

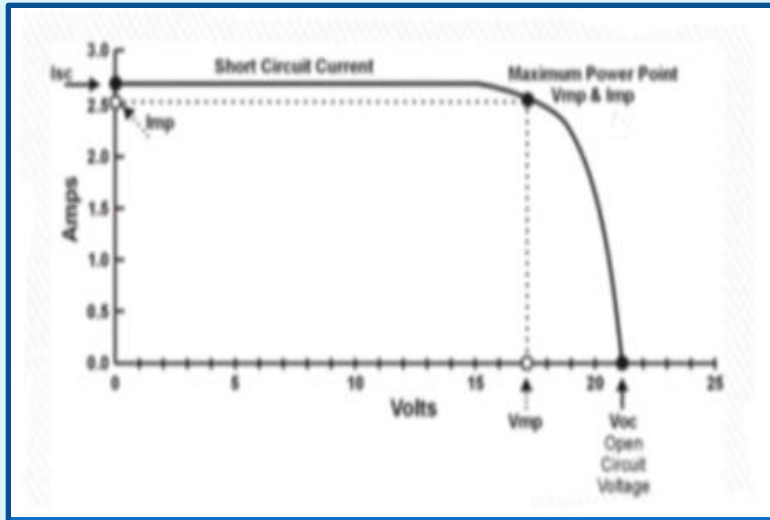


The Solar Energy

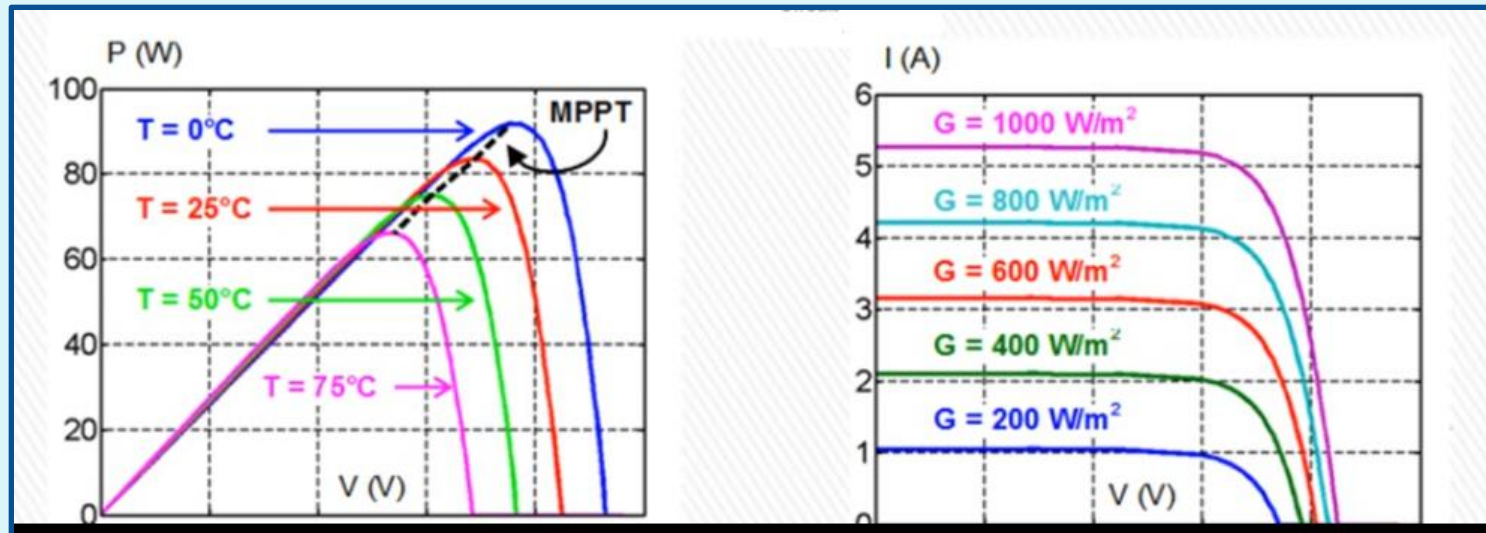
Dr . Raghad Al-journi

Electrical power and machine engineering department

