



ENERGY FROM NATURE IS ENERGY FOR THE FUTURE

Trimo EcoSolutions



**Trimo EcoSolar PV**

Photovoltaic systems

# Advantages of Solar Energy

## ELECTRICITY GENERATION THROUGH ENVIRONMENTALLY FRIENDLY MEANS CAN BE ACHIEVED USING PHOTOVOLTAICS (PV).

The abundance of solar energy by far surpasses our global energy. PV technology uses Silicon cells to transform sunlight into electricity. Every kWh of solar generated electricity can **save our environment over 500 g of Co<sub>2</sub>**.

With the need to control climate change, we need to reconsider our energy sources in order to reduce greenhouse gas emissions precipitated by the burning of fossil fuels. With this in mind, we must look to **green energy to play an increasingly significant role** in accomplishing our energy producing goals.

**PV power plants can be a very competitive source of energy.** In many countries across the globe, governments are subsidising green power generation using incentives. **Feed-in tariffs\*** are government incentives for the solar generated electricity fed back into the grid which enables you to greatly increase your return on investment. With the lifespan of a PV power plant substantially longer than your return on investment, investors can generate higher profits.

\* Feed-in tariffs vary across countries

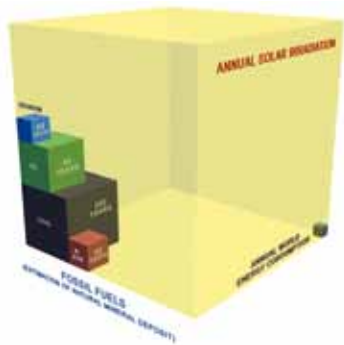


FIG. 1: TRIMO PV POWER PLANT WITH THIN-FILM AMORPHOUS-SILICON PV MODULES

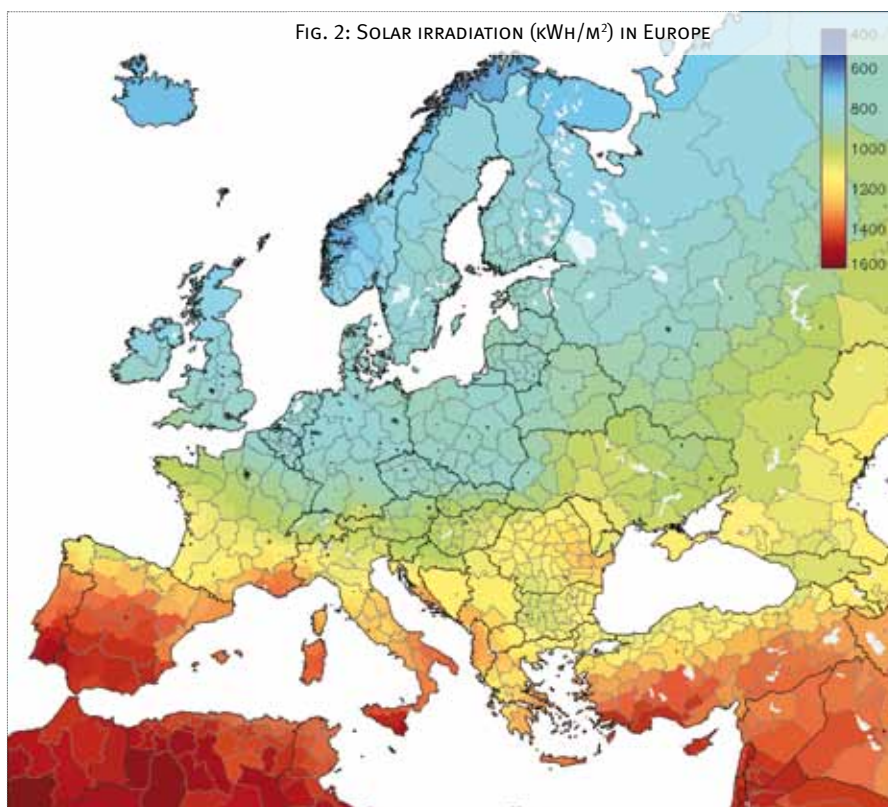


# Conceptualisation of your PV power plant

## OPTIMAL DESIGN IS KEY FOR GREAT PERFORMANCE

The main function of every rooftop, apart from thermal insulation, is to retain its watertightness and airtightness. Although there are several types of rooftop, not every PV application is appropriate **as each PV system must be carefully selected and designed in order not to spoil the functionality and / or the aesthetics of the roof.** In addition, when installing PV modules static analyses, roof penetrations, wind loadings and efficiency calculations must be taken into consideration in order to select the most appropriate application and type of PV technology.

