

PV- Power Solution

Archer Business Unit

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Photovoltaic power generation is based on the principle of photogenerated volt effect, using solar cells to directly convert sunlight energy into electrical energy.

The photovoltaic power generation system is mainly composed of three parts: solar panels (components), controllers and inverters, which are mainly composed of electronic components and do not involve mechanical parts, so the photovoltaic power generation equipment is extremely refined, reliable and stable, with long life and easy installation and maintenance.

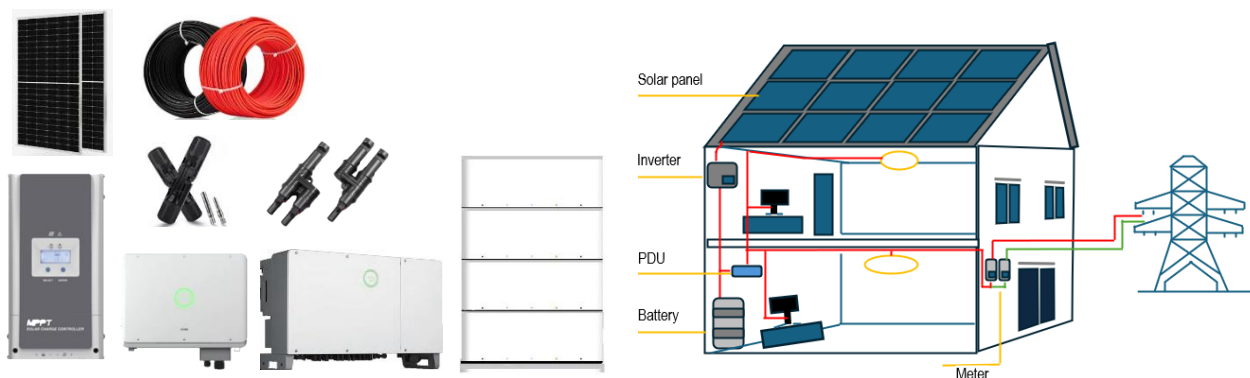


Figure 1 Solar system showing

PV- Power Solution

Grid-Connected PV system

PV systems are most commonly in the grid-connected configuration because it is easier to design and typically less expensive compared to off-grid PV systems, which rely on batteries. Grid-connected PV systems allow homeowners to consume less power from the grid and supply unused or excess power back to the utility grid (see Figure 2). The application of the system will determine the system configuration and size. For example, residential grid-connected PV systems are rated less than 20 kW, commercial systems are rated from 20 kW to 1MW, and utility energy-storage systems are rated at more than 1MW.

