GPS600

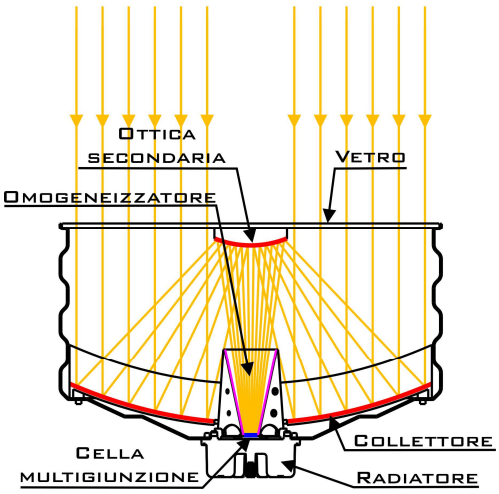
Concentratore solare ad inseguimento biassiale HCPV 600 soli

The technology of the system GPS600 of GPIII Solar combines the high performance of multi-junction photovoltaic cells with the advantages of the system of Cassegrain concentration, used for the realization of modern optical telescopes, obtaining the maximum efficiency possible.

The optical system is composed of:
- A primary collector plastic heat-deformable high reflectivity.
- A mirror aspheric secondary boron silicate high reflectivity
- A homogenizer optical coating aluminum with silver high reflectivity

The container is constituted by:
- A casing made of galvanized steel or aluminum (such as shipbuilding) to magnesium.
- A glass top ultra clear hail with double antireflective treatment.
- A cooling radiator aluminum

Ottica Cassegrain GPS600

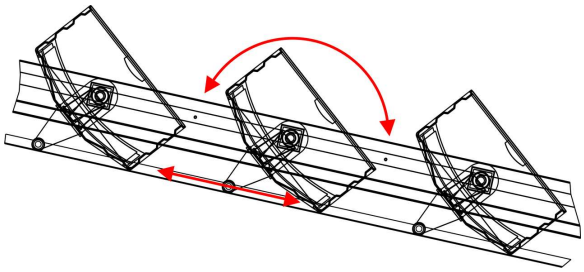


The solar radiation captured by the collector with a surface area of 600 cm ², is conveyed on the multijunction cell having an active surface of 1 cm ² realizing a concentration factor equal to 600 suns.

The individual optical groups are connected in series to form an array basis from 8 concentrators placed within formwork with degree of protection IP65; at the ends of each formwork are fixed hubs of cables used for the rotation of tilt of the formwork and for the circulation forced air so as to prevent the formation of condensation.
The series / parallel connection of array base (nornalmente 28) comprises the system GPS600.

In order for any CPV concentrator can produce energy, her outlook is always directed towards the solar source.
The traditional solar concentrators are made of modules having a ratio between height and width very low and therefore, to minimize the mutual shading, it is necessary that vangano installed very far from each other.
These structures, large domensioni, offer a considerable wind resistance and require a heavy ballast, when the wind speed exceeds a safety threshold, to avoid breakage of the mechanical components, are generally rotated in a horizontal position by interrupting the production.

The dual-axis tracking system of GPS600 is based on a structure with fixed angle of inclination and very reduced in rotating on central pin for alignment azimuth, while the tracking of the tilt is made by tilting the individual arrays basis.



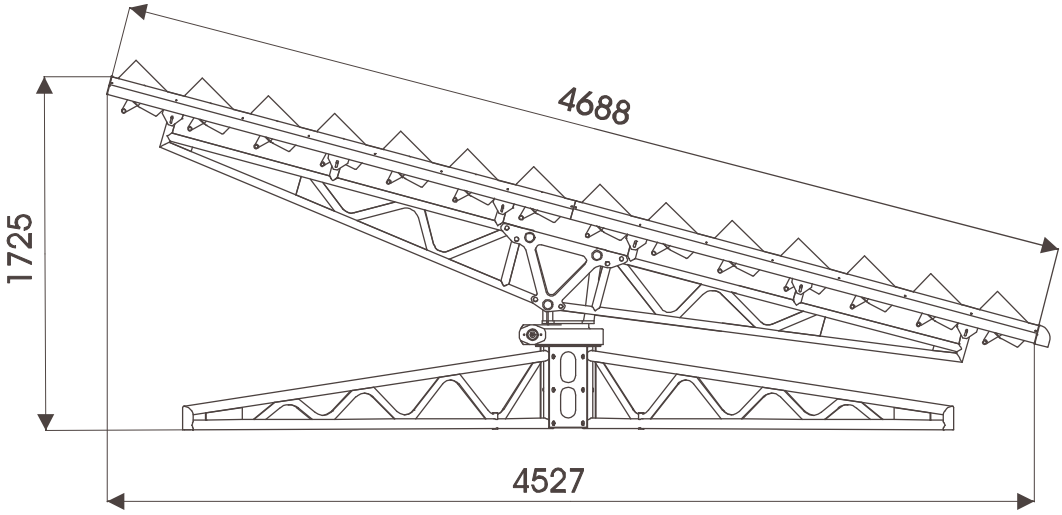
The advantages of the system of GPS600 GPIII Solar compared to other concentrators are numerous and concern both the optical concentration of the mechanics tracking:

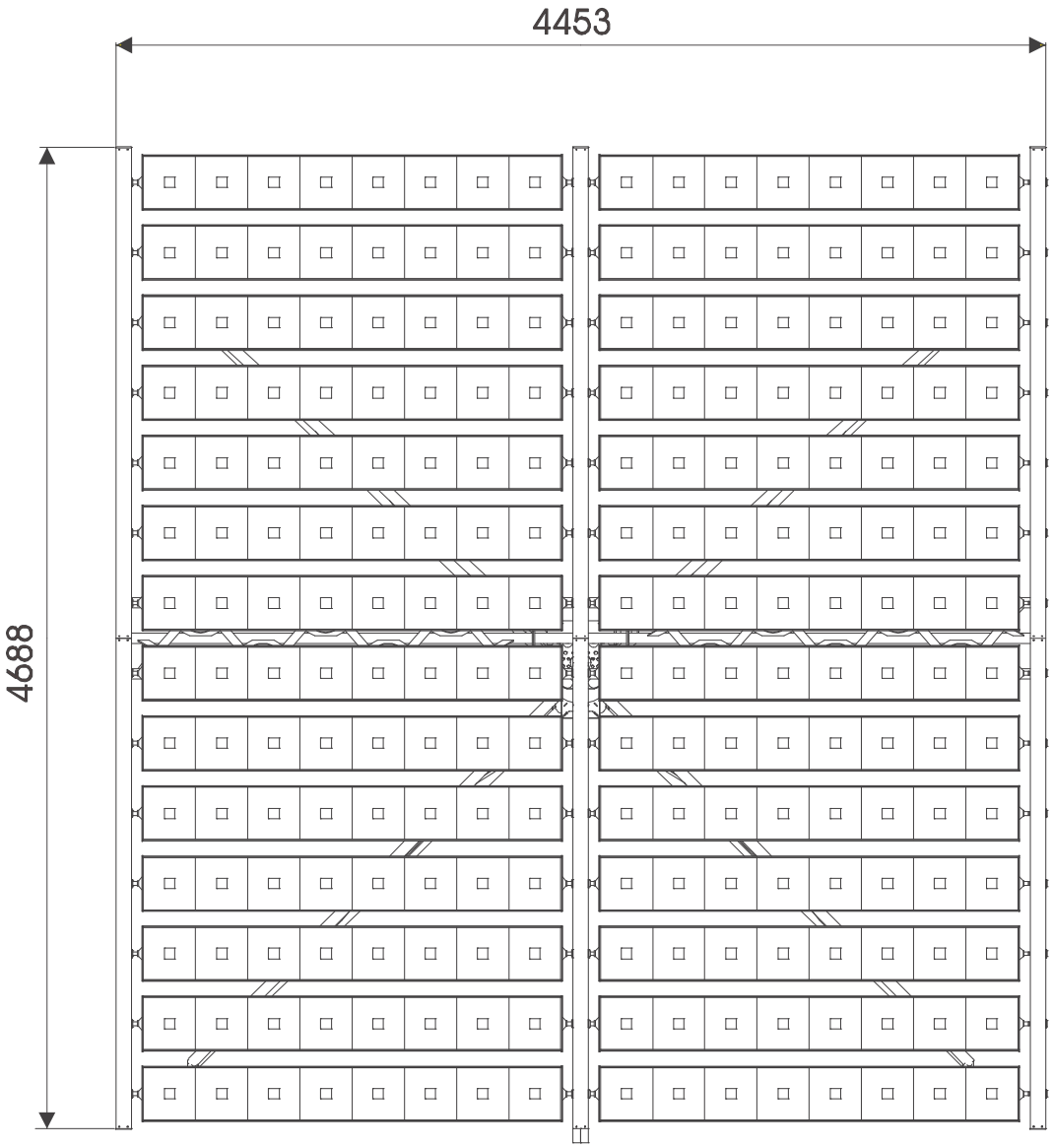
- The Cassegrain optical concentration compared to the more widespread Fresnel lens reduces optical losses resulting from typical aberrations generated by the characteristic rings of the lenses and is therefore more efficient.
Furthermore, in almost all systems concentration Fresnel lens the upper part is made of transparent plastic material and is therefore subject to aging, both due to UV yellowing that the polymer which, either because of scratches generated in the presence of wind and sand.
The upper closure of the modules GPS600 is made of the same tempered glass hail used in traditional solar panels whose mechanical resistance tests are performed with specific procedure certified.
The length of this area is also extensively field-tested over decades of exposure to the elements.

- The mechanical tracking has been designed so as to offer the least possible resistance to the wind and the structure results have a very low profile that allows the installation even on flat roofs or slightly inclined.
The side frames contain electrical wiring and, in addition to the support function of the modules act as channel for the exclusive (and patented) system to prevent condensation.

- The particular sensor tracking integrates a pyrheliometer (instrument for measuring the intensity of solar radiation) which, by transmitting the measured data to the data-logger, puts it in a position to compare the intensity with solar energy production and to recognize the various causes of defects and / or failures.

