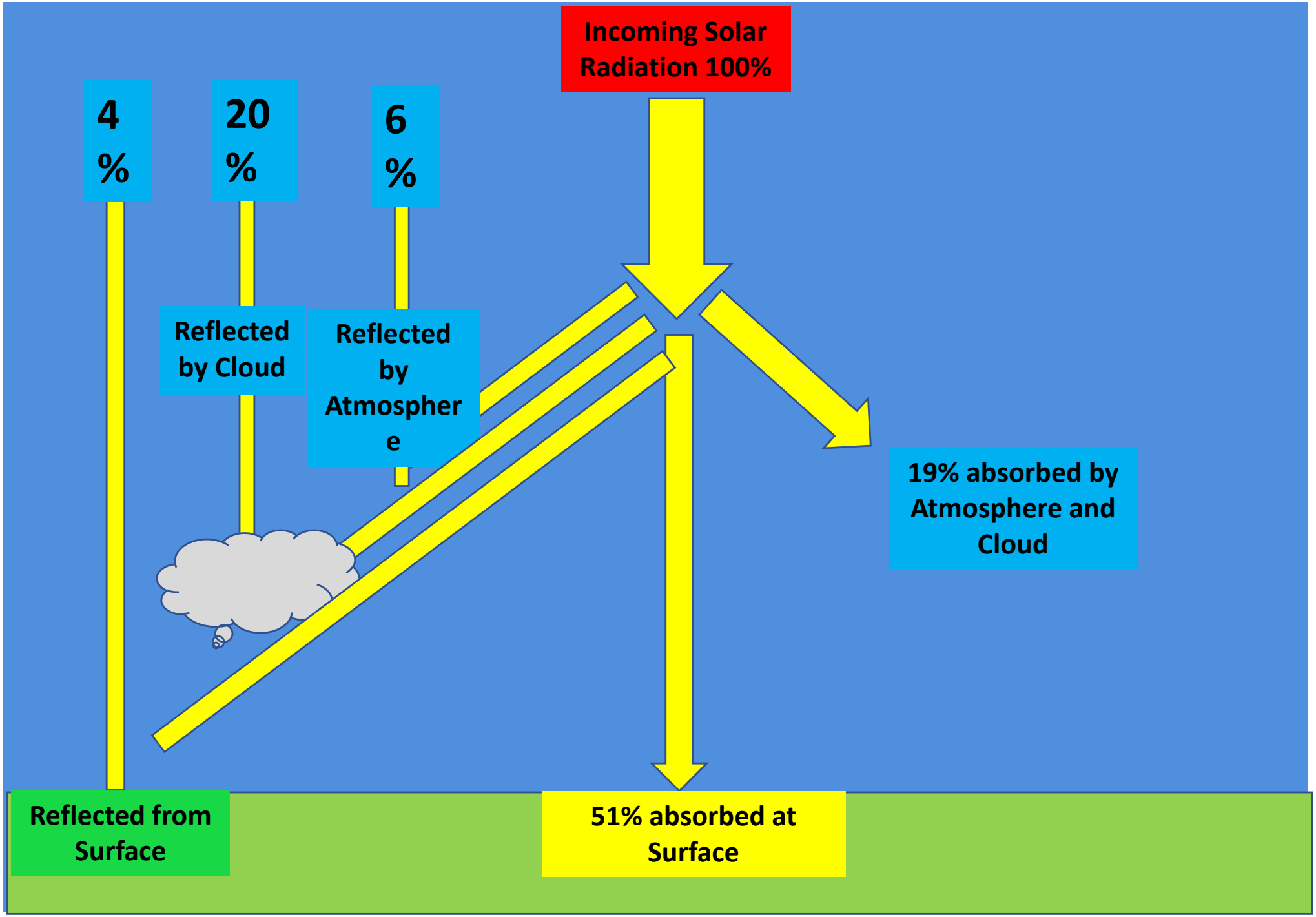
Federation of Myanmar Engineering Society

Knowledge Sharing
for
Single phase rooftop home solar system

U Shwe
BE(EP) 1977(Nov)
PE0063(BS),
ACPE 00700/MM
National Counterpart

Date - 23/12/2023

Solar irradiation



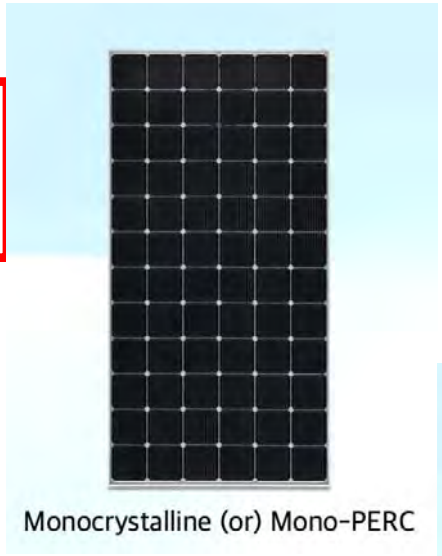
Main materials requirement for Rooftop Solar system

- Solar Panels (Photovoltaic Module) (PV Module)
- Solar Charge Controller
- Inverters
- Batteries
- Circuit Breakers, Protected devices and Connection cables & wires and accessories

Solar Panels (Photovoltaic Module) (PV Module)

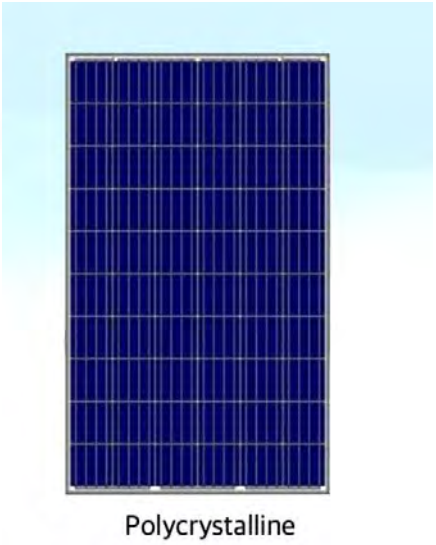
Types of solar panels (Photovoltaic Module) (PV Module)

Mono Crystalline Solar Panels



Monocrystalline (or) Mono-PERC

Poly Crystalline Solar Panels



Polycrystalline

Thin Film Solar Panels

Thin film

Bifacial monocrystalline silicon PV module

The solar panels can be divided into 4 major categories:

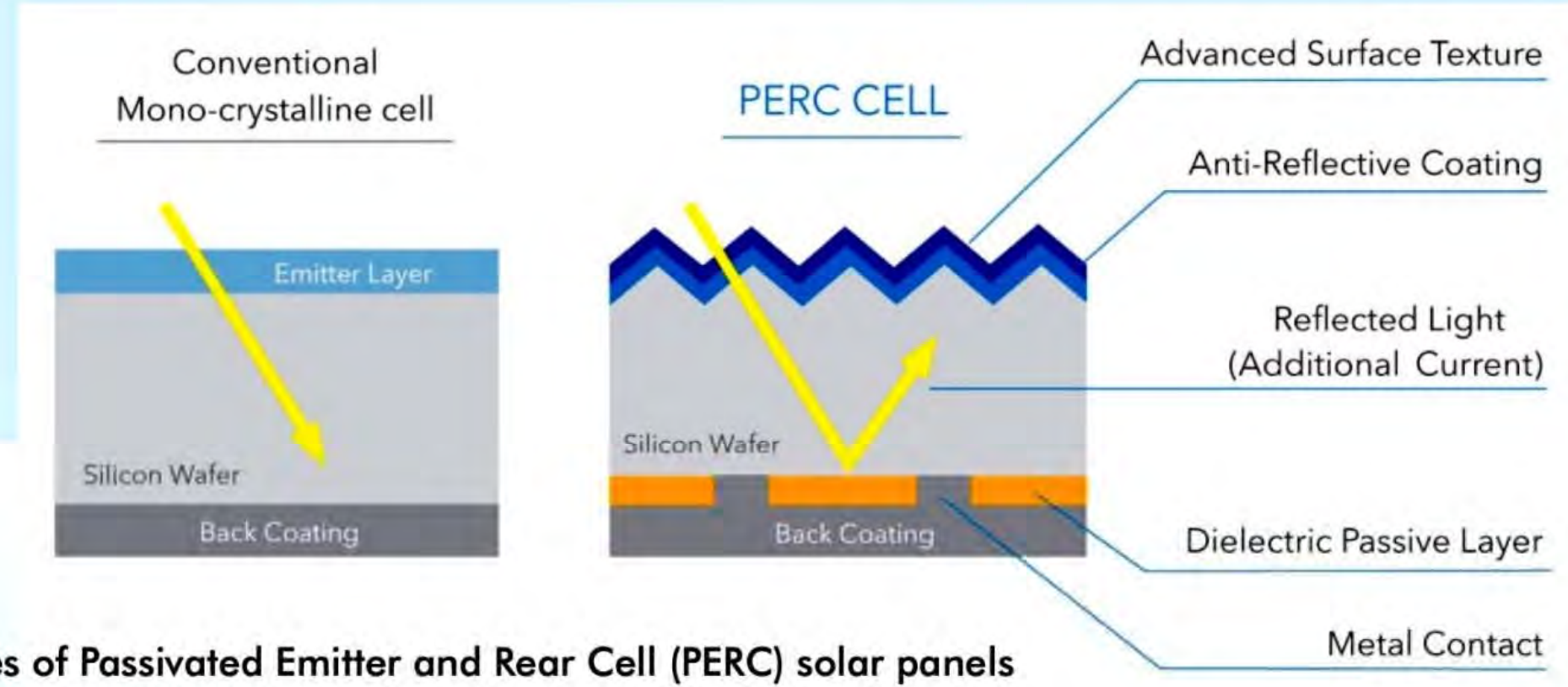
- Monocrystalline solar panels
- Polycrystalline solar panels
- Passivated Emitter and Rear Contact cells (PERC) solar panels
- Thin-film solar panels

The solar panels are determined by the type of solar cells present in it. Each ce
has a unique characteristic and has a different appearance.