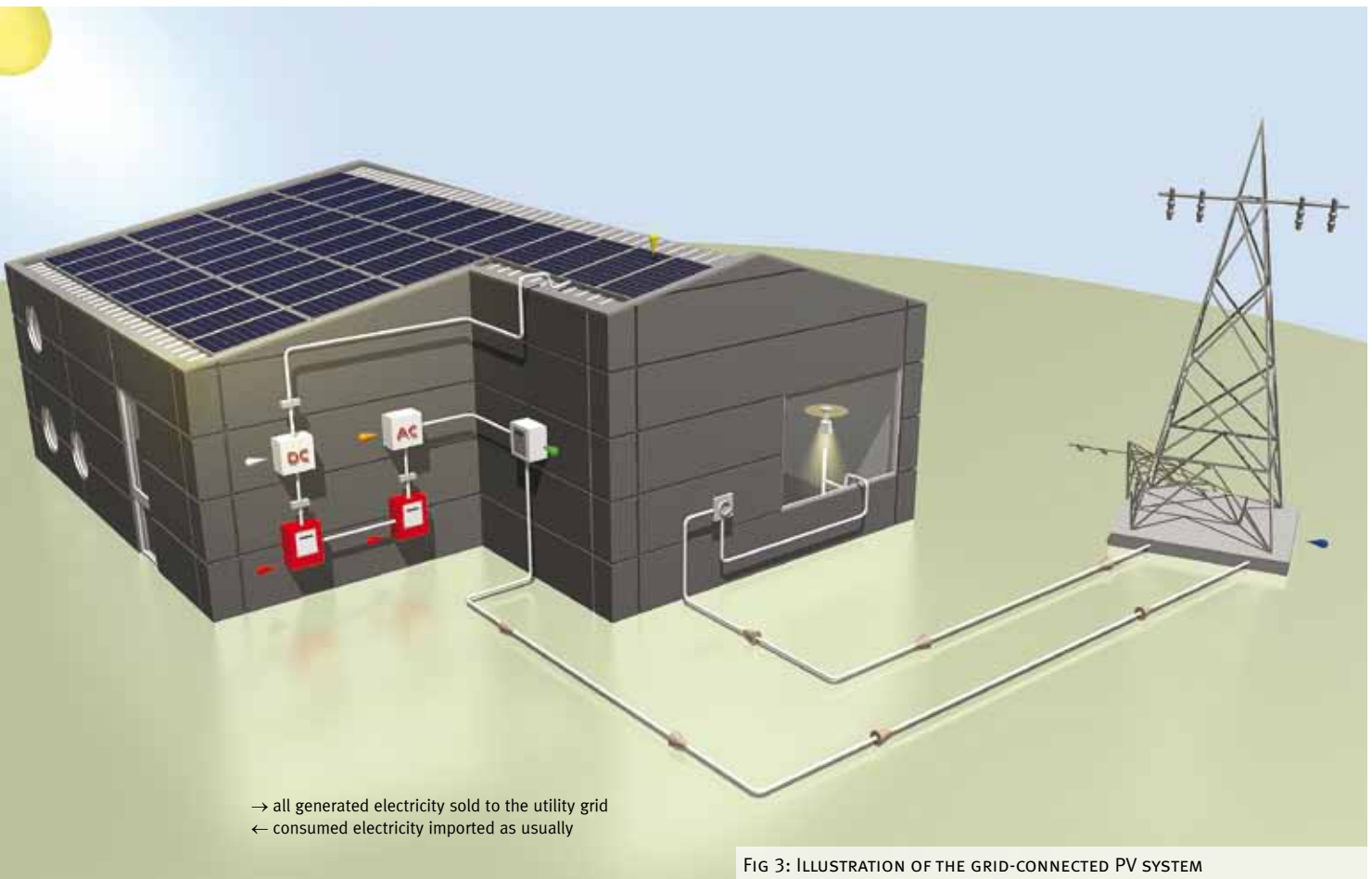
The energy yield of PV modules depends on: type of module, conceptualisation of your building such as orientation of the roof, inclination angle as well as any possible shading effect caused by potential natural or artificial obstacles on the roof. Latitude or location of your solar power plant also plays an important role in the amount of **energy yield and consequently your return on investment.**



Source: PV - GIS (c) EC JRC 2002-2004

# Utilizing sunlight to generate electricity

**INTERCONNECTING PHOTOVOLTAIC CELLS FORM A PHOTOVOLTAIC MODULE. LINKING TOGETHER PHOTOVOLTAIC MODULES INTO STRINGS FORMS A SOLAR POWER PLANT, WHICH HAS THE POSSIBILITY OF BEING CONNECTED IN TO THE UTILITY GRID.**