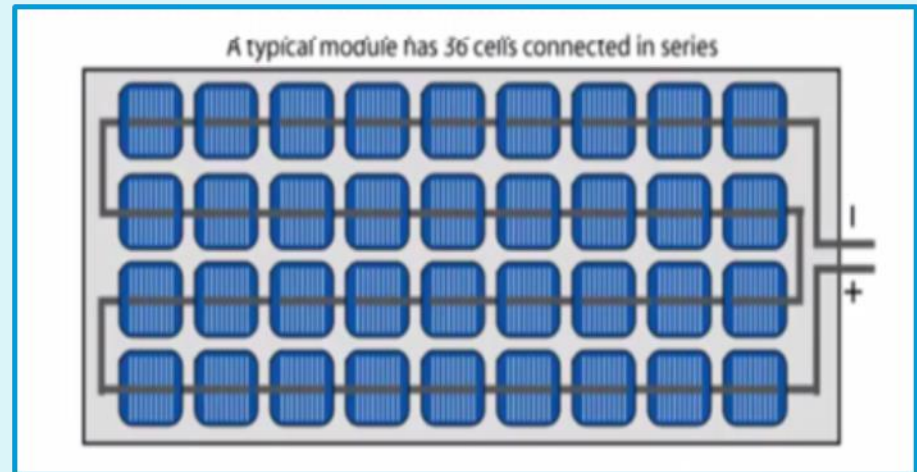
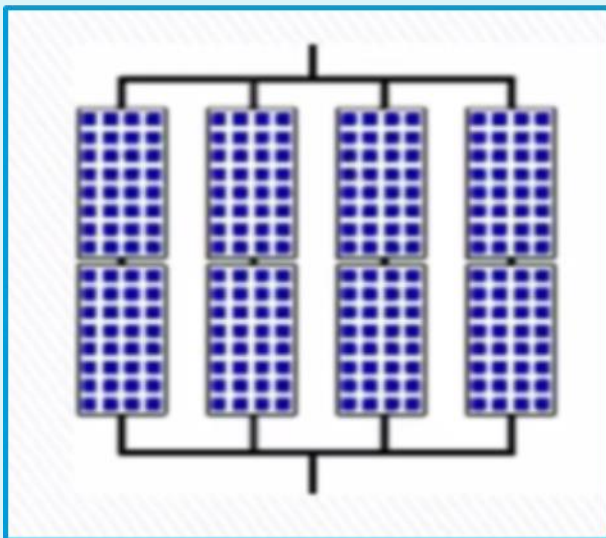
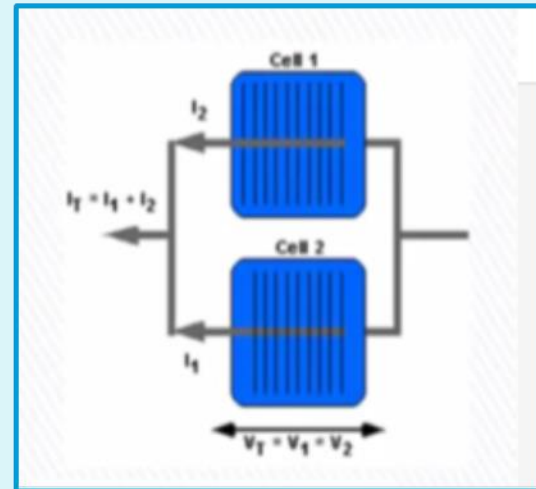
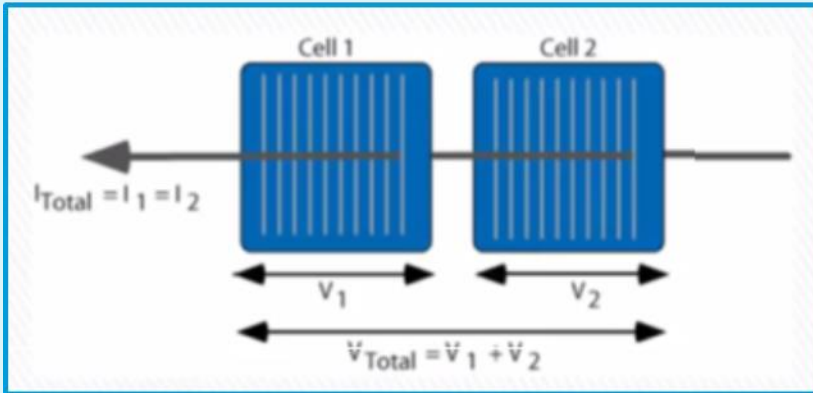
PV Characteristics