Size standard module GPS600



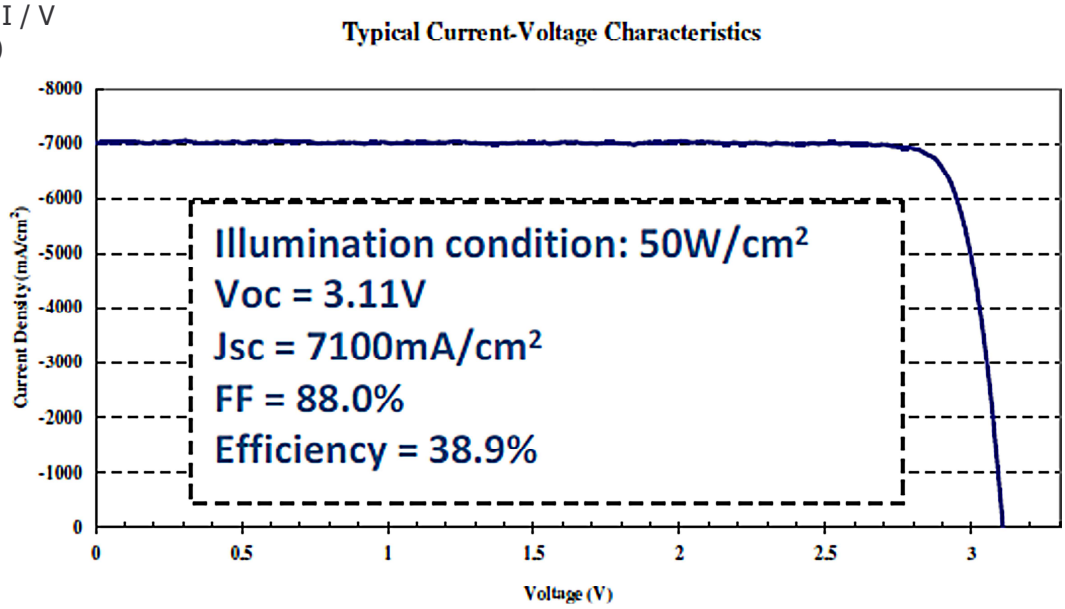


Technical Data GPS 600 module standards

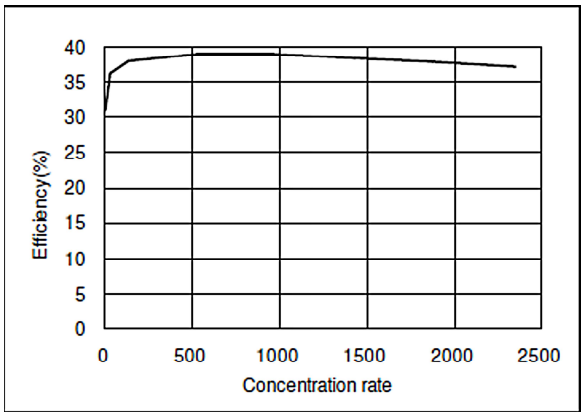
GPS600	LX/MX/HX	
DATI MECCANICI		
– Area captante:		13,44 mq
– Area Totale:	20,87 mq	
– Inseguimento:	2 Assi	
– Movimentazione:	24 VDC	Max 2x20 W
– Peso:	761 Kg	Max
– Rapporto di concentrazione:	600	
– Dimensioni:	H 1750 (LX) L 4450 P 4690 2950 (MX) 3950 (HX)	
DATI ELETTRICI		
– Tensione alla potenza massima:		2X 285 V
– Corrente alla potenza massima:	2X 7.9 A	
– Tensione a circuito aperto:	2X 350 V	
– Corrente di cortocircuito:		2X 8.9 A
– Potenza di picco:	4,45 KW	
– Valore NOCT:	65°C	
– Coefficiente di temperatura corrente A/°C:		0,015
– Coefficiente di temperatura tensione V/°C:		-0,54
– Rendimento:	33%	

Characterization of triple-junction cells

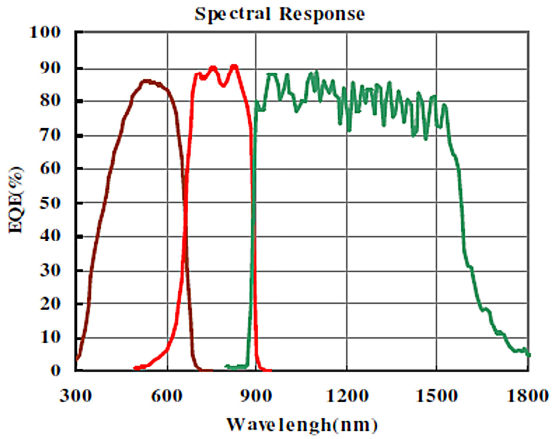
- Feature I / V
(500 Sun)



- Efficiency / Concentration Factor



- Answer to the solar spectrum



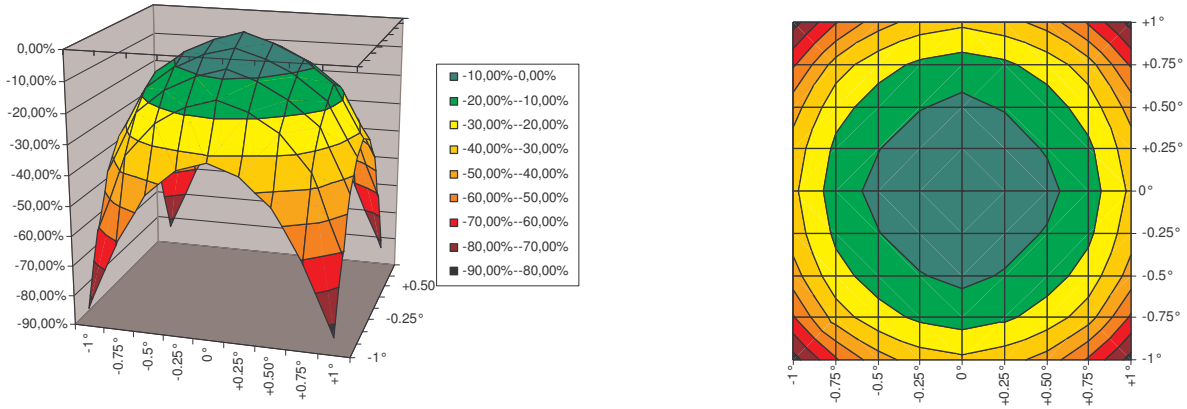
materials triple-junction cells

InGaP (Fosfuro di Indio-Gallio)

InGaAs (Arseniuro di Indio-Gallio)

Ge (Germanio)

angular acceptance



The peak value of the power is normalized to 1KW/m2.

This is for simplicity in the calculation of annual production through the use of maps SolarGis with the values of DIN year actually observed from 2004 to 2010.
The use of maps PVGIS in fact, requires to proceed with approximations and can be misleading.

The life expectancy of the panels GPS600 concentration is at least 35 years.

In addition, considering an "infant mortality" around the 0.03% of the cells, the degradation in performance and productivity in warm climates is lower by up to 70% compared to traditional panels.