- PV GENERATOR**
- INVERTERS** convert direct voltage (DC) into alternating voltage (AC) and thereby synchronize functioning of the PV power plant with the utility grid.
- DC FUSE** provides a built-in overvoltage protection to disconnect the photovoltaic modules from the inverters in case of overvoltage.
- AC FUSE** provides disconnection between the electric meter and inverters.
- ELECTRICITY METER** indicates the amount of generated electricity.
- UTILITY GRID**

Remote monitoring and display is provided by professional dataloggers which form the communication centre of your solar power station. The dataloggers collect all data regarding the inverter including energy yield, PV module temperature and solar irradiation. Thus you can always be informed on the current status and safety of your system.

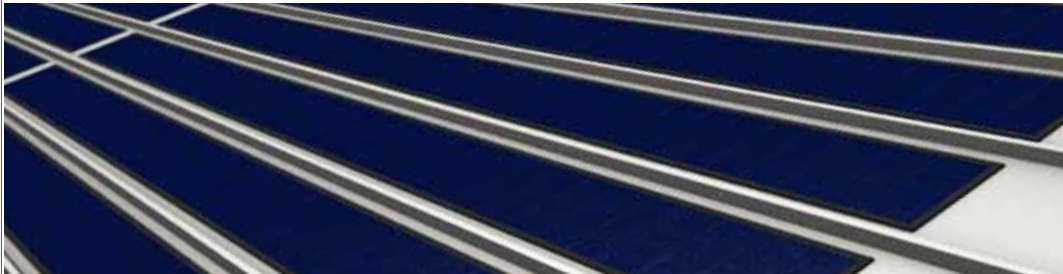


#### **OFF-GRID PHOTOVOLTAICS:**

Off-grid PV systems are most often custom-made according to the specifications of an individual purchaser. They are usually applied in remote areas with no or unreliable grid power supply. Please consult Trimo technical department for preliminary design.

# Trimo EcoSolar PV applications overview

TRIMO PROVIDES A WIDE RANGE OF TECHNICAL SOLUTIONS ABOUT AS WHAT KIND OF PV MODULES CAN BE COMBINED WITH DIFFERENT ROOF TYPES. SEE SOME TYPICAL APPLICATIONS IN THE TABLE AND CONSULT TRIMO TECHNICAL SUPPORT FOR NON-STANDARD SOLUTIONS.

## PITCHED ROOFS $\geq 3,5^\circ$

TRIMO ECOSOLAR FLEXIBLE	
TRIMO ECOSOLAR DIRECT	
TRIMO ECOSOLAR INCLINED	

## FLAT ROOFS

TRIMO ECOSOLAR INCLINED	
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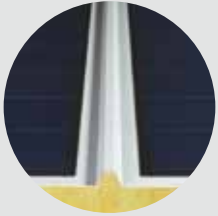
## CARPORTS & CANOPIES

TRIMO ECOSOLAR TILES	
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# Pitched roof applications

## TRIMO ECOSOLAR FLEXIBLE

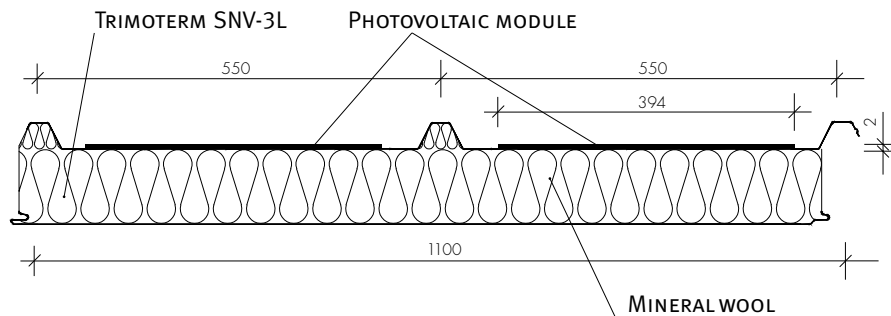
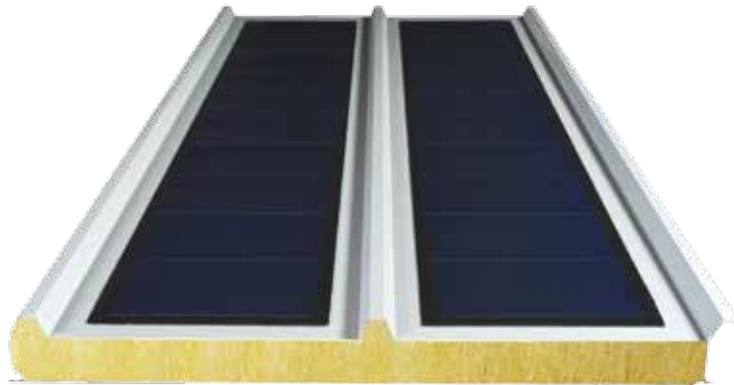
FACTORY FITTED PV MODULE