STC (standard Test condition) 25C,
G=1000W/m²,
AM=1.5

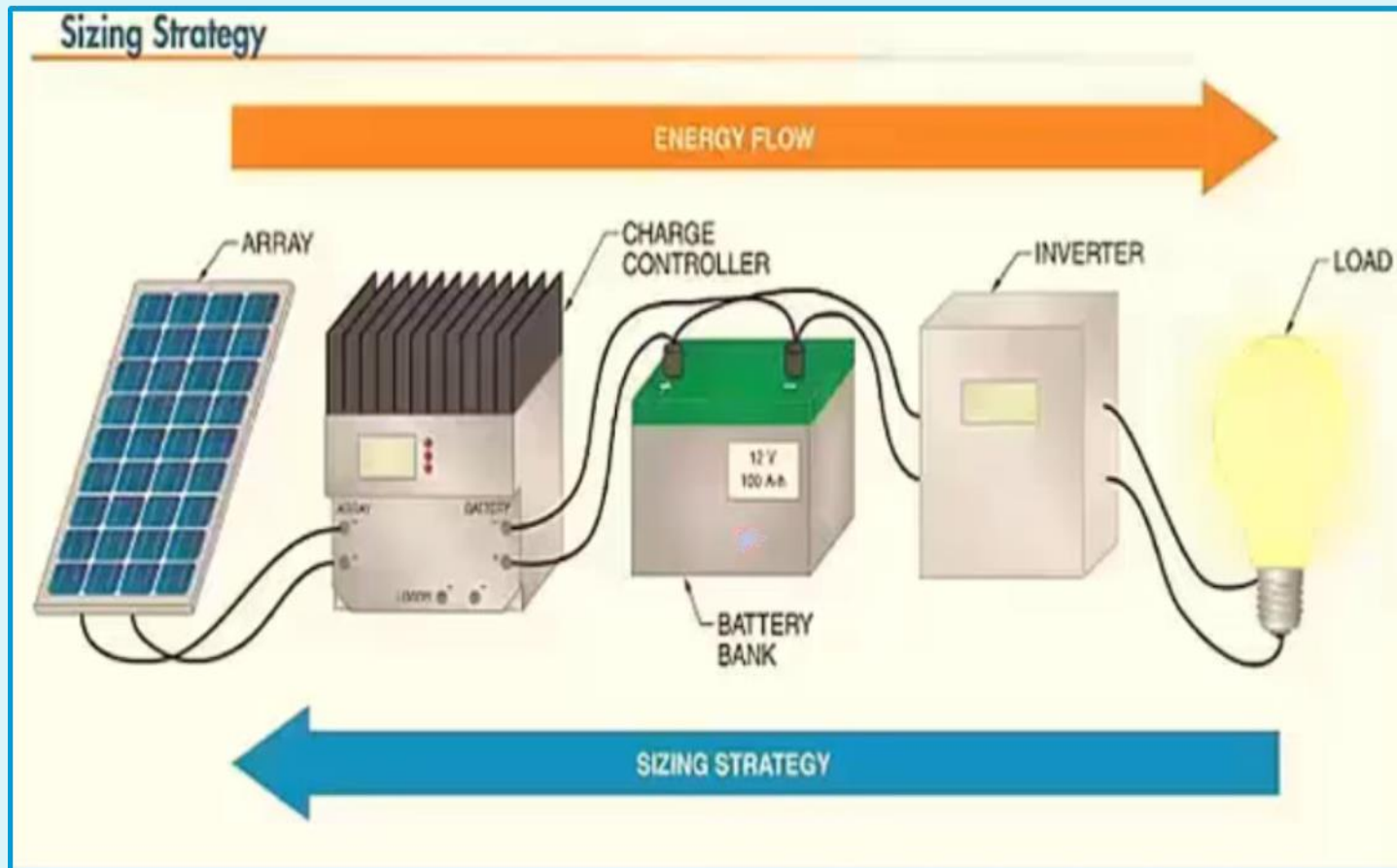


