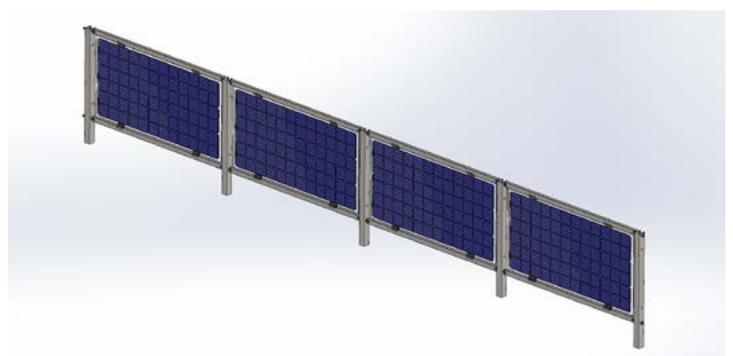
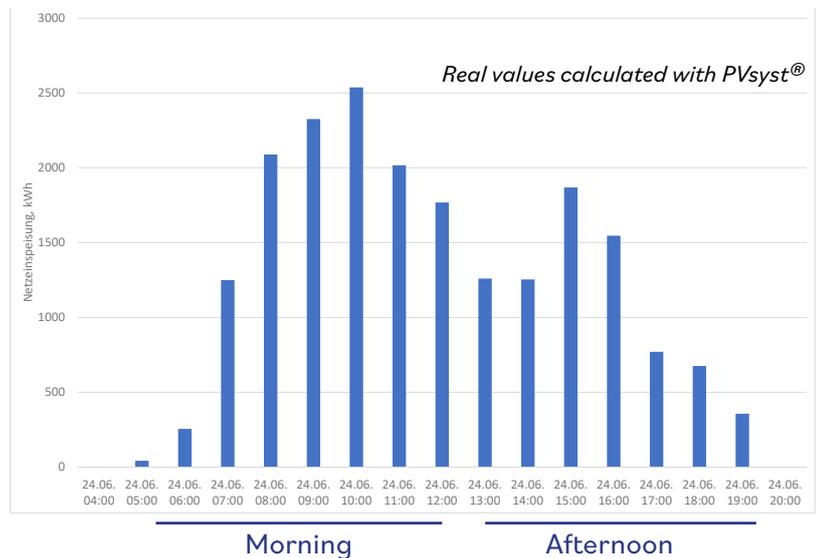
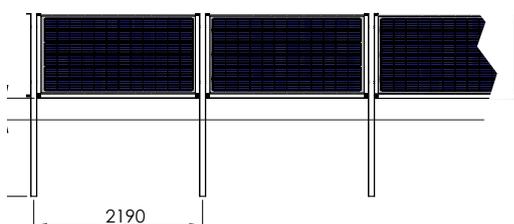
## Our AgriPV fencing system enables practically double yields:

Both the yield from agricultural use, as well as a significant electricity yield. The bifacial modules used have an output of up to 450 Wp on the front side. Since we use special cells, the power on the back is only slightly lower. This is important for a vertical installation, as the sun shines on both sides in succession during the day. The yield curve is also different from a „normal“ installation and has two distinct peaks (see graph below). Short pay-back time even without subsidies!

### double row system



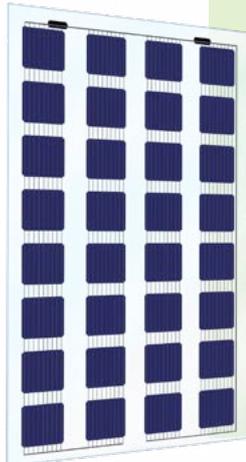
### single row system



# Transparent & powerful modules

CERTIFIED DOUBLE GLASS MODULES ACCORDING TO EN12600 FOR OVERHEAD MOUNTING

for fruit & vegetable growing:



**AG-B32 - 200 Wp**

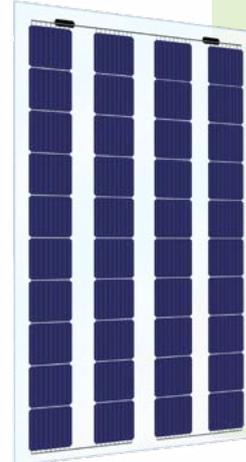


**47% Transparency**

GLASS-GLASS BIFACIAL



CERTIFIED TO IEC61215 / IEC61730



**AG-B40 - 250 Wp**



**40% Transparency**

GLASS-GLASS BIFACIAL



CERTIFIED TO IEC61215 / IEC61730



**AG-B48 - 300 Wp**

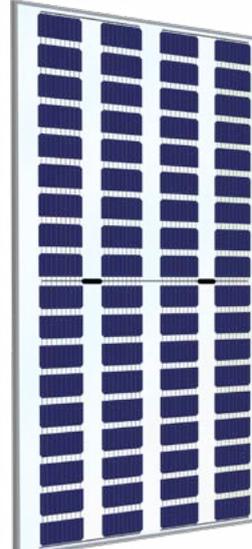


**40% Transparency**

GLASS-GLASS BIFACIAL



CERTIFIED TO IEC61215 / IEC61730



**AG-B72 - 230 Wp**



**50% Transparency**

GLASS-GLASS BIFACIAL  
with frame



CERTIFIED TO IEC61215 / IEC61730

for PV fence:



**AG-B60 - 370 Wp**

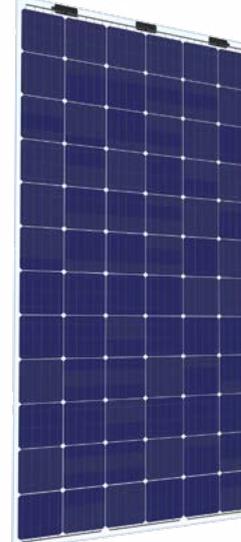


**12% Transparency**

GLASS-GLASS BIFACIAL



CERTIFIED TO IEC61215 / IEC61730



**AG-B72 - 445 Wp**



**12% Transparency**

GLASS-GLASS BIFACIAL



CERTIFIED TO IEC61215 / IEC61730