### BUILDING INTEGRATED PHOTOVOLTAICS (BIPV): SNV-3L (OR TPO-3L) ROOF PANEL + THIN-FILM FLEXIBLE PV MODULES

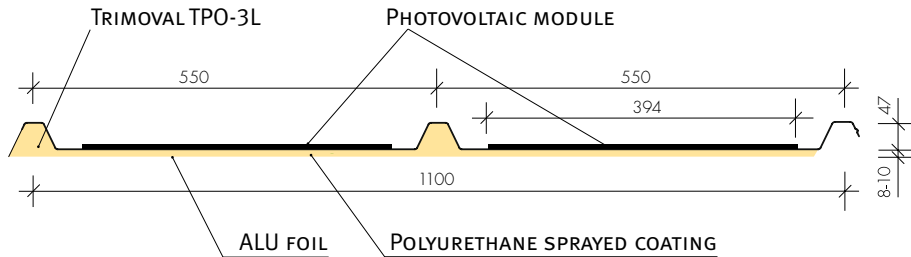
Amorphous-Silicon (am-Si) PV modules are lower in cost and extremely practical. Am-Si PV modules are less efficient than crystalline PV modules, they provide lower costs and more flexibility. This integrated application secures water-tightness of your roof since no penetrations are needed when applying the PV modules onto the sandwich roof panel. PV modules are also very lightweight and therefore do not cause statical problems. The final integrated solution is also very wind resistant.

### TRIMOTERM SNV-3L ROOF PANEL AND PV MODULE



TECHNICAL DATA SNV-3L	SNV-3L 60	SNV-3L 80	SNV-3L 100	SNV-3L 120	SNV-3L 150	SNV-3L 172	SNV-3L 200
PANEL THICKNESS (MM)	60	80	100	120	150	172	200
WEIGHT SNV-3L [KG/M <sup>2</sup> ] FE 0.6 / FE 0.5	16.8	18,8	20.8	22.8	25.8	28.0	30.8
U THERMAL CONDUCTIVITY [W/M <sup>2</sup> K] (EN 14509:2006)	0.60	0.47	0.38	0.32	0.26	0.23	0.20
COMBUSTIBILITY OF INSULANT CORE (EN 13501-1)	NON-COMBUSTIBLE, CLASS A1						
RW SOUND REDUCTION [dB] (EN ISO 140-3)		30		32			
MIN. ROOF SLOPE	5° OR 3° WITH ADDITIONAL SEALING						
COVER WIDTH [MM]	1100						
PANEL LENGTH [M]	UP TO 14						

## TRIMOVAL TPO-3L AND PV MODULE

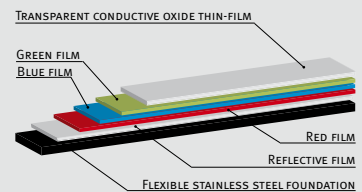


TEHNICAL DATA TPO-3L	TPO-3L
METAL SHEET THICKNESS (MM)	FE 0.6
WEIGHT (KG/M <sup>2</sup> )	8.36
U THERMAL CONDUCTIVITY [W/M <sup>2</sup> K] (EN ISO 6946)	1.24
ROOF SLOPE	MINIMUM 3.5°, RECOMMENDABLE 5°
COVER WIDTH [MM]	1100
PANEL LENGTH [M]	UP TO 14
ENV 1187:2003 THE SELF SUPPORTING METAL STEEL SHEET IS RESISTANT TO EXTERNAL FIRE.	

## CELL TYPE: AMORPHOUS SILICON (AM-Si)

Photovoltaic module is thin-film and flexible. It converts solar energy directly into electrical energy utilizing “Triple junction” technology, whereby each solar cell consist of thin-film semiconductors stacked on top of one another. Each of these cells then absorbs a portion of solar radiation spectre. Consequently, PV modules can achieve higher energy yield, especially in diffuse light conditions.