PV Cells Connection

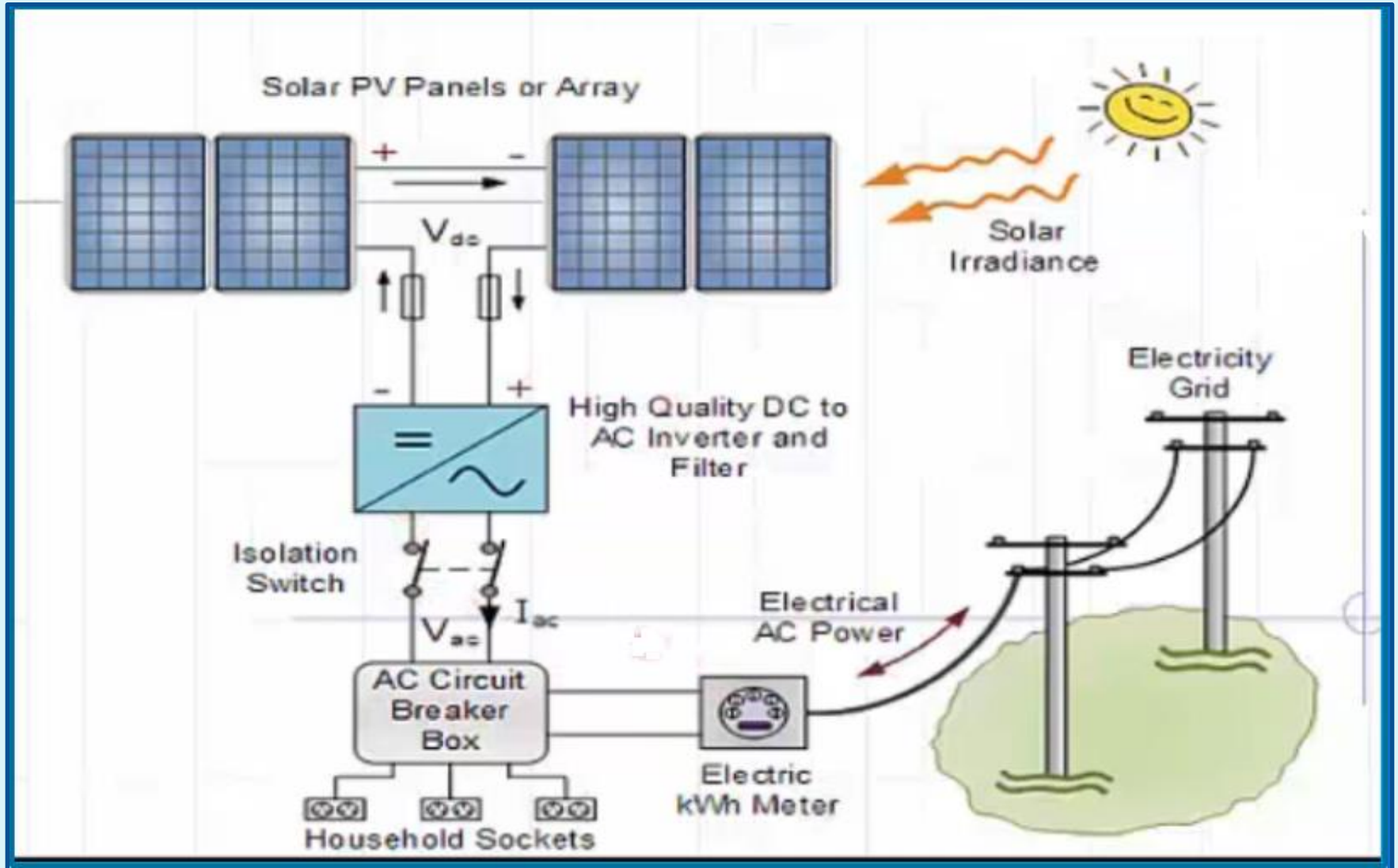




Sizing Strategy