Solar Panel Types by Efficiency

- **Monocrystalline or PERC (20% and up)**
- **Polycrystalline (15% ~ 17%)**
- **Thin-film**
  - Copper Indium Gallium Selenide (CIGS) thin-film (13% ~ 15%)
  - Cadmium Telluride (CdTe) thin-film (9% ~ 11%)
  - Amorphous Silicon (a-Si) thin-film (6% ~ 8%)

Passivated Emitter and Real Cell (PERC) Solar Panel



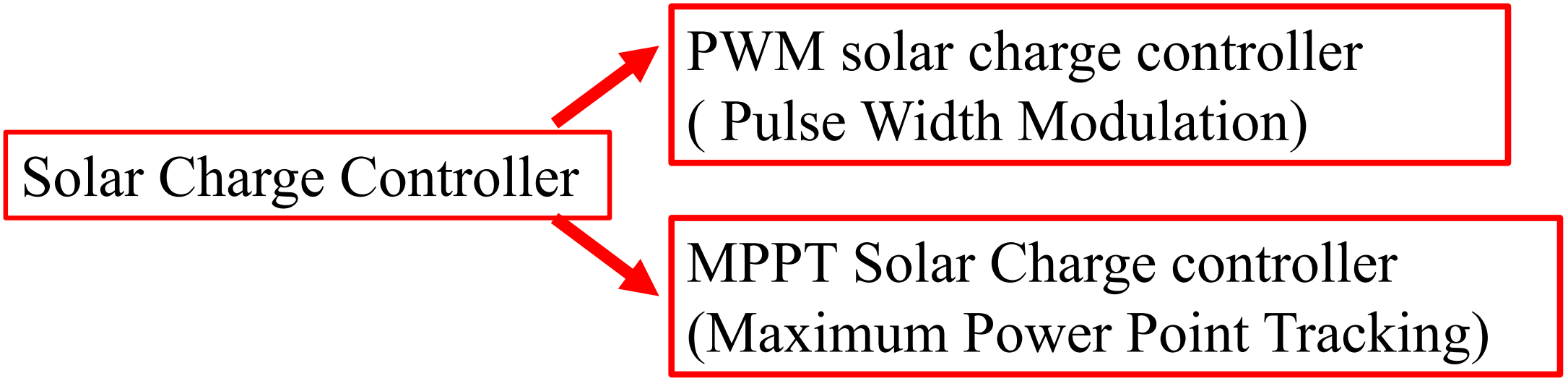
Features of Passivated Emitter and Rear Cell (PERC) solar panels

- PERC solar panels are more efficient as compared to traditional solar panels as they absorb more sunlight.
- There is an additional layer at the back of the panels which reflects the unabsorbed sunlight back to the sola cells for further absorption of the sunlight.

Comparison of types of solar panels on cost, Efficiency & Appearance

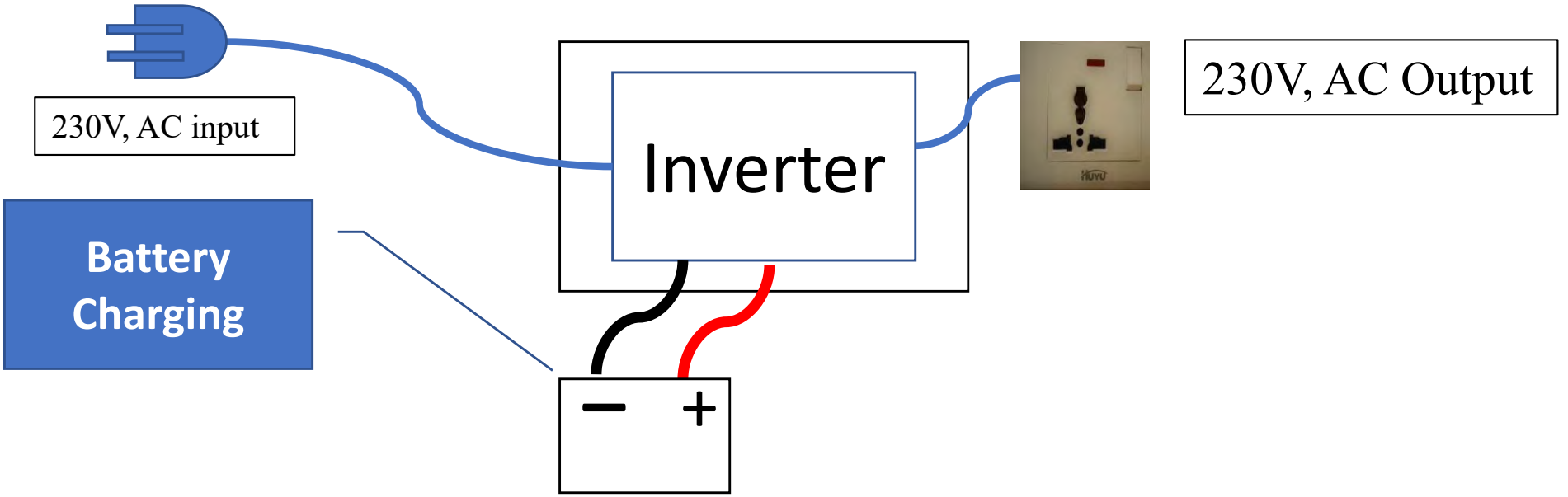
Particulars	Monocrystalline	Polycrystalline	Mono-PERC	Thin-film
Cost	High	Medium	Highest	Lower
Efficiency	High	Medium	Highest	Less
Appearance	Black/ Darker colour with octagonal shape	Blue colour with square edges	Black and rounded edges	Depends on the variant
Advantages	Energy efficient Heat resistant	Affordable Less wastage	Most efficient Less space required	Lowest installatio cost Lightweight
Disadvantages	Expensive High carbon footprint	Low heat resistance Lower energy efficiency	Most expensive	Shorter life span Lower efficiency

Solar Charge Controller

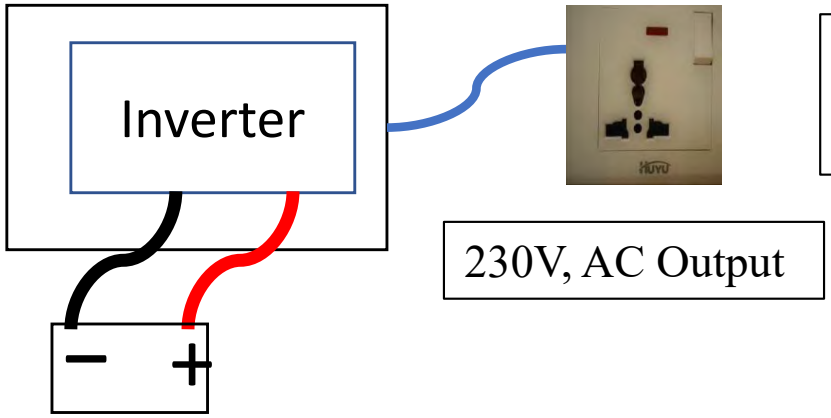


Inverters

Normal Inverters



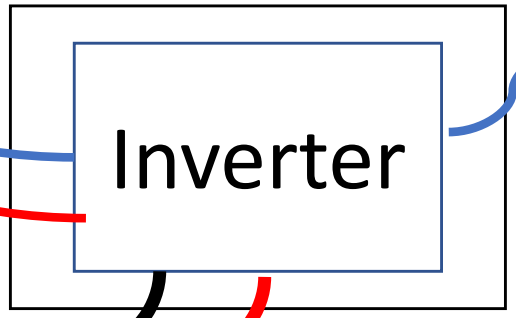
Inverter battery is charged with **DC charger** power by normal AC power from home and Convert from DC to AC by **Inverter,** produced output 230 AC to use home electric utilities such as, lightings and powers.

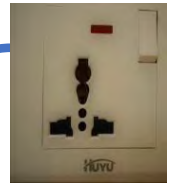


230V, AC Output still supply when input AC power is failure.