GPS600

Modulo solare HCPV 600 soli

Solar module HCPV 600 suns

GPIII SOLAR

Prospettive del fotovoltaico a concentrazione

La tecnologia dei tradizionali pannelli fotovoltaici al silicio è armai arrivata al suo limite fisico di efficienza, mentre i costi di produzione non hanno più la possibilità di ridursi. Al contrario la tecnologia delle celle multigiunzione, che costituiscono il cuore dei pannelli a concentrazione, ha ancora notevolissimi margini di sviluppo nel breve periodo e si prevede che la loro efficienza si incrementi del 5% ogni anno del prossimo decennio.
Per contro, i pannelli tradizionali subiscono forti cali di rendimento all'aumentare della temperatura mentre per le celle utilizzate nei concentratori questo calo è praticamente assente. Per questa ragione la tecnologia a concentrazione risulta particolarmente adatta alle zone ad alta insolazione. La tendenza del mercato è sempre più quella di ridurre la superficie utilizzata e aumentare il tempo di produzione ed è opinione unanime che la tecnologia a concentrazione costituisce il futuro del fotovoltaico.

Il progetto HCPV GPS600

(Solare fotovoltaico ad alta concentrazione)

La soluzione tecnica scelta è costituta da un sistema a doppia riflessione di tipo Cassegrain inizialmente studiato per la realizzazione di telescopi e opportunamente modificato per le esigenze specifiche del sistema di concentrazione.
I pregi del sistema Cassegrain sono:

- Alto rendimento dovuto alla scarsa diffusione (assenza di aberrazioni) dei raggi solari.
- Angolo di accettanza ampio che consente l'utilizzo di inseguitori più leggeri.
- Spessore ridotto del pannello dimezzato grazie alla doppia riflessione.
- La possibilità di utilizzare il classico vetro ultrachiaro (esente da invecchiamento) per l'involucro che garantisce maggior continuità di rendimento. Altri sistemi implicano invece l'utilizzano materiale plastico per la parte superiore che oltre ad essere soggetto ad ingiallimento da UV può venire facilmente graffiato (ad esempio dalla sabbia) e quindi risulta molto meno affidabile.

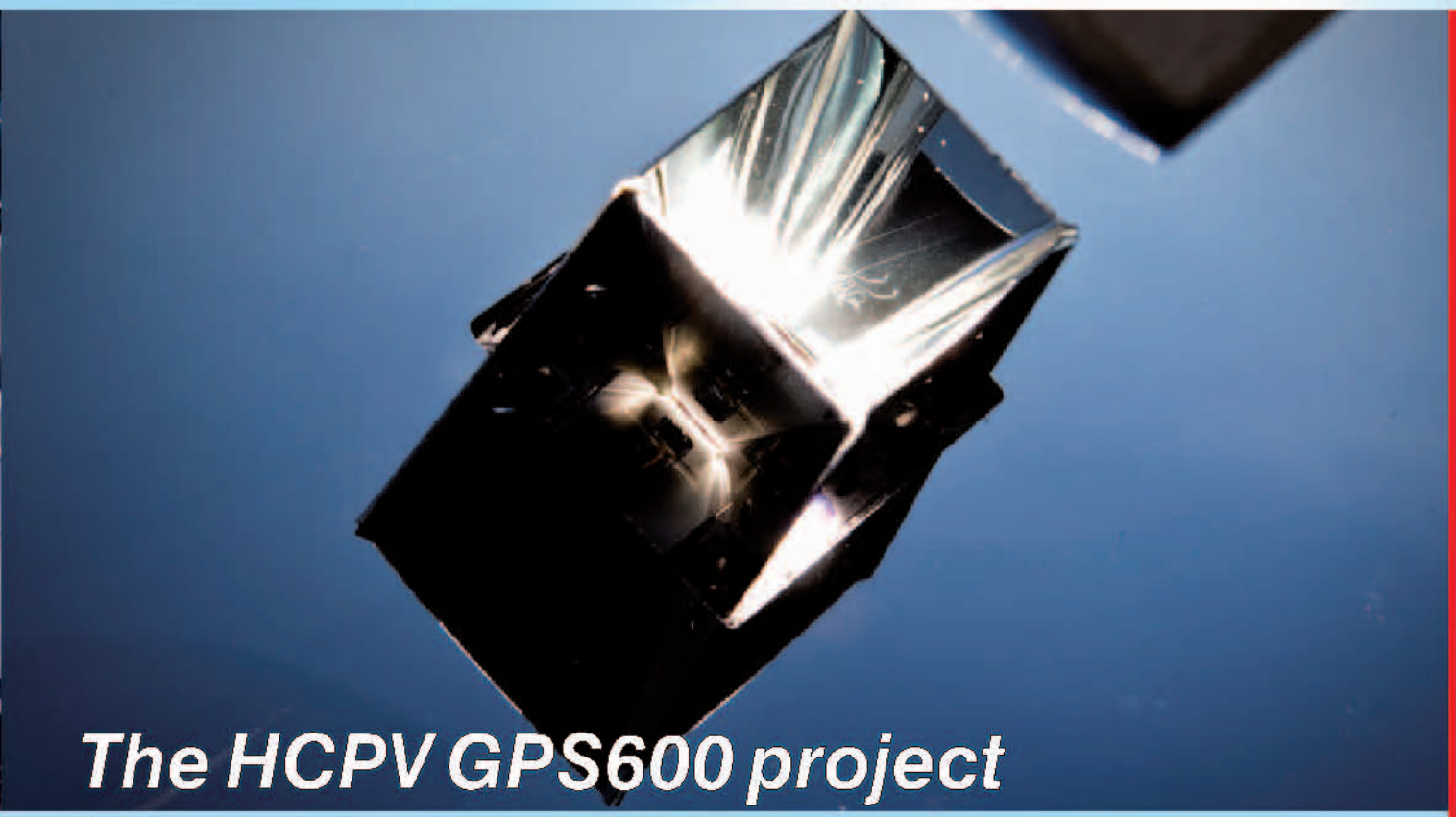
La progettazione del sistema gps600 è stata volta con successo a trovare soluzioni che consentissero:

- l'utilizzo di inseguitori a basso profilo, tanto da poter essere installati agevolmente su tetti piani o con inclinazioni fino a 20°. E' da notare che nessun altro concentratore attualmente sul mercato possiede questa caratteristica.
- la riduzione dello spazio a terra tanto da poter installare oltre 100KWp su 1000mq senza che i moduli si ombreggino a vicenda. Diverse simulazioni hanno evidenziato che il miglior rapporto prezzo/potenza (considerando buoni margini di sicurezza per quanto riguarda le temperature di esercizio) si ottiene con un fattore di concentrazione 600 utilizzando celle da 10x10mm. Il sistema di puntamento è corredato da un esclusivo pireliometro (AKKUTRACK www.akkutrack.com) che oltre a garantire un allineamento perfetto analizza l'intensità istantanea della radiazione solare. Ciò consente, al software di controllo di confrontare i dati di produzione di energia provenienti dagli inverter con la reale intensità del sole e quindi di individuare immediatamente anomalie e/o malfunzionamenti (ad esempio segnalare la necessità di effettuare la pulizia dei moduli).