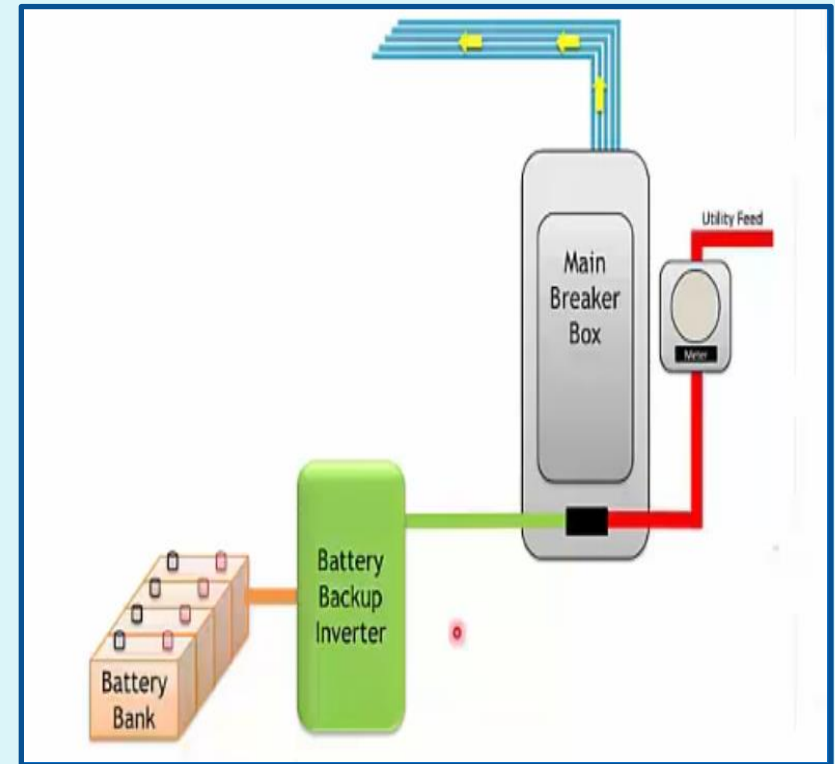
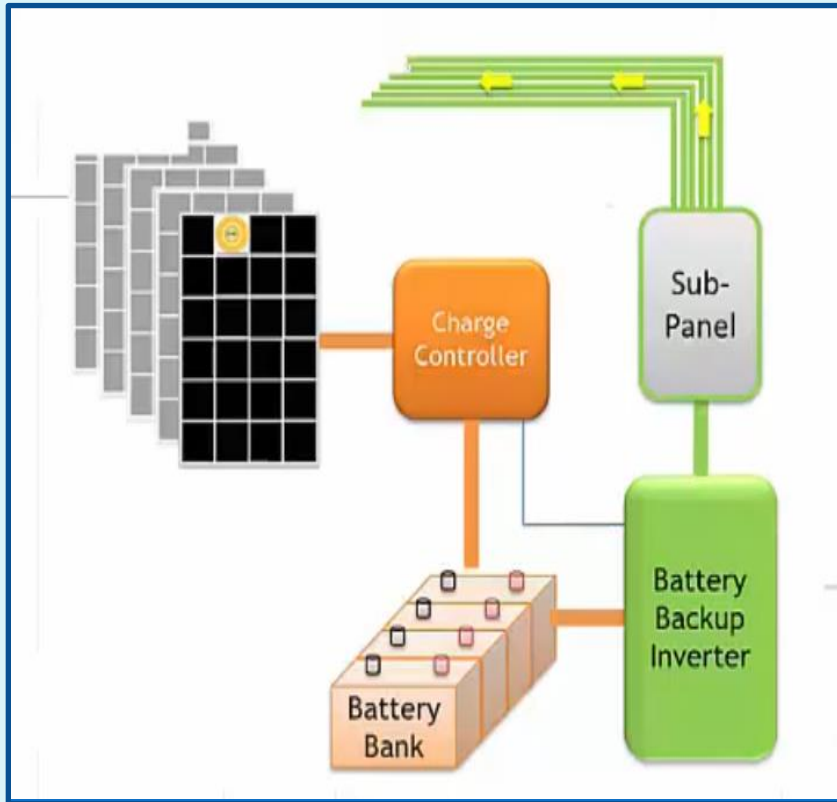
1-On – grid solar PV system