OFF Grid Solar Inverters

Inverter battery is charged by Sun's radiation.
Solar panel output Voltage charge to battery with built in solar charged controller and convert DC to AC by Inverter.

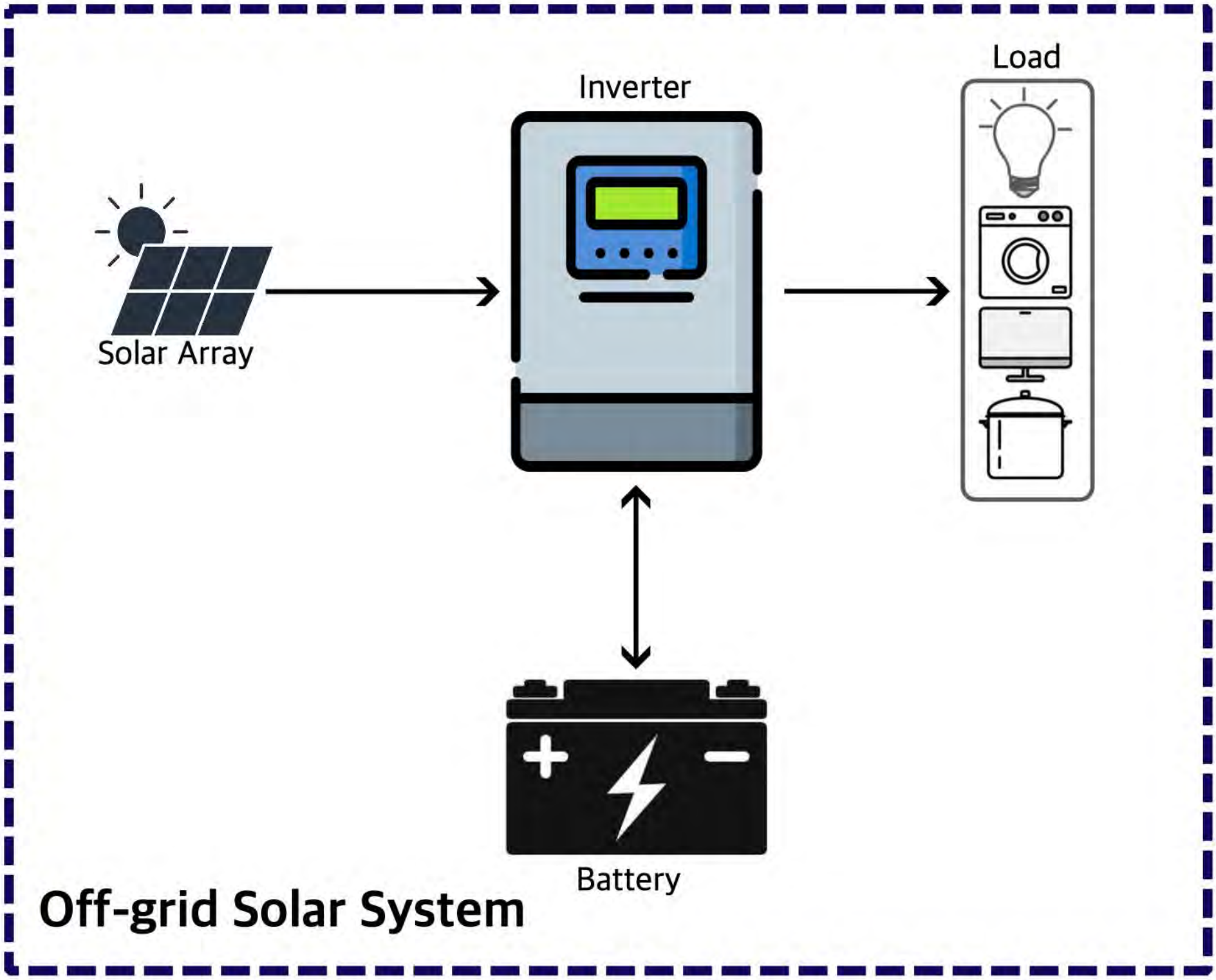




230V, AC Output

Day Time AC power can use the whole Sunshine time.

Night Time AC power can use depend on battery's Storage capacity.


Load
Inverter
Solar Array
Battery
Off-grid Solar System

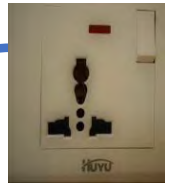
Hybrid Solar Inverters

Inverter battery is charged by Sun's radiation.
Solar panel output Voltage charge to battery with built in solar charged controller as well as convert DC to AC by Inverter.
If Sun radiation is not enough to charge battery or the night time battery can charged by built in battery charger with home power.

230V, AC input

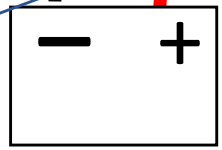
Solar

Inverter

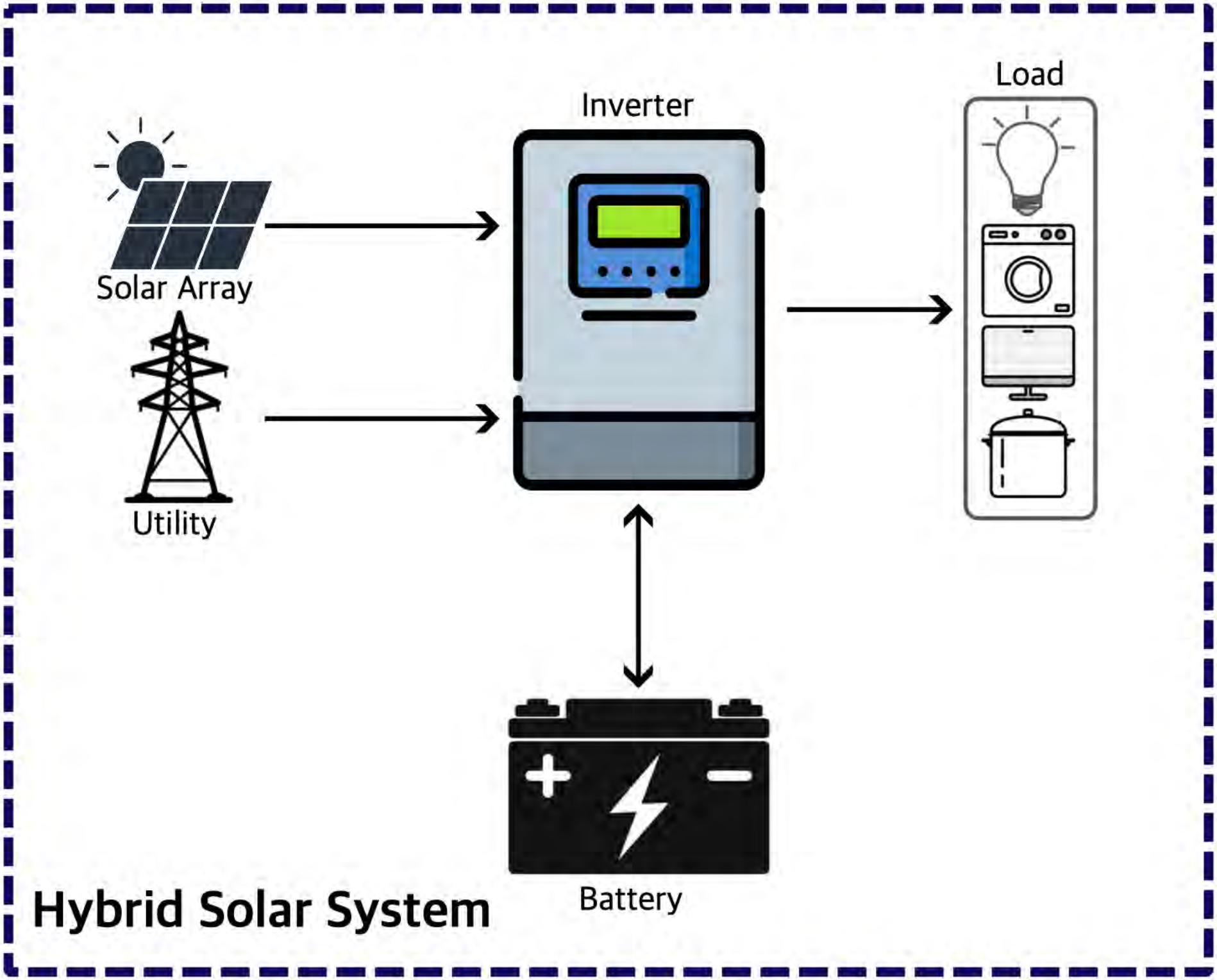


230V, AC Output

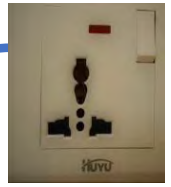
Battery Charging



Day Time AC power can use the whole day.
Night Time AC power can use depend on battery's Storage power if Grid power failure time.