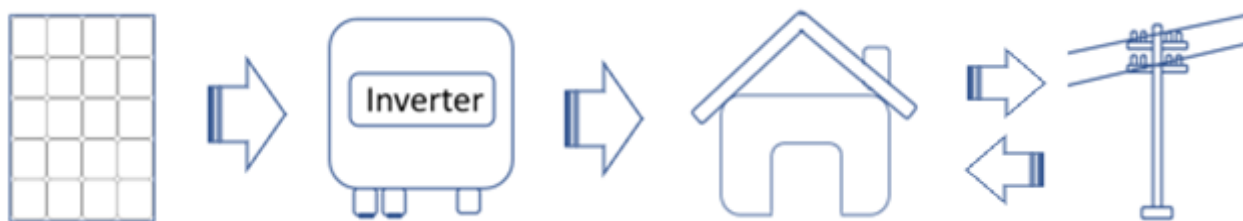


Figure 2 Grid connected PV system

Off-Grid (Stand-Alone) PV system

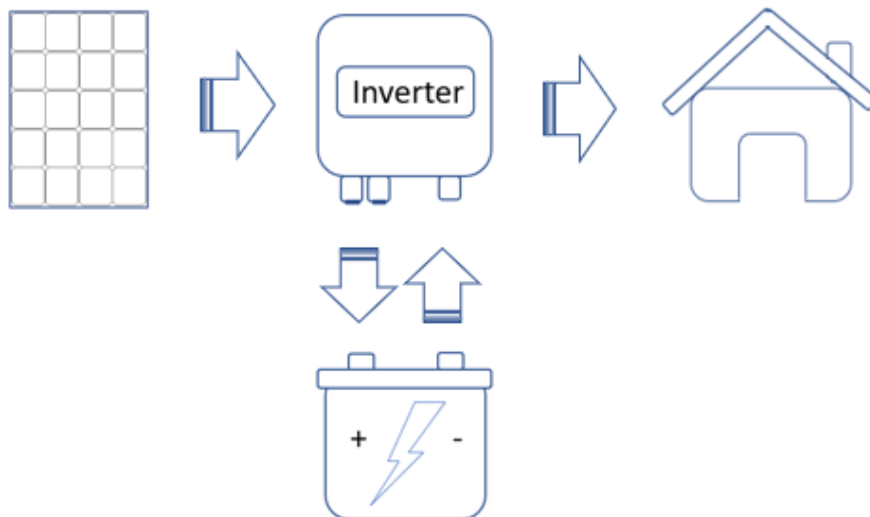


Figure 3 Off Grid PV system

Off-grid (stand-alone) PV systems use solar panels to charge banks of rechargeable batteries during the day for use at night when energy from the sun is not available.

The reasons for using an off-grid PV system include reduced energy costs and power outages, production of clean energy, and energy independence.

Off-grid PV systems include battery banks, inverters, charge controllers, battery disconnects, and optional generators.

Off- Grid PV system for telecommunication

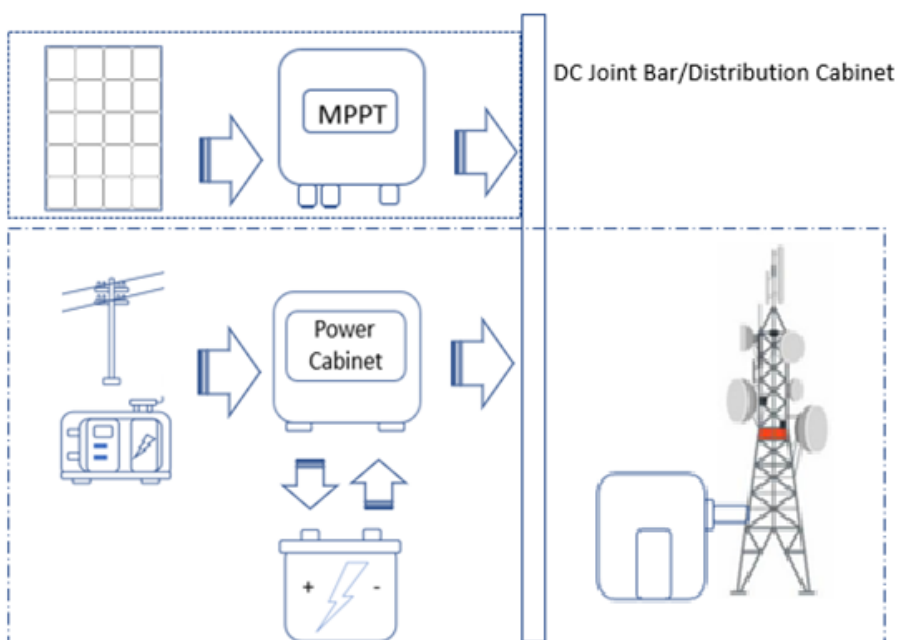


Figure 4 Off Grid PV system for telecom site

To set the imbed solar system voltage above the current power system, it will easy to tell system the power priority and use the PV power firstly. Since the MPPT output directly current, in the telecommunication use, no need additional inverter to exchange the power.

Main Products introduction

Solar Panel

Solar panels used in PV systems are assemblies of solar cells, typically composed of silicon and commonly mounted in a rigid flat frame. Solar panels are wired together in series to form strings, and strings of solar panels are wired in parallel to form arrays. Solar panels are rated by the amount of DC that they produce. Solar panels should be inspected periodically to remove dirt, debris, or snow, as well as to check electrical connections.

Since photovoltaics are adversely affected by shade, any shadow can significantly reduce the power output of a solar panel. The performance of a solar panel will vary, but in most cases, guaranteed power output life expectancy is between 10 years and 25 years. Solar panel power output is measured in watts. Power output ratings range from 350 W to 650W under ideal sunlight and temperature conditions.