Prospects for photovoltaic concentration

The technology of traditional photovoltaic silicon panels has now arrived at its physical limit of efficiency, while the production costs no longer have the possibility of being reduced. In contrast, the multi-junction cell technology - which implies that multi-junction cells are the heart of the concentration panels - still has very considerable room for development in the short-term and it is expected that the efficiency of such cells will increase by 5% each year for the next decade.

Traditional panels undergo considerable yield losses with increasing temperature, while this decrease is virtually non-existent for cells used in concentrators. For these reason, the concentration technology is particularly suited to areas with high insolation. The market trend is increasingly aimed at reducing the space used and increasing production times and it is the unanimous opinion that the future of photovoltaics lies in concentration technology.



The HCPV GPS600 project

(High concentration solar photovoltaics)

The technical solution consists of a double-reflection Cassegrain system which was initially studied to create telescopes and which was suitably amended to meet the specific needs of the concentration system.

The merits of the Cassegrain system as follows:

- *High efficiency due to the low diffusion (no aberrations) of sunlight.*
- *Acceptance angle allows the use of lighter trackers.*
- *Reduced thickness of the panel; halved thanks to the double reflection.*
- *The possibility of using classic ultra clear glass (exempt from ageing) for the casing which guarantees greater continuityof performance. On the other systems imply the use of plastic material for the top part which, besides being subject to yellowing by UV, can be easily scratched (by sand for example), and is thus much less reliable.*

The design of the system GPS600 successfully found solutions that would allow:

- *The use of low profile trackers, so that they can be easily installed on flat roofs or with tilts of up to 20°. It should be noted that no other concentrator currently available on the market has this feature.*
- *Lower floor space is needed, so you can install more than 100kWp on 1000 square meters without the modules shading each other.*

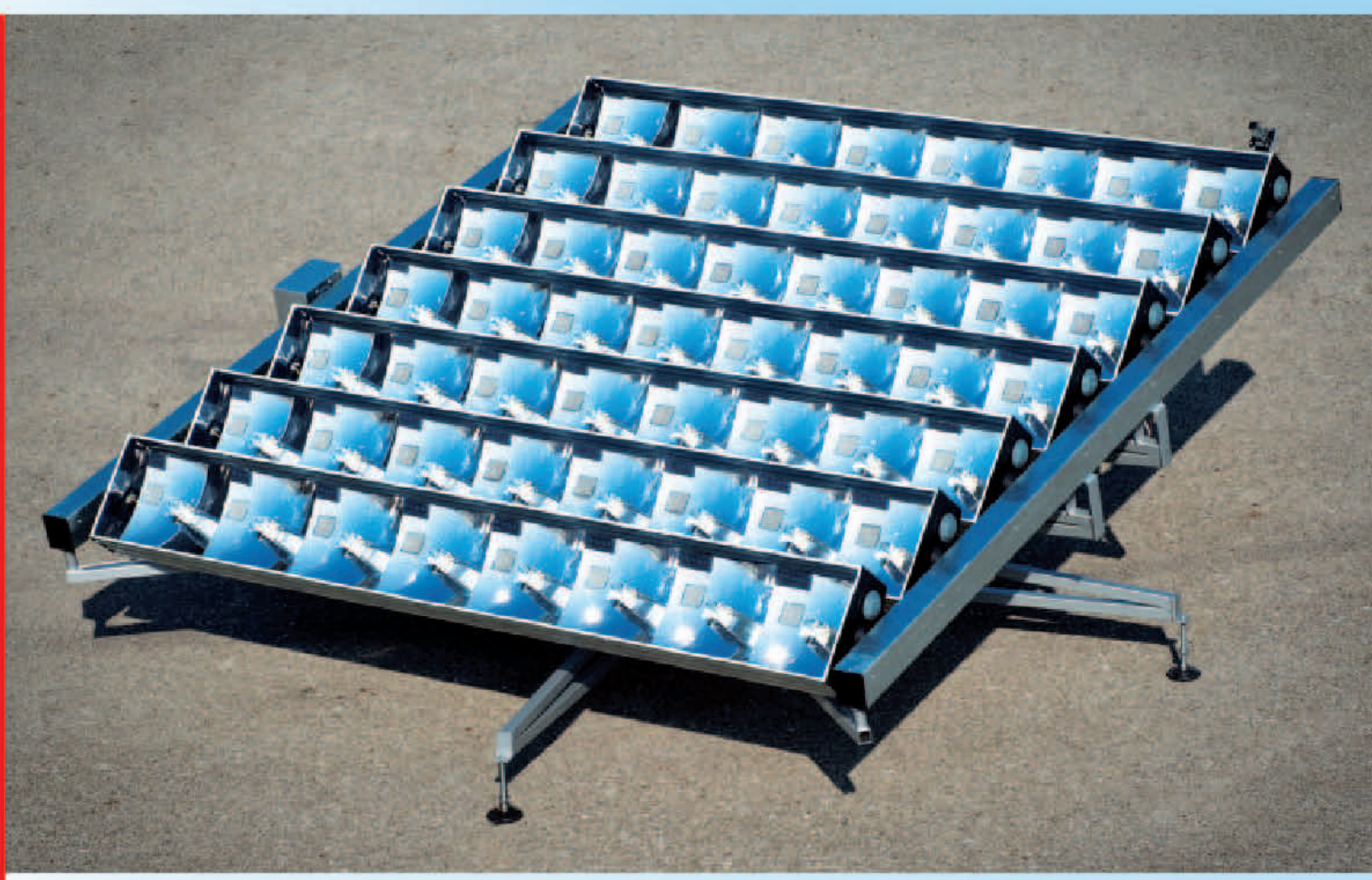
Several simulations have shown that the best price / power ratio (considering sound safety margins with respect to the operating temperature) is obtained with a concentration factor of 600 using 10x10 mm cells.