### PROFILE OF PHOTOVOLTAIC MODULE



## ELECTRICAL SPECIFICATION OF PV MODULE (PVL-68 AND PVL-136)

UNISOLAR PV MODULE	PVL-68	PVL-136
LENGTH (MM)	2849	5486
WIDTH (MM)	394	394
RATED POWER (WP)	68	136
MAXIMUM POWER VOLTAGE $V_{MPP}$ (V)	16.5	33.0
MAXIMUM POWER CURRENT $I_{MPP}$ (A)	4.1	4.1
OPEN-CIRCUIT VOLTAGE $V_{OC}$ (V)	23.1	46.2
SHORT-CIRCUIT CURRENT $I_{SC}$ (A)	5.1	5.1
WEIGHT (KG)	3.9	7.7

# Pitched roof applications

## TRIMO ECOSOLAR DIRECT

Direct mounted PV modules are appropriate for pitched roof applications for new constructions as well as for add-on or refurbishment of existing buildings. As PV modules are directly mounted with the roof panel, they use **less substructure and are more wind resistant**.

Monocrystalline and polycrystalline PV modules can be integrated with all Trimo roof sandwich panels or non-insulated profiled steel sheet.

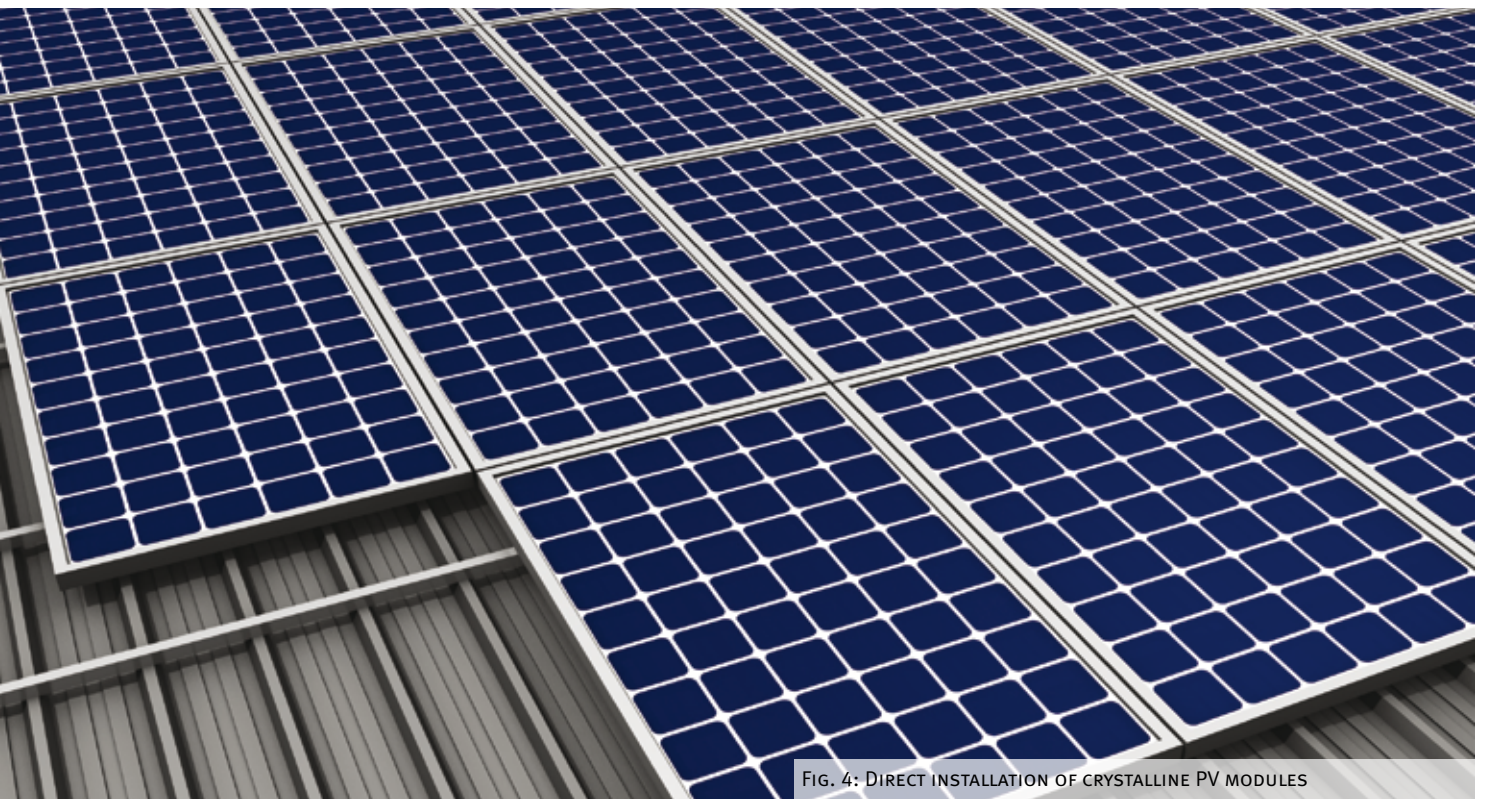


FIG. 4: DIRECT INSTALLATION OF CRYSTALLINE PV MODULES



MONO-CRYSTALLINE CELLS ARE MADE FROM A SOLID MONO-CRYSTAL, IN WHICH THE LATTICE OF THE ENTIRE CELL IS WITHOUT GRAIN BOUNDARIES. MONO-CRYSTALLINE PV CELLS ARE CONSIDERED TO RENDER THE HIGHEST EFFICIENCY DUE TO THE PURENESS OF THE MATERIAL.



POLY-CRYSTALLINE CELLS ARE A SOLID MATERIAL COMPOSED OF MANY CRYSTALLITES OF VARYING SIZE AND ORIENTATION. POLY-CRYSTALLINE CELLS CAN BE RECOGNIZED BY VISIBLE GRAINS, A "METAL FLAKE EFFECT".

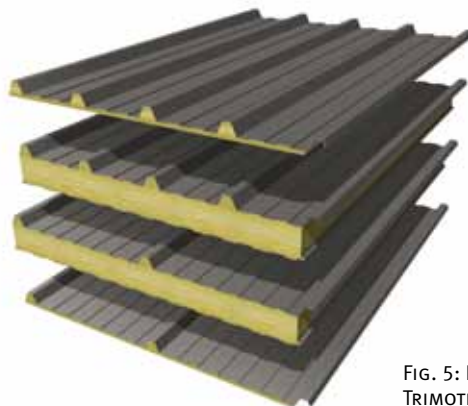