2-Off – grid solar PV system



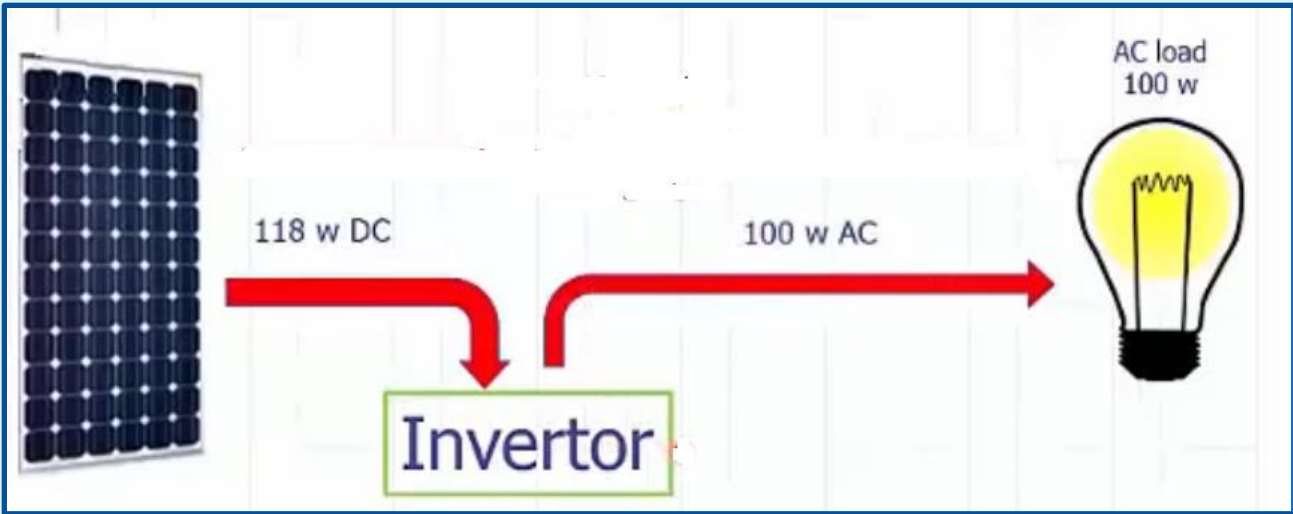
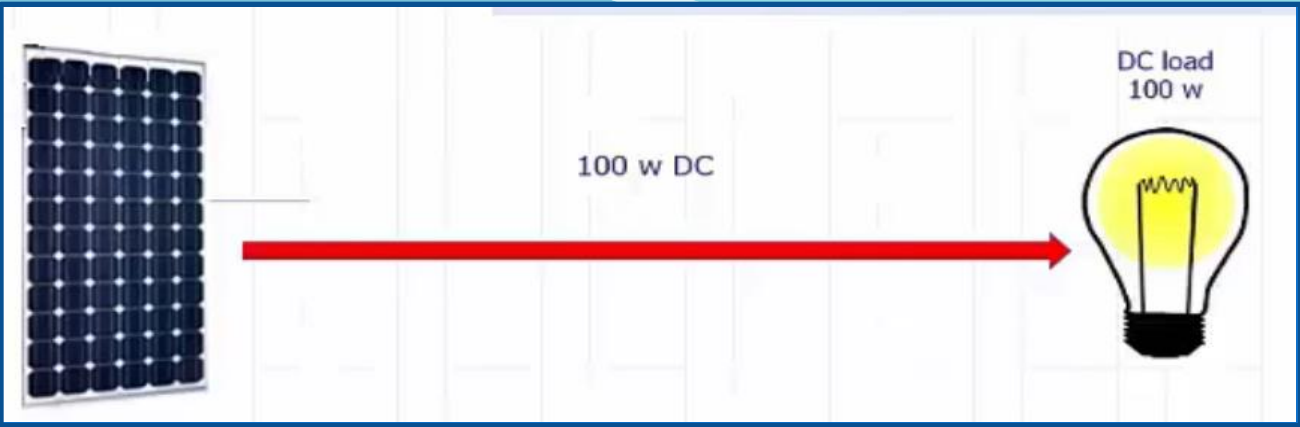
3-Battery Backup system



Backup solar pv system

4-Portable solar PV system





Specification of any solar panels depends on the system:

- 1- Select the type of system required.**
- 2- Select the loads required type.**
- 3-Select the type and capacity of inverter .**
- 4-Select the type and capacity of batteries.**
- 5-Select the size of the panels necessary for the system.**
- 6-Balance of system .**