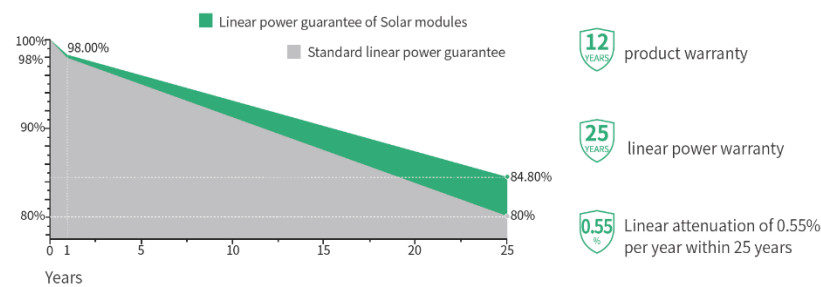


Figure 5 Monocrystalline PV modules

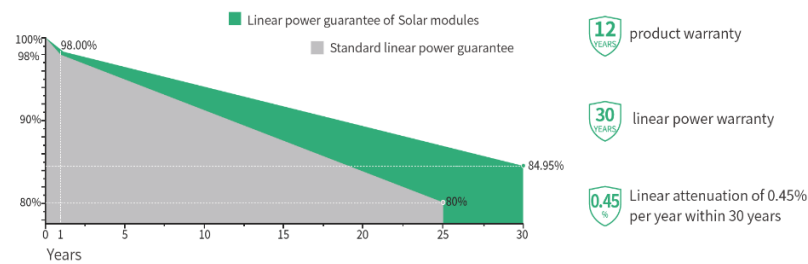


Figure 6 Bifacial Monocrystalline PV modules

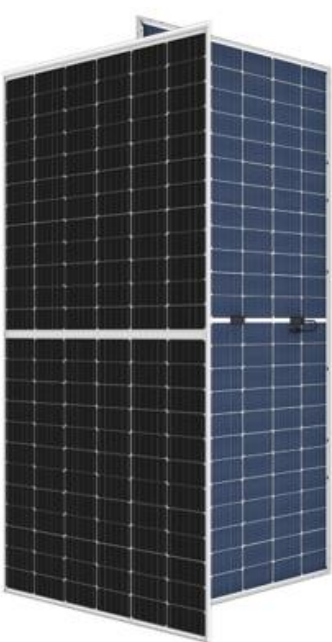


Figure 7 PV Panel showing

Table 1 Typical Product list (all product from 395w to 630w)

PN	Products
ZXM7-SH108-182-395W	10BB HALF-CELL Monocrystalline PERC PV Module, 395W
ZXM7-SH108-182-400W	10BB HALF-CELL Monocrystalline PERC PV Module, 400W
ZXM7-SH108-182-405W	10BB HALF-CELL Monocrystalline PERC PV Module, 405W
ZXM7-SH108-182-410W	10BB HALF-CELL Monocrystalline PERC PV Module, 410W
ZXM7-SH108-182-415W	10BB HALF-CELL Monocrystalline PERC PV Module, 415W
ZXM7-SHLDD132-182-485W	Bifacial double glass monocrystalline PERC PV module 485W

ZXM7-SHLDD132-182-490W	Bifacial double glass monocrystalline PERC PV module 490W
ZXM7-SHLDD132-182-495W	Bifacial double glass monocrystalline PERC PV module 495W
ZXM7-SHLDD132-182-500W	Bifacial double glass monocrystalline PERC PV module 500W
ZXM7-SHLDD132-182-505W	Bifacial double glass monocrystalline PERC PV module 505W
ZXM7-SHLDD132-182-510W	Bifacial double glass monocrystalline PERC PV module 510W
ZXM7-UH120-182-460W	16BB HALF-CELL Monocrystalline N-type TOPCon PV module 460W
ZXM7-UH120-182-465W	16BB HALF-CELL Monocrystalline N-type TOPCon PV module 465W
ZXM7-UH120-182-470W	16BB HALF-CELL Monocrystalline N-type TOPCon PV module 470W
ZXM7-UH120-182-475W	16BB HALF-CELL Monocrystalline N-type TOPCon PV module 475W
ZXM7-UH120-182-480W	16BB HALF-CELL Monocrystalline N-type TOPCon PV module 480W
ZXM7-UHLDD156-182-605W	Bifacial double glass monocrystalline N-type TOPCon PV module 605W
ZXM7-UHLDD156-182-610W	Bifacial double glass monocrystalline N-type TOPCon PV module 610W
ZXM7-UHLDD156-182-615W	Bifacial double glass monocrystalline N-type TOPCon PV module 615W
ZXM7-UHLDD156-182-620W	Bifacial double glass monocrystalline N-type TOPCon PV module 620W
ZXM7-UHLDD156-182-625W	Bifacial double glass monocrystalline N-type TOPCon PV module 625W
ZXM7-UHLDD156-182-630W	Bifacial double glass monocrystalline N-type TOPCon PV module 630W

Controller (MPPT)

MPPT (Maximum Power Point Tracking) is an essential technology that improves the efficiency and output of solar photovoltaic (PV) systems. Its purpose is to continuously optimize the maximum power point (MPP) of solar panels, enabling the extraction of the highest amount of power from sunlight.