FIG. 5: FROM TOP: TRIMOVAL TPO 1000, TRIMOTERM SNV, TRIMOTERM SNV-3L, TRIMOVAL TPO-3L

TECHNICAL CHARACTERISTICS OF TRIMO PRODUCTS CAN BE FOUND UNDER CATALOGUES AND TOOLS ON [WWW.TRIMO.EU](http://WWW.TRIMO.EU).

## TRIMO ECOSOLAR INCLINED

Inclined mounted PV modules are appropriate for pitched roof applications on new constructions as well the for upgrading or refurbishment of existing buildings. The tilt angle is chosen to **maximize the array output** and varies in its optimal position depending upon latitude, season and time of the day. This application is less wind resistant and uses more substructure compared to direct mounted PV modules.

Monocrystalline and polycrystalline PV modules can be integrated with all Trimo roof sandwich panels or non-insulated profiled steel sheet.



FIG. 6: INCLINED CRYSTALLINE PV MODULES

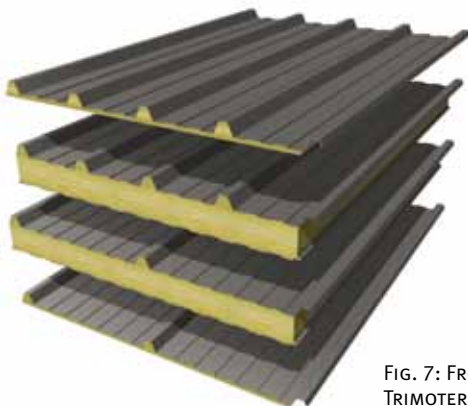
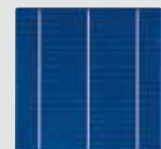


FIG. 7: FROM TOP: TRIMOVAL TPO 1000, TRIMOTERM SNV, TRIMOTERM SNV-3L, TRIMOVAL TPO-3L

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# Flat roof applications

## TRIMO ECoSOLAR INCLINED

For new constructions where built-up roofs are designed Trimo offers a solution with tilted crystalline PV modules and their substructure standing on columns attached to purlins.

Monocrystalline and polycrystalline PV modules can be applied.

For existing flat membrane roofs an add-on application can be performed using custom-made ballasts in order to stabilise PV modules and make them wind-resistant.