The optic system is accompanied by an exclusive pyrheliometer (AKKUTRACK www.akkutrack.com) twhich, in addition to ensuring perfect alignment, analyzes the immediate intensity of solar radiation.

This enables the control software to compare the data of energy production from the inverters with the real intensity of the sun, and then to immediately identify irregularities and/or malfunctions (e.g.: notify the need to clean the modules).

La Soluzione innovativa

La soluzione adottata è costituita da barre di 8 cellule di concentrazione montate su un'unica fila con dimensioni 260 x 2060mm. Tale conformazione si presta al montaggio basculante e sono quindi stati previsti perni di rotazione posti sul baricentro che vengono usati per l'uscita dei cavi e per la ventilazione forzata utile ad evitare i fenomeni di condensa.



Installazione su tetti piani

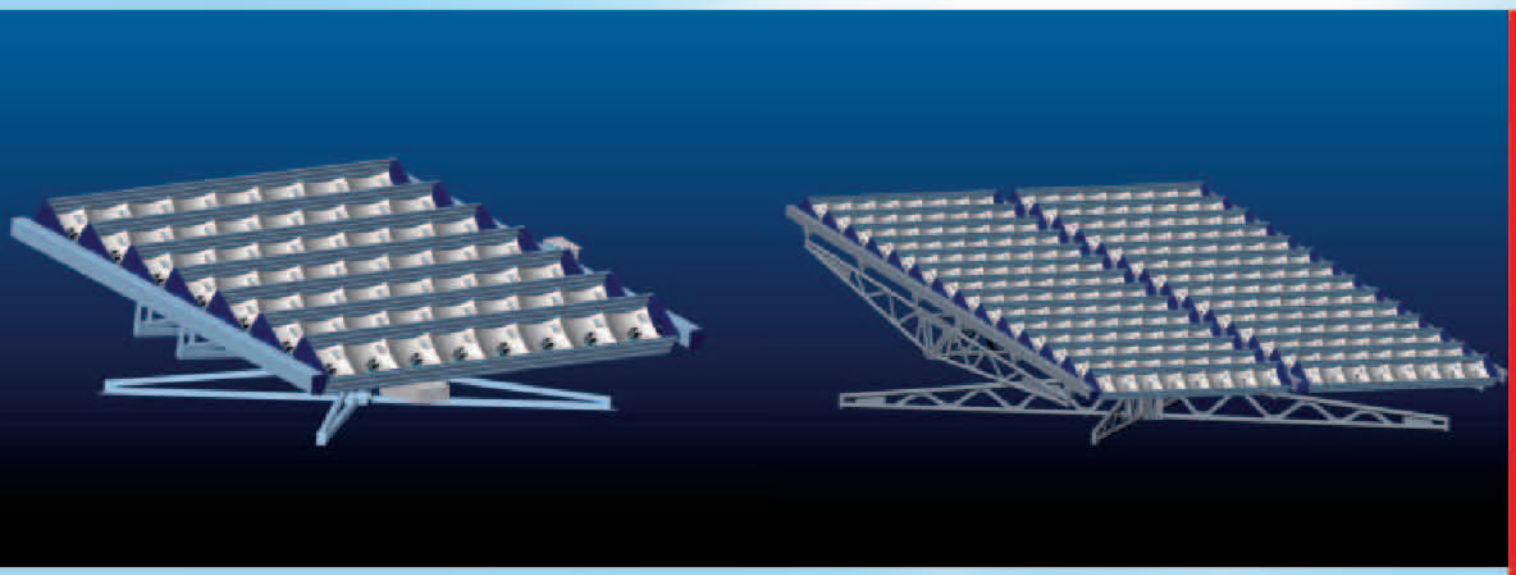
Questo tipo di struttura consente un agevole installazione su tetti piani il che costituisce una prerogativa unica per quanto riguarda il solare a concentrazione. Ogni modulo è completamente autonomo ed il suo l'assemblaggio viene effettuato direttamente sul tetto senza richiedere strutture aggiuntive ne l'utilizzo di particolari sistemi di sollevamento.
Il suo basso profilo consente un rapporto potenza superficie occupata senza paragoni.

Installation on flat roofs

This type of structure allows an easy installation of flat roofs which is a prerogative only as regards solar concentration. Every module is fully autonomous and its assembly is made directly on the roof and no additional facilities or the use of special lifting systems is needed. Its low profile allows unparalleled ratio between power and occupied surface.

Innovative solution

The solution adopted consists of bars of 8 concentration cells mounted on a single row with a size of 260x2060mm and a weight of 17.5 kg. This configuration lends itself to a swivel mount and rotating pins placed on the center of gravity are therefore provided to be used for the output of cables and forced ventilation which are useful to avoid condensation.