Load
Inverter
Solar Array
Utility
Battery
Hybrid Solar System

ON Grid Solar Inverters (Single Phase)



Inverter

230V, AC

No use battery

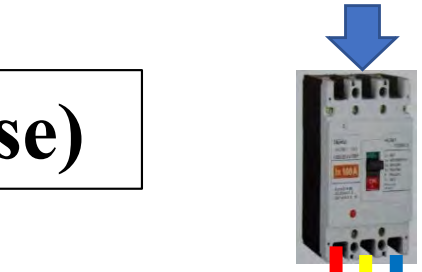
Solar

Inverter will produce with reference voltage of Grid power. No output if No Grid power

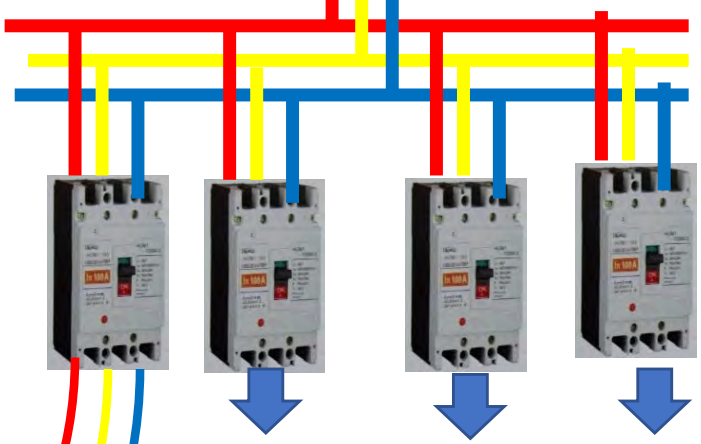
ON Grid Solar Inverters (Single Phase)

Inverter will produce with reference voltage of Grid power. No output if No Grid power

ON Grid Solar Inverters (Three Phase)



From Grid Power



Load Load Load

Inverter will produce with reference voltage of Grid power.
No output if No Grid power

Which is better on-grid or off-grid solar system?

Especially for residential houses, on –grid solar systems are good in that they do not require bulky and costly battery storage solutions, and you will also need fewer solar panels than you would if you were on an off-grid system- due to no need for producing extra power when there is no sunlight.

It is possible for stable power supply countries. Solar power is installed just for energy saving.

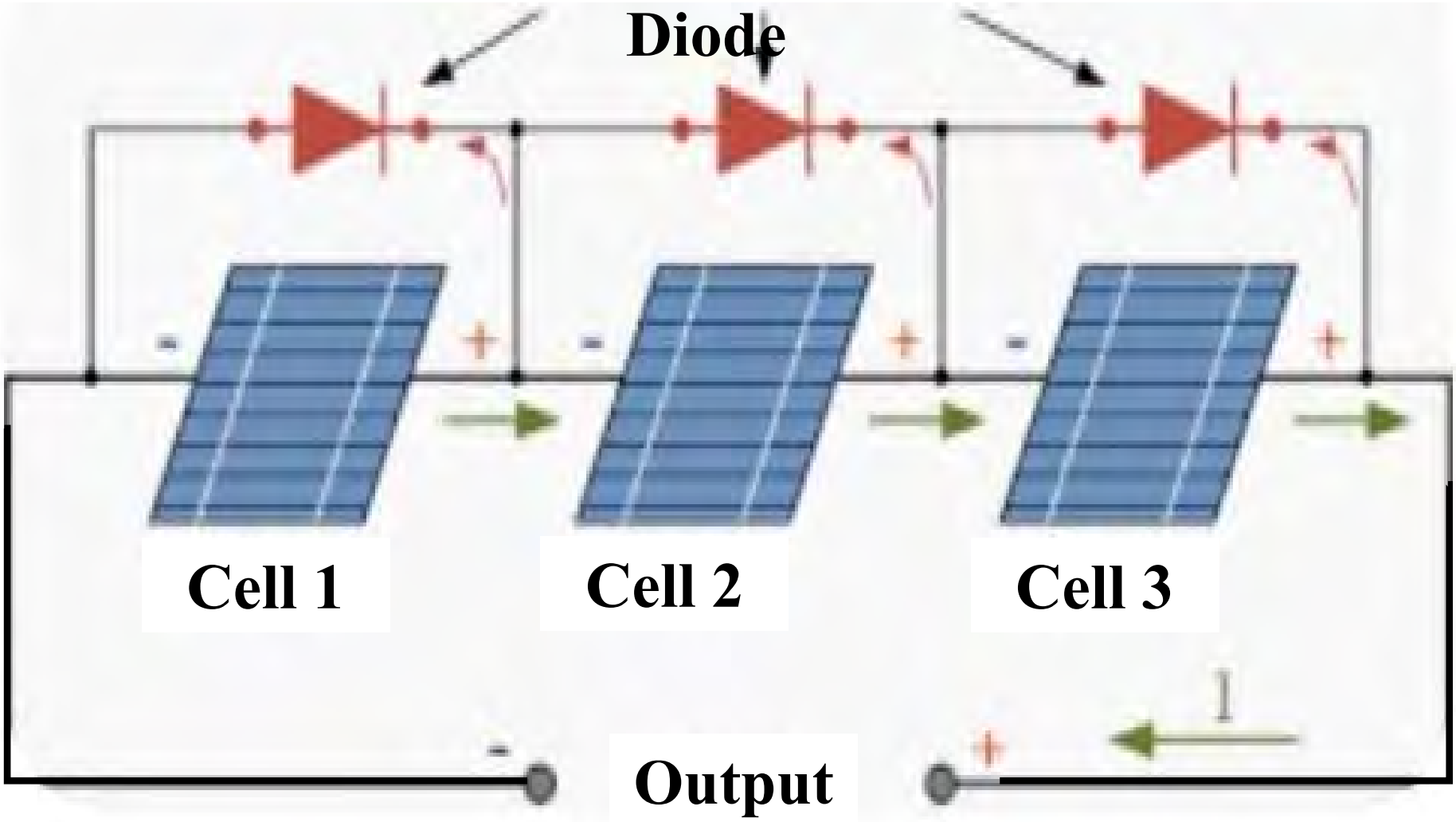
For our country, necessary to install Hybrid solar system with energy storage batteries.

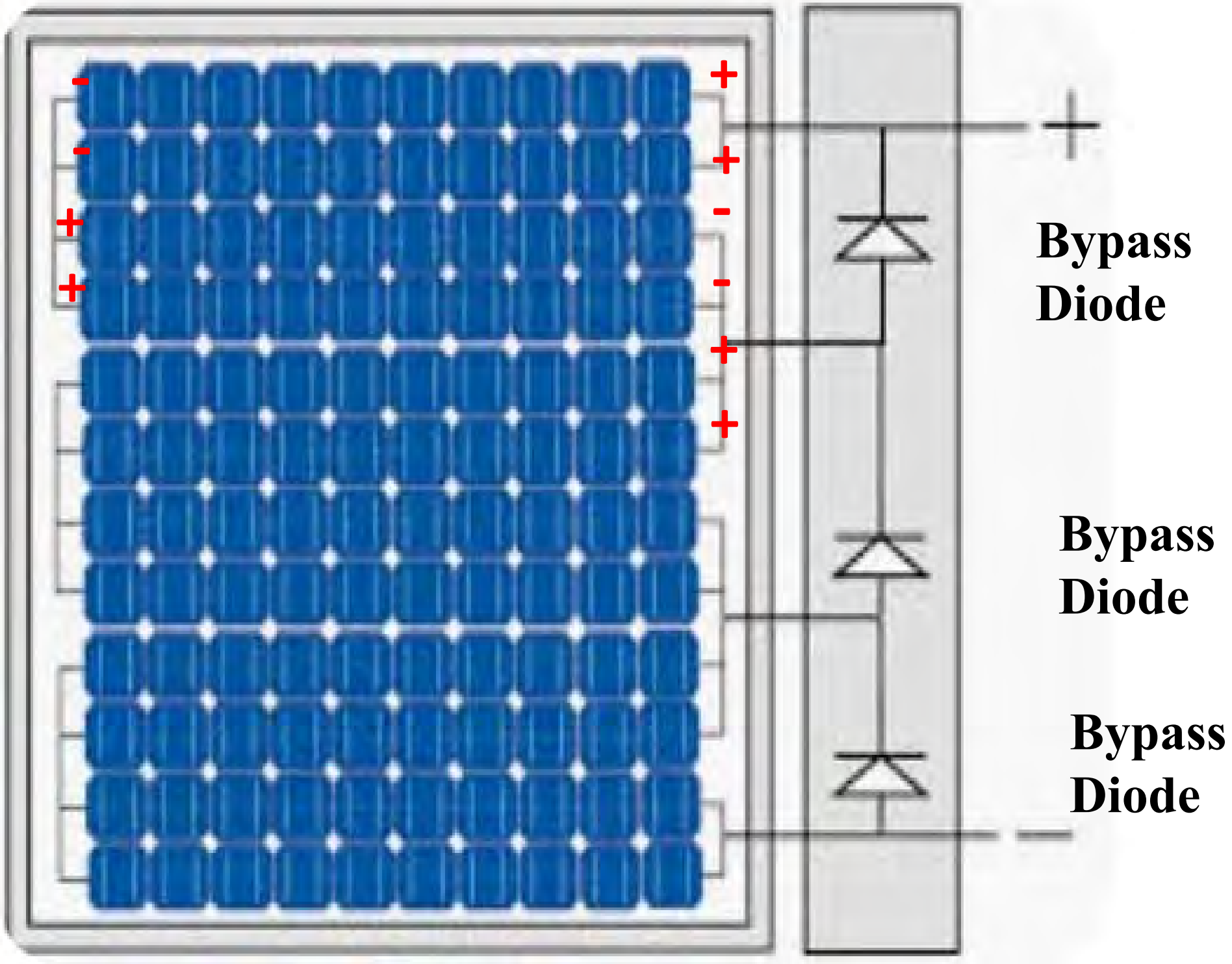
Notice points when solar panels installation