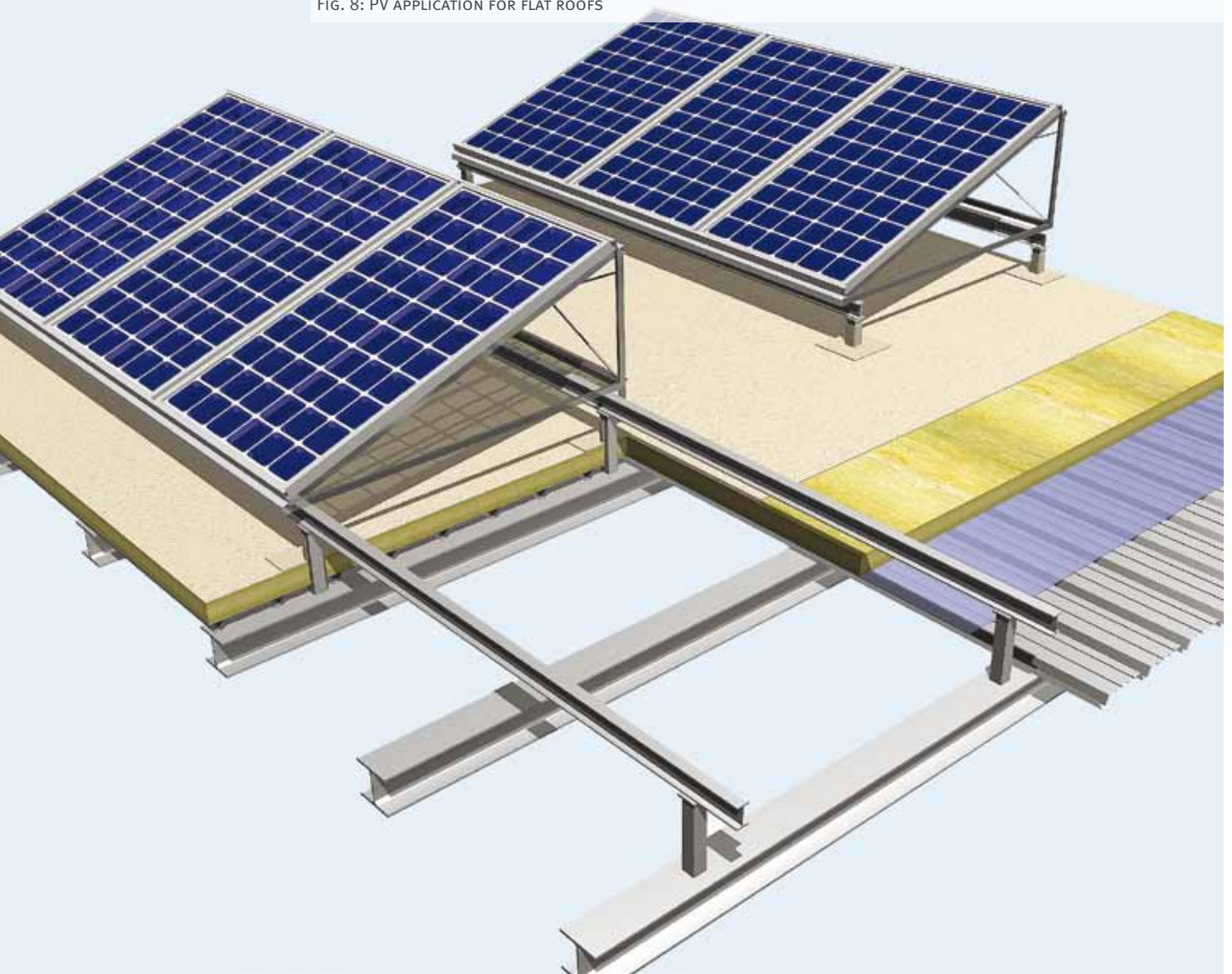


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FIG. 8: PV APPLICATION FOR FLAT ROOFS

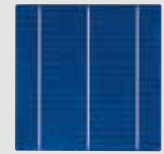


Our special application contains a solution for your carport. Tiles or common roof panels can be replaced by monocrystalline or polycrystalline PV modules providing you with a carport that generates solar electricity and offers shelter and aesthetics for your parking lot. Based on your chosen concept, Trimo can design the steel structure with tilt material consumption.

Monocrystalline and polycrystalline PV modules can be applied.



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FIG. 9: CARPORT WITH CRYSTALLINE PV MODULES AS TILES IS VERY FUNCTIONAL AS WELL AS ESTHETICAL.



# TrimoExpert PV

**TRIMO HAS DEVELOPED ITS OWN PROPRIETARY SOFTWARE PROGRAMME TRIMO EXPERT PV TO ASSIST CUSTOMERS BY FORECASTING ANNUAL ENERGY YIELD OF THEIR PV POWER PLANT.**

Each calculation takes into account:

- › location of the PV power plant
- › roof pitch
- › orientation of PV modules
- › number of PV modules
- › shadowing by neighbouring buildings, trees or other obstacles

Trimo Expert PV forecasts energy yield based on data of the standard meteorological year (solar irradiation (kWh/m<sup>2</sup>) of a given location. Actual measurements of the energy yields prove Trimo Expert PV to be an accurate and realistic forecast tool.