Maximum AC Power Requirement

12

Appliance	Rated power(W)	No.	Hours per day used
30w light	180	6	8
45w fan	180	4	12
TV	200	1	6
Satellite TV	20	1	6
Refrigerator	500	1	5
Washer	1500	1	0.8
Toaster	<u>1500</u>	1	0.025
	4080 W		

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Solar Panels	Backup Power	RV & Marine	Power Centers	Package Systems

Special Pricing on Pallets of Solar Panels

Model	Watts	Quantity Per Pallet	Total Pallet Watts	Price Per Watt	Price
Astronergy 305 Poly Silver Frame	305	20	6,100	\$0.86	\$5,270

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- Offers a wide range of inverters to suit most any solar panel or system
- Forefront of Inverter technology
- [More about SMA Inverters](#)

Made In: Germany and USA
Warranty: 5-10 years

Model	Part Number	Watts	Type	Price
SMA Grid Tie Sunny Boy				
SMA Sunny Boy 240-US Micro Inverter	2960055	240	Grid Tie	\$190
SMA Sunny Boy 3800US-12	3960001	3,800	Grid Tie	\$1,955
SMA Sunny Boy 4000USS-12	3960002	4,000	Grid Tie	\$1,987
SMA Sunny Boy 5000US-12	3960003	5,000	Grid Tie	\$2,427
SMA Sunny Boy 6000US-12	3960004	6,000	Grid Tie	\$2,724
SMA Sunny Boy 7000US-12	3960005	7,000	Grid Tie	\$2,730
SMA Sunny Boy 8000US-12	3960006	8,000	Grid Tie	\$3,234
SMA Sunny Boy 3000TL-US-22	2931715	3,200	Grid Tie	\$1,519
SMA Sunny Boy 4000TL-US-22	2931716	4,200	Grid Tie	\$1,865
SMA Sunny Boy 5000TL-US-22	2931714	5,300	Grid Tie	\$2,269
SMA Sunny Boy 6000TL-US-12	2931717	6,300	Grid Tie	\$2,409
SMA Sunny Boy 7000TL-US-12	2931718	7,300	Grid Tie	\$2,520
SMA Sunny Boy 8000TL-US-12	2931755	8,300	Grid Tie	\$2,965
SMA Sunny Boy 9000TL-US-12	2931719	9,300	Grid Tie	\$2,990

Technical data**Input (DC)**

Max. usable DC power (@ $\cos \varphi = 1$)
Max. DC voltage
Rated MPPT voltage range
MPPT operating voltage range
Min. DC voltage / start voltage
Max. operating input current / per MPP tracker
Number of MPP trackers / strings per MPP tracker

Output (AC)

AC nominal power
Max. AC apparent power
Nominal AC voltage / adjustable
AC voltage range
AC grid frequency; range
Max. output current
Power factor ($\cos \varphi$)
Output phases / line connections
Harmonics

Efficiency

Max. efficiency
CEC efficiency

Protection devices

DC disconnection device
DC reverse-polarity protection
Ground fault monitoring / Grid monitoring
AC short circuit protection
All-pole sensitive residual current monitoring unit
Arc fault circuit interrupter (AFCI) compliant to UL 1699B

Sunny Boy 5000TL-US**208 V AC****240 V AC**

5300 W	
600 V	
175 - 480 V	
125 - 500 V	
125 V / 150 V	
30 A / 15 A	
4550 W	5000 W
4550 VA	5000 VA
208 V / ●	240 V / ●
183 - 229 V	211 - 264 V
60 Hz / 59.3 - 60.5 Hz	
22 A	
1	
1 / 2	
< 4%	

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SOLAR TECHNOLOGY

Model: Sunny Boy 5000TL-US

Brand: [SMA Inverters](#)Product Type: [Inverters](#)

Item:	Price:
2931714	\$2,269.00

Qty: [add to cart](#)

Sunny Boy 5000TL-US

SMA has introduced their next generation of home and light commercial grid-tie inverters designed to help you get the most out of your system. The Sunny Boy 5000TL-US ships with a handful of new features including an SMA exclusive Secure Power Supply (SPS) which can provide up to 1,500 watts of dedicated power in the event of a daytime power outage. [Watch the Secure Power Supply video](#)

- Simplified DC wiring saves on labor and materials
- Dual maximum power point tracking for more design options
- Reduce effects of partial system shading with OptiTrac™
- Built-in LCD screen for output display
- Flexible design and simple installation

By incorporating transformerless topology into the design, SMA has improved a variety of specifications making this a leading choice among professionals.