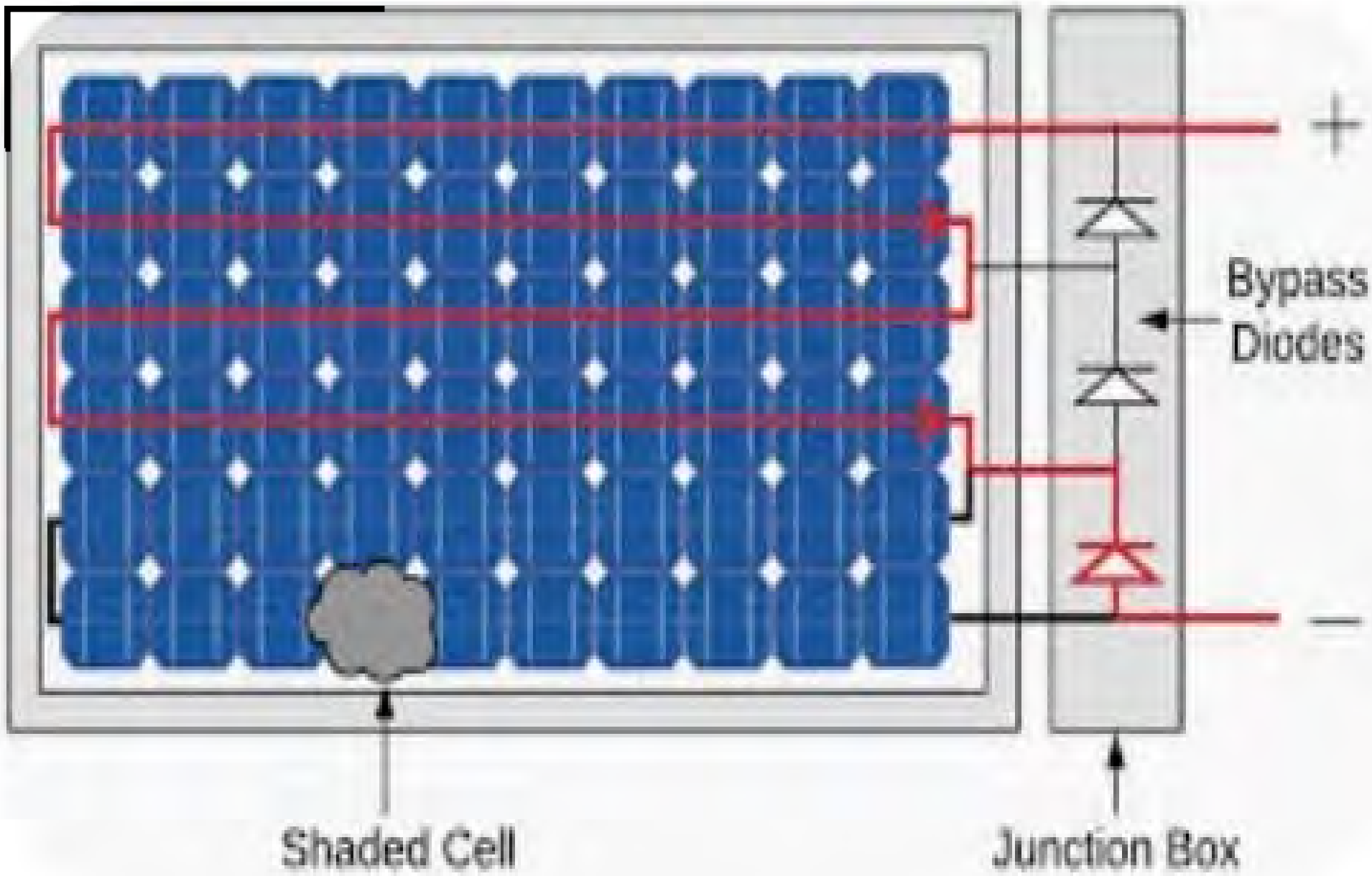
When solar panels are connected in series.

Bypass diodes should be used in each parallel connected branches.

Cell connection in solar module




Bypass Diode
Bypass Diode
Bypass Diode

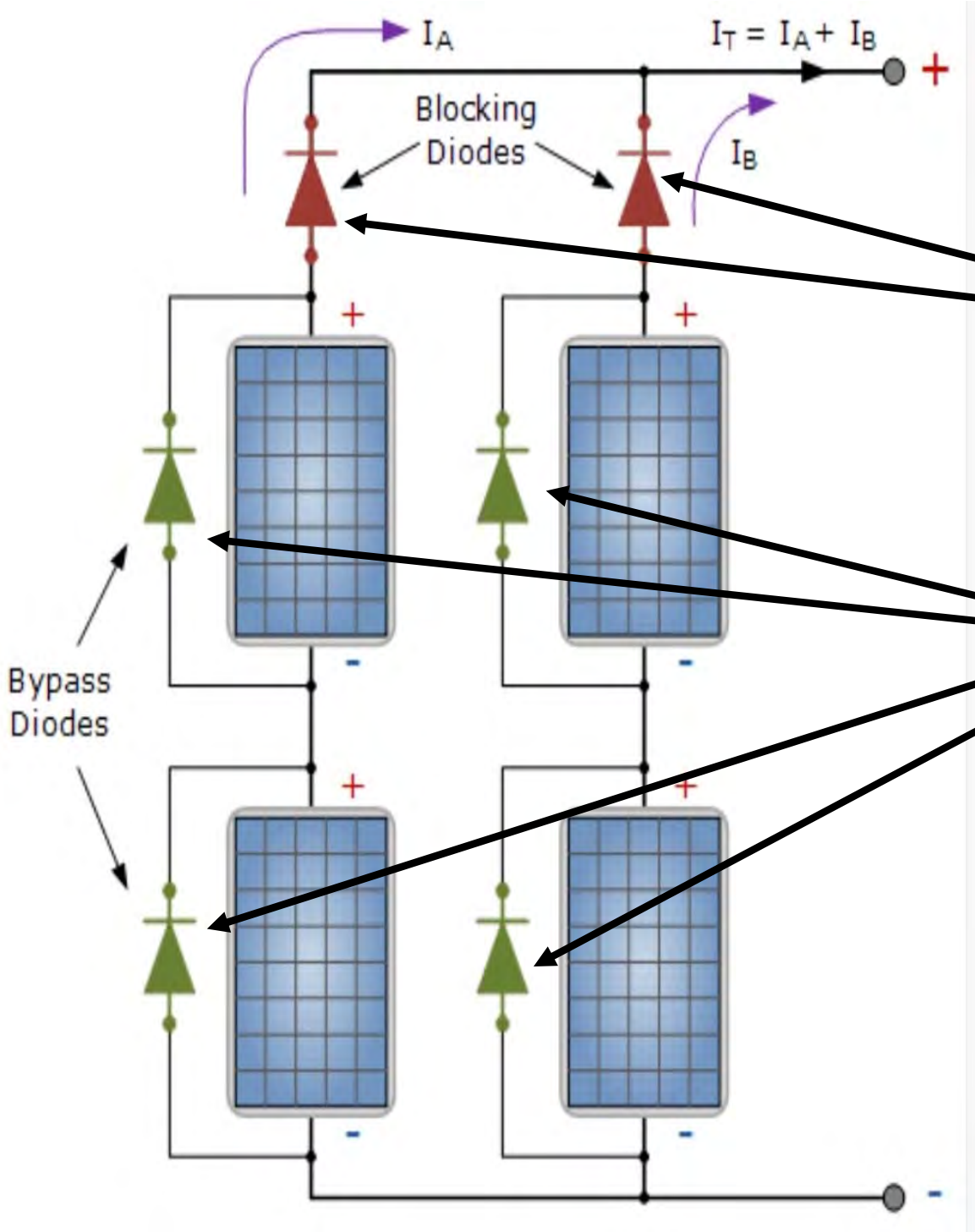

+
Bypass
Diodes
–
Shaded Cell
Junction Box

Notice points when solar panels installation

When solar panels are connected in parallel,

Blocking diodes should be used in each parallel connected branches.