## TRIMOEXPERT PV SOFTWARE FORECASTING POWER GENERATION





FIG. 10: RATED POWER OF THE PV POWER PLANT: 49,9 kWp





FIG. 11: RATED POWER OF THE PV POWER PLANT: 6,8 kWp



FIG. 12: RATED POWER OF THE PV POWER PLANT: 21,2 kWp

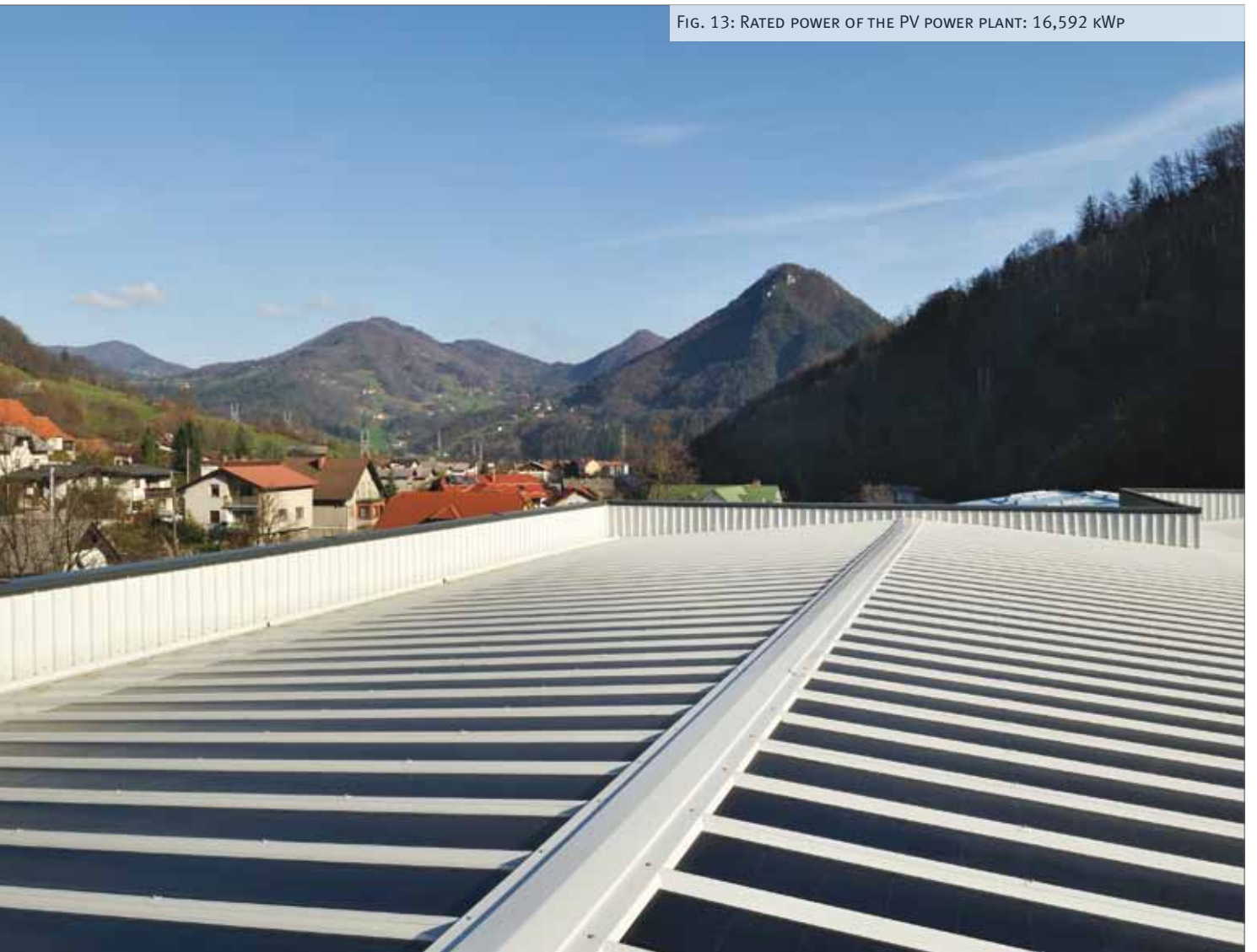


FIG. 13: RATED POWER OF THE PV POWER PLANT: 16,592 kWp



FIG. 14: RATED POWER OF THE PV POWER PLANT: 38,08 kWp



FIG. 15: RATED POWER OF THE PV POWER PLANT: 10 kWp



FIG. 16: RATED POWER OF THE PV POWER PLANT: 4,08 kWp



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