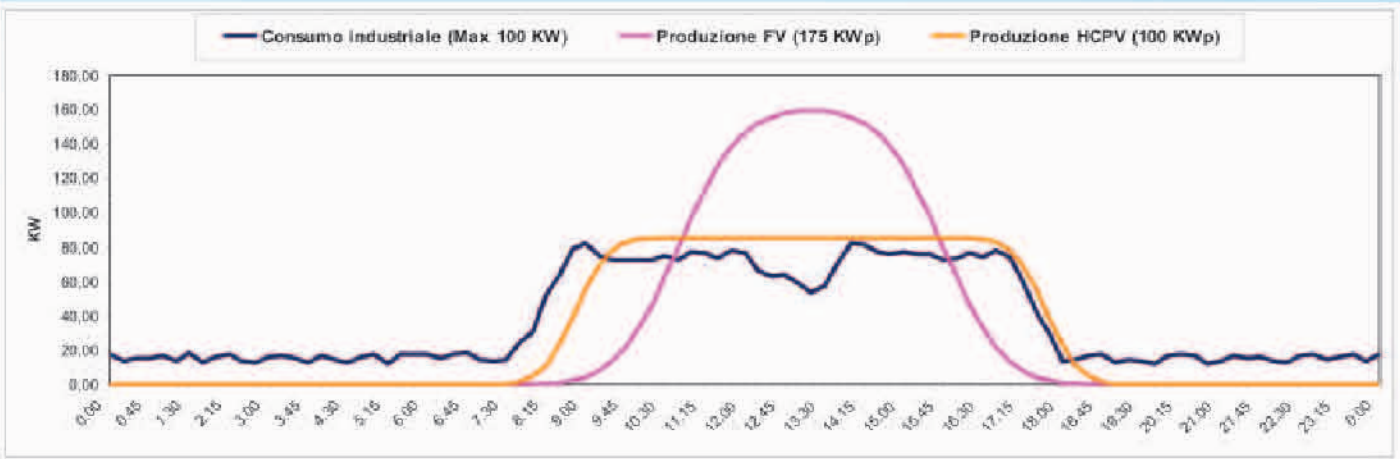


Energia di valore

Il valore dell'energia dipende anche dal momento in cui essa viene prodotta.
La produzione di energia del sistema HCPV rispetto ai sistemi FV è distribuita su un intervallo di tempo molto più ampia ed in questo modo aumenta notevolmente la parte di energia un auto-consumo e si riduce lo scambio con la rete che risulta economicamente svantaggioso. L'energia prodotta dai sistemi HCPV quindi, oltre ad essere superiore in quantità risulta avere anche un valore maggiore.

Valuable energy

The value of the energy also depends on the time at which it is produced.
The energy production with HCPV system compared to FV systems is distributed over a time interval much wider and in this way greatly increases the part of a self-consumption energy and reduces the exchange with the grid that is economically disadvantageous. The energy produced by the HCPV systems therefore, in addition to being superior in quantity also has a greater value.



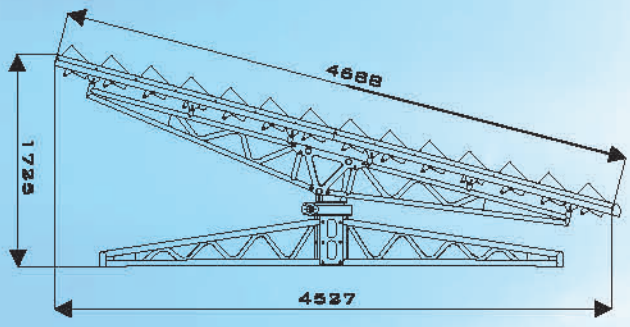
Installazione a vele

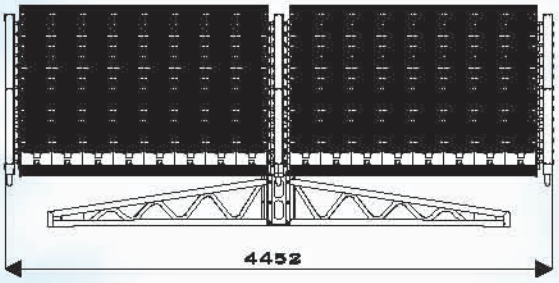
Questo tipo di struttura, viene utilizzata per installazioni a terra (mod. MX) e per la copertura di parcheggi (mod. HX).
A differenza delle vele tradizionali, in questa particolare struttura, l'inclinazione orizzontale è fissa e l'inseguimento verticale viene effettuato dalle barre basculanti. Ciò consente di dimezzare la distanza necessaria ad evitare l'ombreggiamento.
Avendo un solo grado di libertà, la struttura portante risulta inoltre più stabile e, grazie al profilo ribassato ed alla permeabilità all'aria del sistema, la resistenza al vento è ridotta di oltre il 50% e riduce al minimo le perdite di produzione anche in zone molto ventose.

Solar sail installation

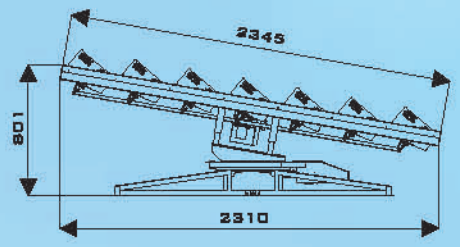
This type of structure is used for ground installations (model MX) and to cover parking (model HX).
Unlike traditional sails, the horizontal inclination of this particular structure is fixed and vertical tracking is performed by the tilting bars.
This reduces the distance needed to avoid shading by over 35%.
Since it only has one degree of freedom, the bearing structure is also more stable and thanks to the system's low profile and air permeability, the wind resistance is reduced by over 50% and decreases production losses to a minimum even in very windy areas.