- Reduces weight for easier installation
- Increases CEC efficiency to 96.5%
- Provides greater operating voltage range
- Expands operating temperature range

By utilizing dual MPP trackers multiple roof orientations and system configurations can be easily managed by this unit. Partial system shading will no longer have as much impact on total system output.



Call Wholesale Solar for current pricing on Sunny Boy 5000-TL-US 5,300-watt inverter at 1 (800) 472-1142

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ELECTRICAL SPECIFICATIONS

STC rated output (P_{mpp})*	285 Wp	290 Wp	295 Wp	300 Wp	305 Wp	310 Wp
PTC rated output (P_{mpp})**	256.5 Wp	261.1 Wp	265.7 Wp	270.3 Wp	275 Wp	279.6 Wp
Standard sorted output	0/+5 Wp					
Warranted power output STC ($P_{mpp\ min}$)	285 Wp	290 Wp	295 Wp	300 Wp	305 Wp	310 Wp
Rated voltage (V_{mpp}) at STC	35.66 V	35.68 V	35.72 V	35.74 V	35.77 V	35.80 V
Rated current (I_{mpp}) at STC	8.04 A	8.15 A	8.30 A	8.40 A	8.53 A	8.68 A
Open circuit voltage (V_{oc}) at STC	44.77 V	44.90 V	45.03 V	45.16 V	45.29 V	45.42 V
Short circuit current (I_{sc}) at STC	8.80 A	8.84 A	8.87 A	8.91 A	8.95 A	8.99 A
Module efficiency	14.7%	14.9%	15.2%	15.4%	15.7%	15.9%
Rated output (P_{mpp}) at NOCT	199.0 Wp	202.5 Wp	206.0 Wp	209.5 Wp	213.0 Wp	216.5 Wp
Rated voltage (V_{mpp}) at NOCT	32.39 V	32.51 V	32.47 V	32.63 V	32.67 V	32.70 V
Rated current (I_{mpp}) at NOCT	6.14 A	6.23 A	6.34 A	6.42 A	6.52 A	6.62 A
Open circuit voltage (V_{oc}) at NOCT	41.08 V	41.20 V	41.32 V	41.44 V	41.56 V	41.68 V
Short circuit current (I_{sc}) at NOCT	6.80 A	6.83 A	6.86 A	6.89 A	6.92 A	6.95 A
Temperature coefficient (P_{mpp})	- 0.45%/K	Maximum system voltage UL				1000 Voc
Temperature coefficient (I_{sc})	+0.087%/K	Number of diodes				6 (or 3)

No of panel = $4080/305 = 13.3 = 14$ panels

Connect 7S2P $P_{max} = 4270w$ (STC)

$V_{ocmax} = V_{oc}(1 + T_{cmin} - 25) (\Delta v_{oc}/\Delta c)$

$V_{mmin} = V_{oc}(1 + T_{cmax} - 25) (\Delta v_{oc}/\Delta c)$

$T_c = T_a + (NOCT - 20)G/0.8$

G=0 at sunrise

G=1 at noon

NOCT = 47 $T_{cmax} = 50 + (47 - 20)1/0.8 = 84$ C

$V_{ocmax} = 45.29(1 + (-1 - 25)(-0.0311)) = 52V$

$V_{m-min} = 35.77(1 + (50 - 25)(-0.044)) = 26V$

$T_{cmin} = -1 \text{ C}$ $T_{cmax} = 84 \text{ C}$

$V_{oc \text{ max}} = 52\text{V}$ $V_{mmin} = 26\text{V}$

$V_{oc \text{ max}}(t) = 52 * 7 = 364\text{V}$

$V_{m \text{ min}}(t) = 26 * 7 = 182\text{V}$

Inverter cost = \$2299

Panels cost = \$5104

Rack mount price = \$1088

Wiring and protection = \$500

Installation = \$300

Total approx = \$9291



Thank you for your attention !