Features

- 48V communication base station application
- Support customized development and design
- 19-inch standard rack-mounting
- Wall mounting rack
- 50-100A, 2.5kW-5kW capacity range
- Multiple parallel machines available
- RS485 communication, expansion of remote management and intelligent control of the entire system



Figure 8 Typical MPPT

Table 2 Solar controller typical product list

PN	Products
PR-MTAN-6210	MPPT output 24V 1500W
PR-MTAN-5415	MPPT output 48V 2500W
PR-MTAN-6415	MPPT output 48V 3000W
PR-MTAN-8415	MPPT output 48V 4000W
PR-MTAN-10415	MPPT output 48V 5000W

PR-MTAN-5420	MPPT output 48V 2500W
PR-MTAN-6420	MPPT output 48V 3000W
PR-MTAN-8420	MPPT output 48V 4000W
PR-MTAN-10420	MPPT output 48V 5000W

Solar Inverter

A solar inverter is really a converter, though the rules of physics say otherwise. A solar power inverter converts or inverts the direct current (DC) energy produced by a solar panel into Alternate Current (AC.)

Features

AC output, residential, commercial, company application
 Lightning protection, high precision leakage monitoring
 Low standby consumption, high efficiency, high yield
 APP connection, all data at real time
 Remote maintenance, remote configuration
 Quiet generation, no noise pollution
 Intelligent & grid-friendly, active response to grid dispatch



Figure 9 Typical Inverter

Table 3 Solar inverter typical product list

PN	Products
R6-3K-T2	PV inverter 3phase, 3kW, 2 MPPT, 16A/16A
R6-4K-T2	PV inverter 3phase, 4kW, 2 MPPT, 16A/16A
R6-5K-T2	PV inverter 3phase, 5kW, 2 MPPT, 16A/16A
R6-6K-T2	PV inverter 3phase, 6kW, 2 MPPT, 16A/16A
R6-8K-T2	PV inverter 3phase, 8kW, 2 MPPT, 16A/16A
R6-10K-T2	PV inverter 3phase, 10kW, 2 MPPT, 16A/16A
R6-12K-T2	PV inverter 3phase, 12kW, 2 MPPT, 16A/16A
R6-15K-T2	PV inverter 3phase, 15kW, 2 MPPT, 16A/16A
R6-15K-T2-32	PV inverter 3phase, 15kW, 2 MPPT, 32A/32A
R6-17K-T2-32	PV inverter 3phase, 17kW, 2 MPPT, 32A/32A
R6-20K-T2-32	PV inverter 3phase, 20kW, 2 MPPT, 32A/32A
R6-22K-T2-32	PV inverter 3phase, 22kW, 2 MPPT, 32A/32A
R6-25K-T2-32	PV inverter 3phase, 25kW, 2 MPPT, 32A/32A
R6-25K-T3-32	PV inverter 3phase, 25kW, 3 MPPT, 32A/32A/32A
R6-30K-T3-32	PV inverter 3phase, 30kW, 3 MPPT, 32A/32A/32A
R6-33K-T3-32	PV inverter 3phase, 33kW, 3 MPPT, 32A/32A/32A
R6-36K-T3-32	PV inverter 3phase, 36kW, 3 MPPT, 32A/32A/32A
R6-36K-T4-32	PV inverter 3phase, 36kW, 4 MPPT, 32A/32A/32A/32A
R6-40K-T4-32	PV inverter 3phase, 40kW, 4 MPPT, 32A/32A/32A/32A

R6-50K-T4-32	PV inverter 3phase, 50kW, 4 MPPT, 32A/32A/32A/32A
C6-75K-T6	PV inverter 3phase, 75kW, 6 MPPT, 6*30A
C6-100K-T9	PV inverter 3phase, 100kW, 9 MPPT, 6*30A
C6-125K-T12	PV inverter 3phase, 125kW, 12 MPPT, 12*30A

Battery

Storage battery is an electrical device that stores the obtained electrical energy in the form of chemical energy and converts chemical energy into electrical energy.

Lithium batteries are a type of battery that uses lithium metal or lithium alloy as the positive/negative electrode material and uses a non-aqueous electrolyte solution.