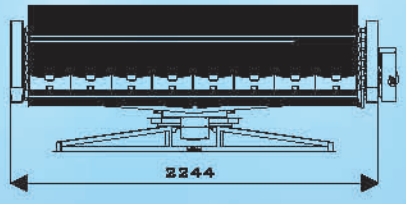
GPS600 LX



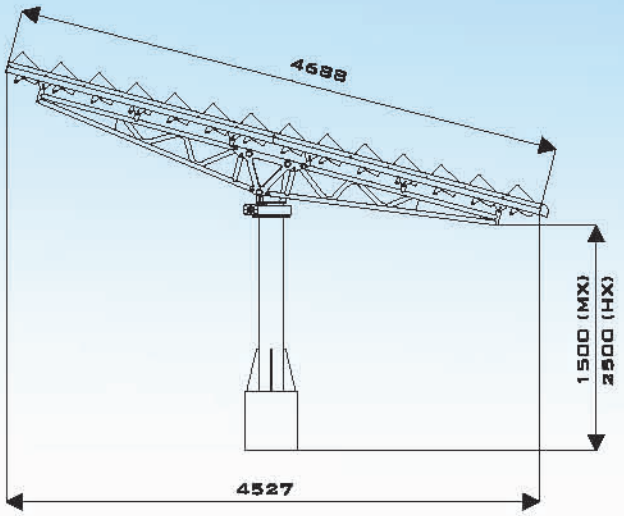


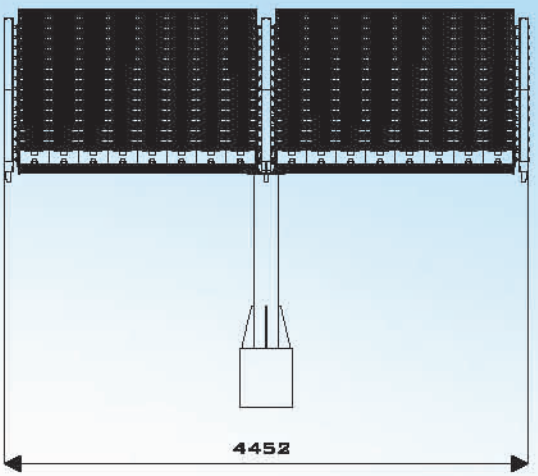
GPS600 LS



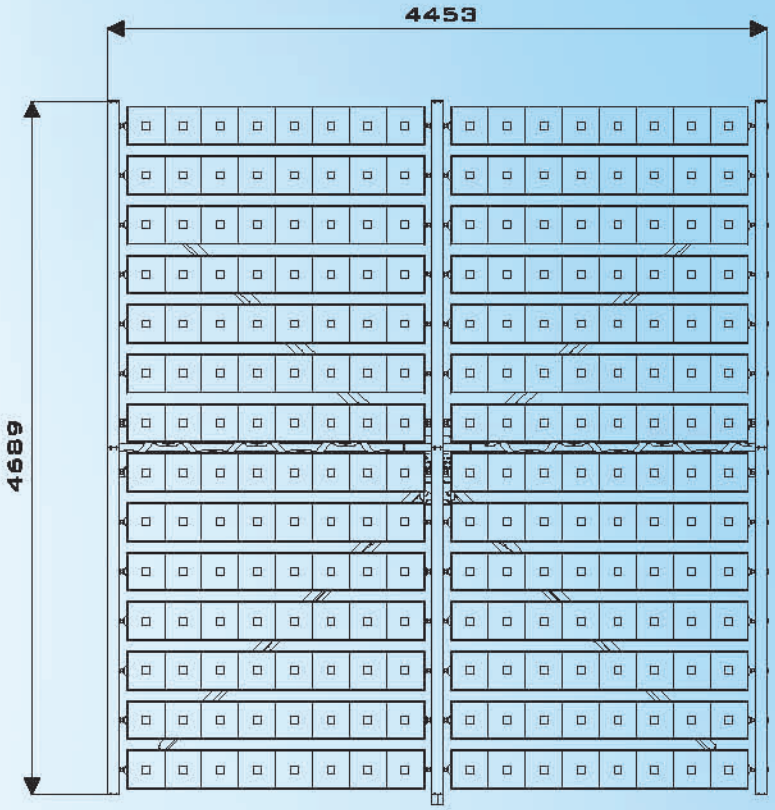


GPS600 MX/HX

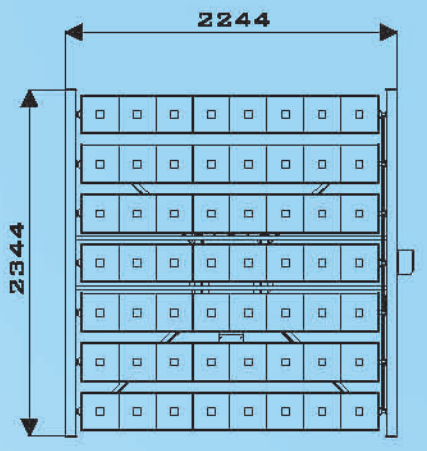




GPS600 LX/MX/HX



GPS600 LS



GPS600	LX/MX/HX	LS
DATI MECCANICI / *Mechanical data*		
– Area captante / *Absorber area:*	13,44 mq	3.36 mq
– Area Totale / *Total area:*	20,87 mq	5,25 mq
– Inseguimento / *Tracking:*	2 Assi	2 Assi
– Movimentazione / *Movement:*	24 VDC Max 2x20 W	24 VDC Max 2x20 W
– Peso / *Weight:*	761 Kg (Max)	221 Kg (Max)
– Rapporto di concentrazione / *Concentration ratio:*	600	600
– Dimensioni / *Size:*	H 1750 (LX) L 4450 P 4690 2950 (MX) 3950 (HX)	H 850 L 2245 P 2345
DATI ELETTRICI / *Electrical data*		
– Tensione alla potenza massima / *Voltage at maximum power:*	2X 285 V	145 V
– Corrente alla potenza massima / *Current at maximum power:*	2X 7.9 A	7.9 A
– Tensione a circuito aperto / *Open circuit voltage:*	2X 350 V	180 V
– Corrente di cortocircuito / *Short-circuit current:*	2X 8.9 A	8.9 A
– Potenza di picco / *Peak power:*	4,45 KW	1,15 KW
– Valore NOCT / *NOCT value:*	65°C	65°C
– Coefficiente di temperatura corrente A/°C *Current / temperature Coefficient A/°C:*	0,015	0,015
– Coefficiente di temperatura tensione V/°C *Voltage / temperature Coefficient V/°C:*	-0,54	-0,54
– Rendimento / *Efficiency DNI:*	33%	34%

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