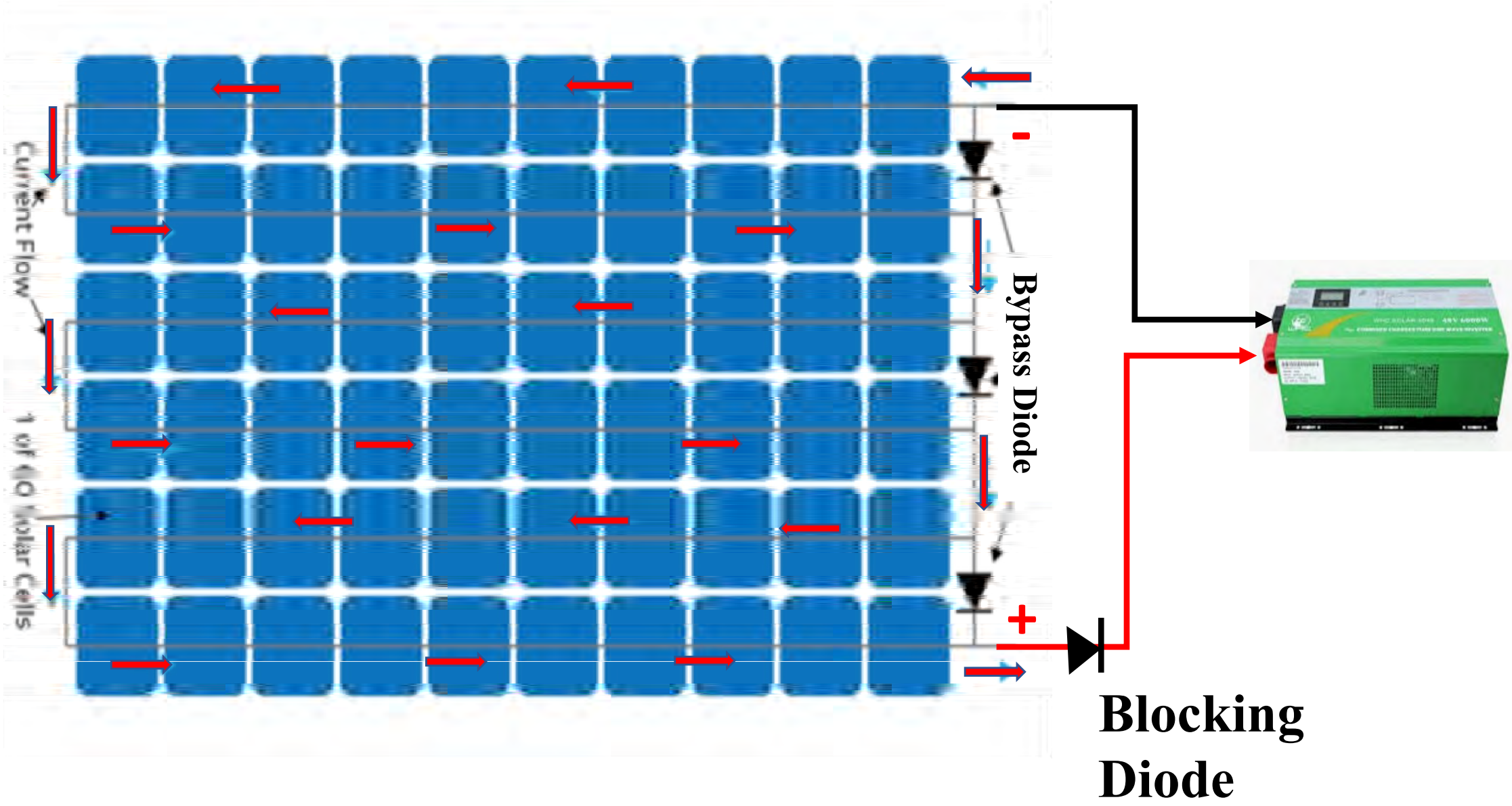
Two series solar panels in parallels



Blocking Diodes

Bypass Diodes

Current flow of Solar Panel and Inverter connection



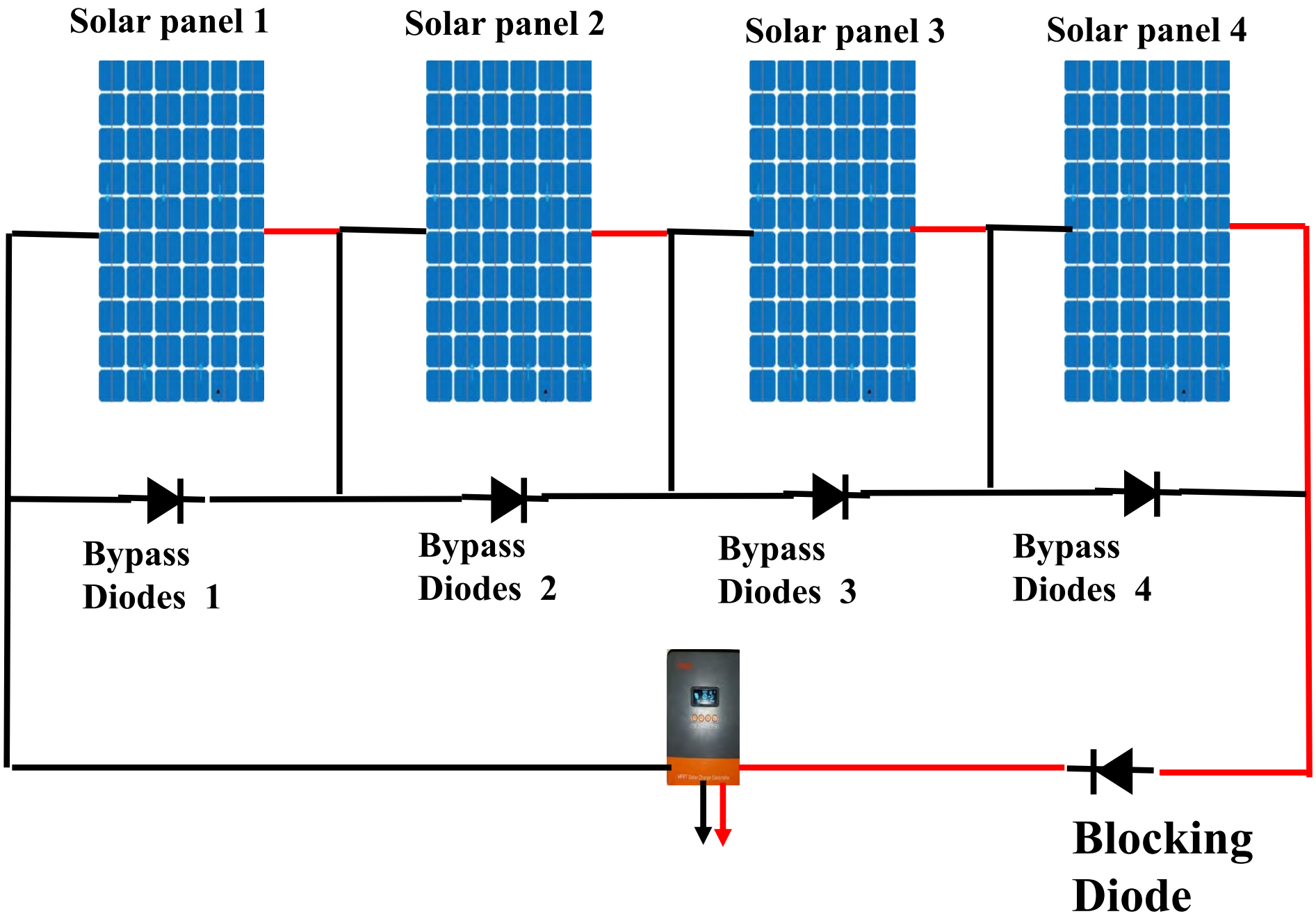
Bypass diodes can be installed in the module junction box or integrated into the module itself.

The bypass diodes should be installed in parallel to the panel.