Common lithium battery packs have several styles such as rack mounting, wall mounting, and stacking. Customers can choose different styles according to their actual needs.

Features

High quality LFP cells

High rate charge / discharge current

High efficiency between charge and discharge

Multiple protection methods based on patented

Integrated with advanced BMS

RS485 communication port

Design standard

IEC 62619, IEC 62620, CE, UL 1973, UL 1642, UN38.3



Figure 10 Typical Battery

Table 4 Battery typical product list

PN	Products
PR-BA1-BR-3L	Battery set 3 layer, 7.68kWh, stand
PR-BA1-BR-4L	Battery set 3 layer, 10.24kWh, stand
PR-BA1-BR-5L	Battery set 3 layer, 12.80kWh, stand
PR-BA1-BR-6L	Battery set 3 layer, 15.36kWh, stand
PR-BA1-BR-7L	Battery set 3 layer, 17.92kWh, stand
PR-BA1-BR-8L	Battery set 3 layer, 20.48kWh, stand
PR-BA2-BR-5kW	Battery set 5kWh, stand
PR-BA2-BR-10kW	Battery set 10kWh, stand
PR-BA2-BR-15kW	Battery set 15kWh, stand
PR-BA2-BR-20kW	Battery set 20kWh, stand
PA-BAT-VT48100E-3U	Battery 48V100A, 3U, 19" mounting
PR-BAT-T48100RC-3.5U	Battery 48V100A, 3.5U, 19" mounting
PR-BAT-T48150RC-3.5U	Battery 48V150A, 3.5U, 19" mounting

Cable and connector

Cable conductor adopting high-quality tinned copper, which has characteristics such as oxidation resistance, rust resistance, and good conductivity. The internal use of 99.98% pure copper has low resistance and can reduce the power loss during current conduction.

The insulation adopting environmentally material, radiation cross-linked, Low smoke zero, halogen free flame-retardant polyolefin (XLPO), which is high and low temperature resistant, ultraviolet resistant, corrosion resistant, and has a long service life.

Features

- TUV certificate
- EN 50618 certificated
- 2.5-10mm² copper wire
- Temperature rating: -40°C to +90°C
- Max. Conductor temperature: 120°C
- Fire retardant & UV resistance



Figure 11 Solar cable

Table 5 Solar cable typical product list

PN	Products
H1Z2Z2-K 1*2.5mm ² BK	Photovoltaic cable, H1Z2Z2-K 1*2.5mm ² , black, insulation and Black jacket
H1Z2Z2-K 1*2.5mm ² RD	Photovoltaic cable, H1Z2Z2-K 1*2.5mm ² , red, insulation and Black jacket
H1Z2Z2-K 1*4mm ² BK	Photovoltaic cable, H1Z2Z2-K 1*4mm ² , black, insulation and Black jacket
H1Z2Z2-K 1*4mm ² RD	Photovoltaic cable, H1Z2Z2-K 1*4mm ² , red, insulation and Black jacket
H1Z2Z2-K 1*6mm ² BK	Photovoltaic cable, H1Z2Z2-K 1*6mm ² , black, insulation and Black jacket
H1Z2Z2-K 1*6mm ² RD	Photovoltaic cable, H1Z2Z2-K 1*6mm ² , red, insulation and Black jacket
H1Z2Z2-K 1*10mm ² BK	Photovoltaic cable, H1Z2Z2-K 1*10mm ² , black, insulation and Black jacket
H1Z2Z2-K 1*10mm ² RD	Photovoltaic cable, H1Z2Z2-K 1*10mm ² , red, insulation and Black jacket

MC4 PV connector is an indispensable component of solar PV power station, and its main role is to transmit the electrical energy generated by solar panels to the power grid. Properly connecting the MC4 PV connector cable can not only ensure the normal operation of the power station, but also reduce power loss and improve power generation efficiency.