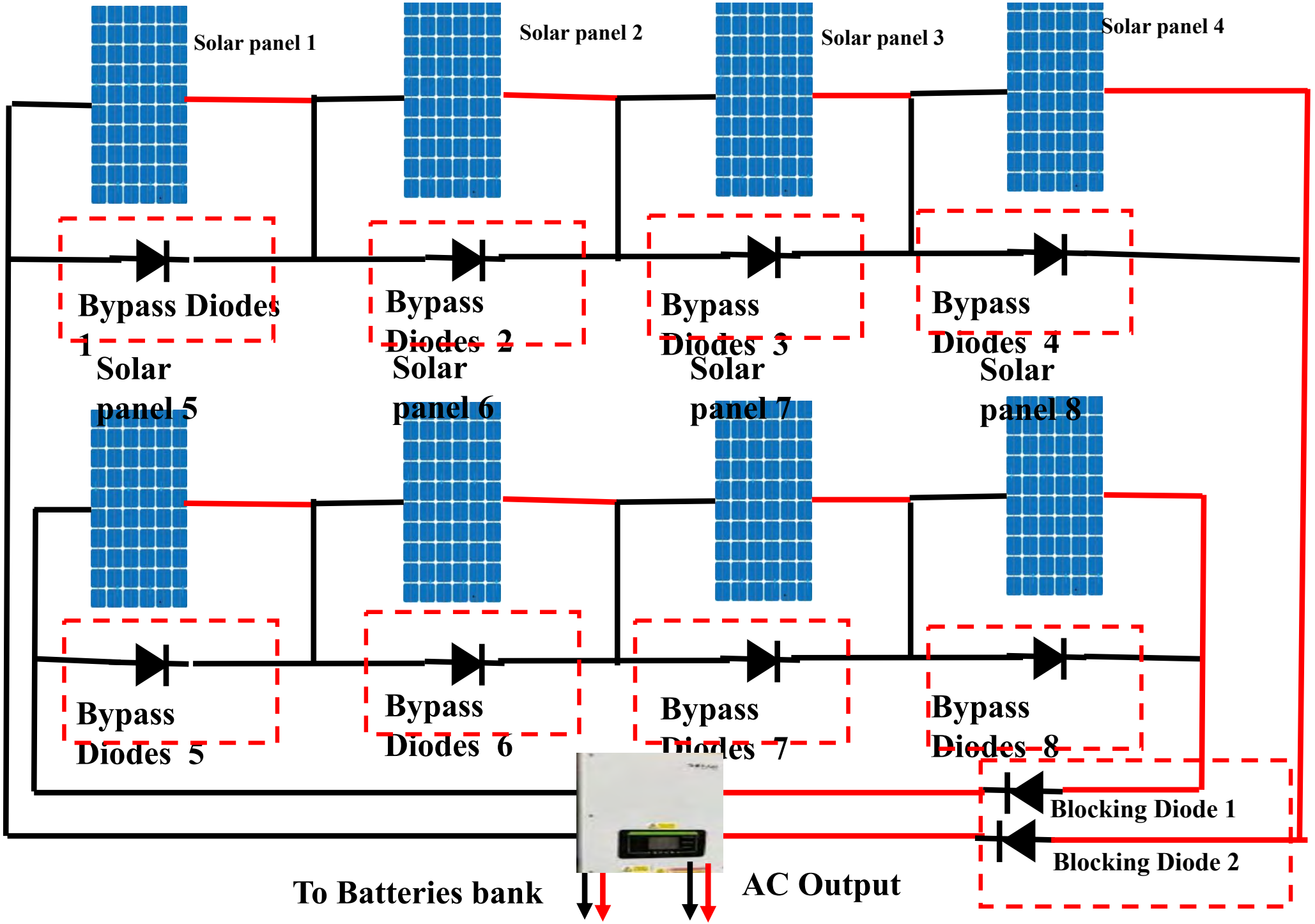
While physically similar to blocking diodes, bypass diodes are wired in parallel with the solar cell or panel, which is in contrast to series- connected blocking diodes.

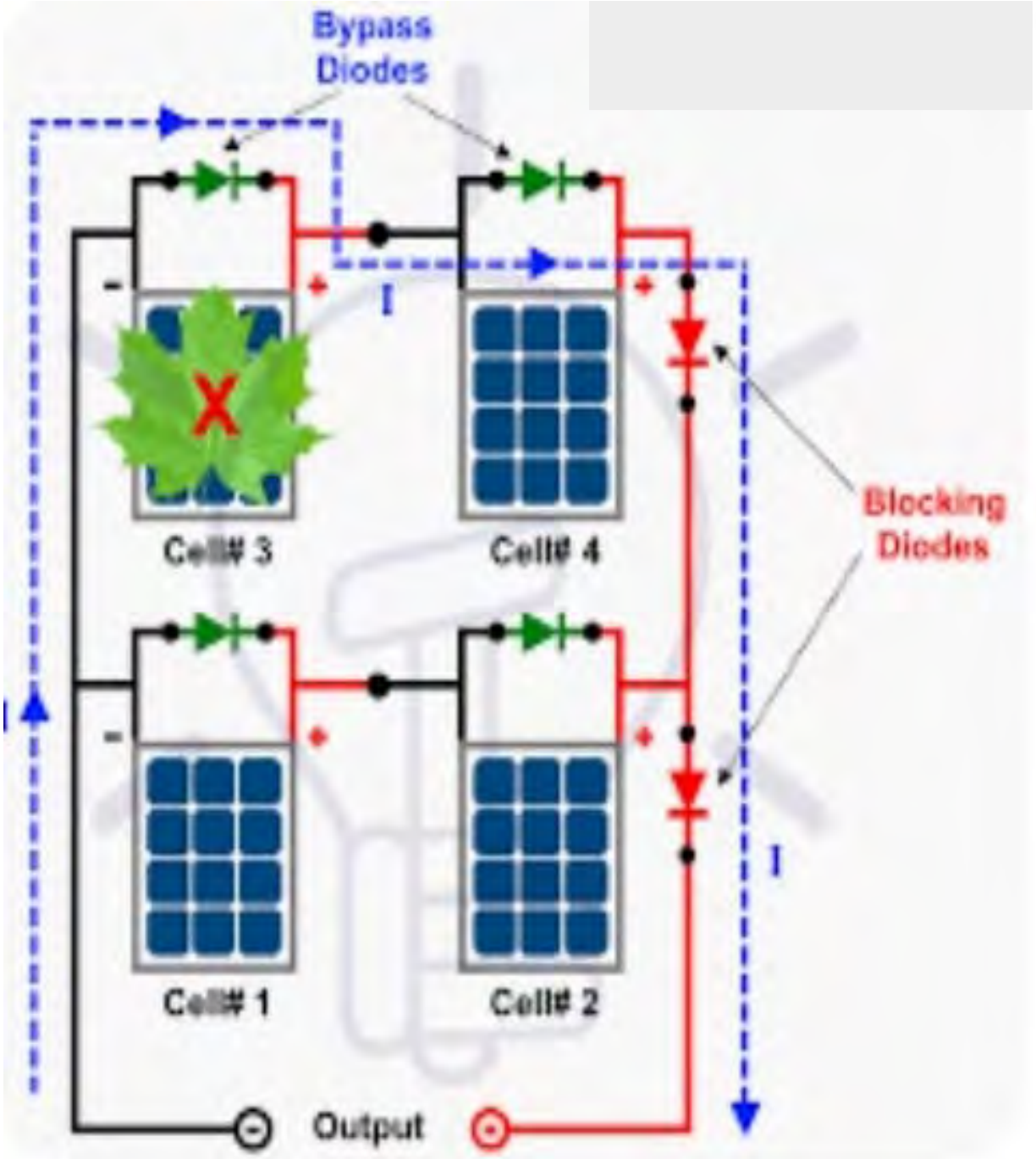
Thus even when a panel is faulty, the bypass diode still makes the whole solar system run and produce electricity at a lower rate

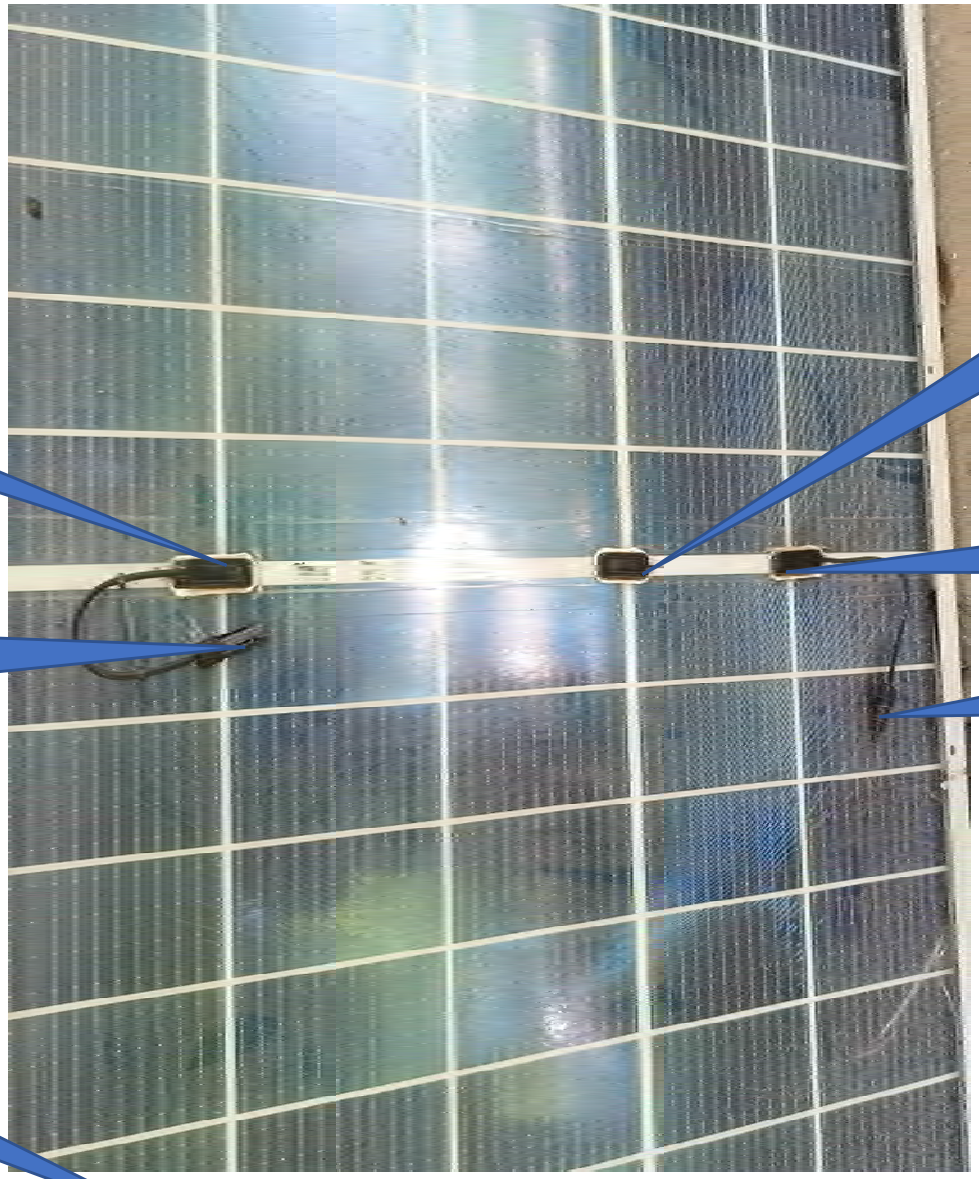
Solar panels series 1 circuits installation diagram