Feature

- 1500V DC (TUV certification)
- 30A, 50A, 65A capacity
- Flame-retardant shell
- High waterproof level IP66
- Temperature rating: -40°C to +90°C



Figure 12 MC4 plug

Table 6 MC4 plug typical product list

PN	Products
PR-PAD-MC4-2T1	MC4 branch adapter 2 to 1, in pairs
PR-PAD-MC4-1M2F	MC4 branch adapter, 1 male to 2 female
PR-PAD-MC4-1F2M	MC4 branch adapter, 1 female to 2 male
PR-PAD-MC4M-SQ6	MC4 power connector male, for photovoltaic cable 2.5-6mm ² , 50A
PR-PAD-MC4F-SQ6	MC4 power connector female, for photovoltaic cable 2.5-6mm ² , 50A
PR-PAD-MC4-SQ6	MC4 power connector male & female, for photovoltaic cable 2.5-6mm ² , 50A
PR-PAD-MC4M-SQ6A	MC4 power connector male, for photovoltaic cable 2.5-6mm ² , 30A
PR-PAD-MC4F-SQ6A	MC4 power connector female, for photovoltaic cable 2.5-6mm ² , 30A
PR-PAD-MC4-SQ6A	MC4 power connector male & female, for photovoltaic cable 2.5-6mm ² , 30A
PR-PAD-MC4M-SQ10	MC4 power connector male, for photovoltaic cable 10mm ² , 65A
PR-PAD-MC4F-SQ10	MC4 power connector female, for photovoltaic cable 10mm ² , 65A
PR-PAD-MC4-SQ10	MC4 power connector male & female, for photovoltaic cable 10mm ² , 65A

Combined box

A PV combiner box receives the output of several solar panel strings and consolidates this output into one main power feed that connects to an inverter. PV combiner boxes are normally installed close to solar panels and before inverters. PV combiner boxes can include overcurrent protection, surge protection, pre-wired fuse holders, and preconfigured connectors for ease of installation to the inverter. The use of pre-wired connectors saves running wires to the inverter. PV combiner boxes should be inspected periodically for leaks or loose connections.

PV combiner boxes are not required for every PV system installation. For example, when there are only two or three strings of solar panels, a combiner box may not be required. In these cases, the strings of solar panels are connected directly to the inverter.

Feature

- High grade ABS/PC box, UV resistance
- Popular MCB, SPD brand selected
- Pre-assembled internal cable
- Pole mounting
- Stainless steel bracket

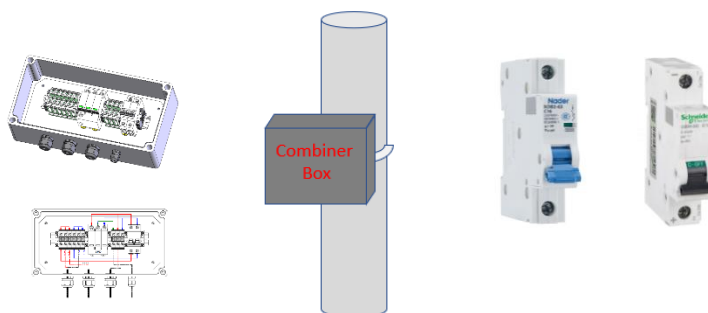


Figure 13 Power distribution box

DC/AC Isolator Switch

An Isolating switch is a switching device that is mainly used to "isolate the power supply, reverse the gate operation, and connect and cut off the small current circuit". When the disconnecter is in different positions, there is an insulation distance between the contacts that meet the specified requirements and an obvious disconnection mark, and when the position is closed, it can carry the current under normal circuit conditions and the current under abnormal conditions (such as short circuit) within the specified time.

Features

Outdoor application, IP66

1P- 4P available

Current range: 10-63A

Voltage range: 1000V

BS-EN60947, IEC60947-3, AS/NZS60947.3:2015

Wall-mounted design, Flexible installation.

Rational Operational design prevents, reverse/incorrect rotation



Figure 14 Isolator Switch

Return on cost

Return on cost= Revenue from electricity generation – system hardware cost- system engineering cost- system maintenance cost

➤ Calculation I

$E_p = H \times P \times K$

E_p --- Solar power generation

H --- The peak sun hours/ day

The cumulative total amount of solar irradiance over a period of time is converted into the duration of continuous irradiation of a light source with an irradiance of $1000\text{W}/\text{m}^2$, and its unit is hours (h)

P ---- Capacity of the solar panel, as request

K ---- Overall effectiveness, normally take 80%

Revenue to year= $E_p \times \text{electricity fee (in local)} \times 365$

General revenue= Yearly revenue $\times 25 \times 90\%$, linear power warranty $> 80\%$ after 25years

➤ Calculation II

Total cost =Solar panel + MPPT (inverter) + accessories+ engineering cost

All costs are by watt, match to the power generation unit

Normally the engineering cost is about 15-20% to the hardware

➤ Calculation III

Return on cost (years)= Total cost/ Revenue to year