Solar panels series and parallel 2 circuits installation diagram




Bypass
Diodes
Blocking
Diodes
Cell# 3
Cell# 4
Cell# 1
Cell# 2
Output
I
I



Bypass Diode

Bypass Diode

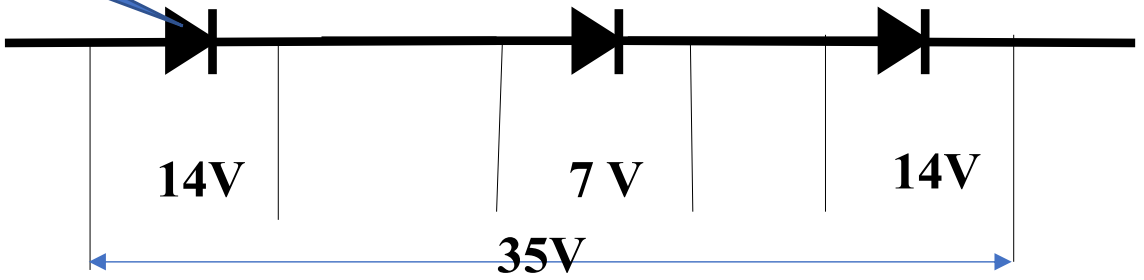
Bypass Diode

(--) connector

(+) connector

Schottky barrier Diodes

One of the primary advantages of using a Schottky diode over a regular diode is its **Low forward voltage drop.**



Why do we need **Bypass Diodes** in solar panels?

Bypass Diodes allow the current from the sunlight cells to go around “bypass” the shaded cells preventing the “hot spot” from occurring.

ဆိုလာပြားများပေါ်တွင် ၎က်ချေးကြောင့် ၎င်းအခြားအညစ်အကြေးကြောင့်၎င်း နေရာကွက် ပြီး အရိပ်ဖြစ်ပေါ်လျှင် ယင်းနေရာ၌ Hot Spot ဖြစ်ပေါ်လာတတ်သည် ထို့အခါ ဆိုလာလျှပ်စီးကြောင်းကို Bypass Diodes မှ ဖြတ်စီးစေ ခြင်းဖြင့် ဆိုလာပြားပျက်စီးမှုကိုကာကွယ်ပေးသည်

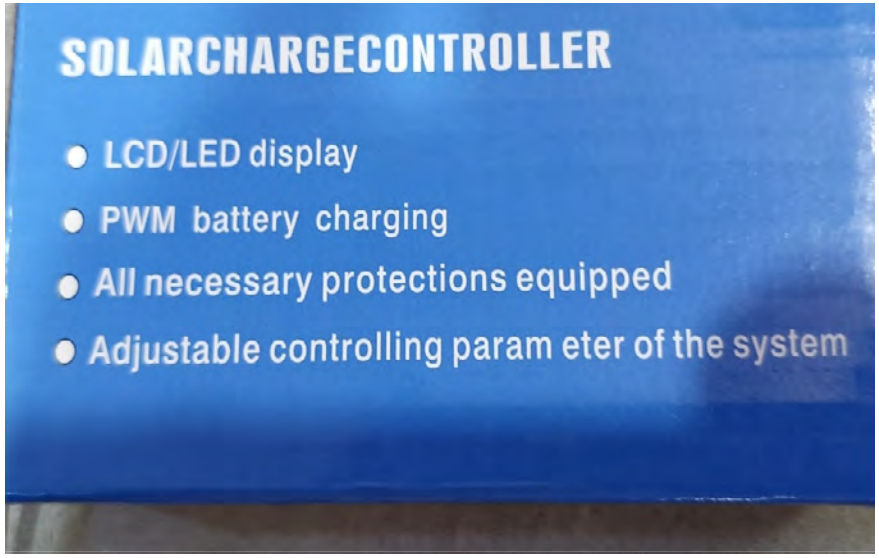
Why do we need **Blocking Diodes** in solar panels?

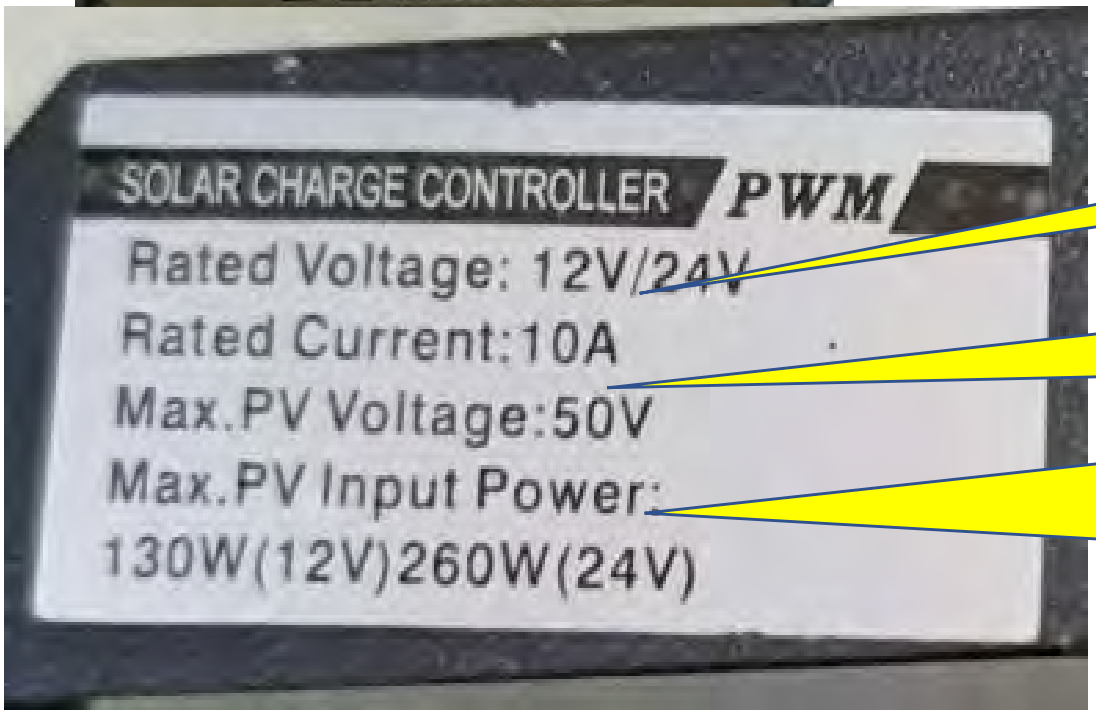
Blocking Diodes is incorporated into the circuit to prevent the battery from discharging back into the solar array at night when the load is being supplied from the battery store.

Blocking Diodes တတ်ဆင်ပါရှိခြင်းသည် ညအခါ ဘက်ထရီမှ တန်းဆက်ဆိုလာပြားများဘက်သို့ လျှပ်စစ် ပြန်မစီးစေရန် ကာကွယ်မှုအနေဖြင့်တတ်ဆင်ထားခြင်းဖြစ်သည်။

SOLAR CHARGE CONTROLLERS

PWM solar charge controller (Pulse Width Modulation)





Can charge to 12V battery
and
24V battery(12V Battery 2 Nos series

Solar panel output Voltage(Charge controller Input Voltage) is Limit 50V)

Solar panel capacity is limit
12 V battery system Inverter , Solar panel capacity is limit **130 W.**
24V battery system inverter, soar panel capacity is limit **260W**

The PWM solar charge controller is a DC to DC converter for solar power system.

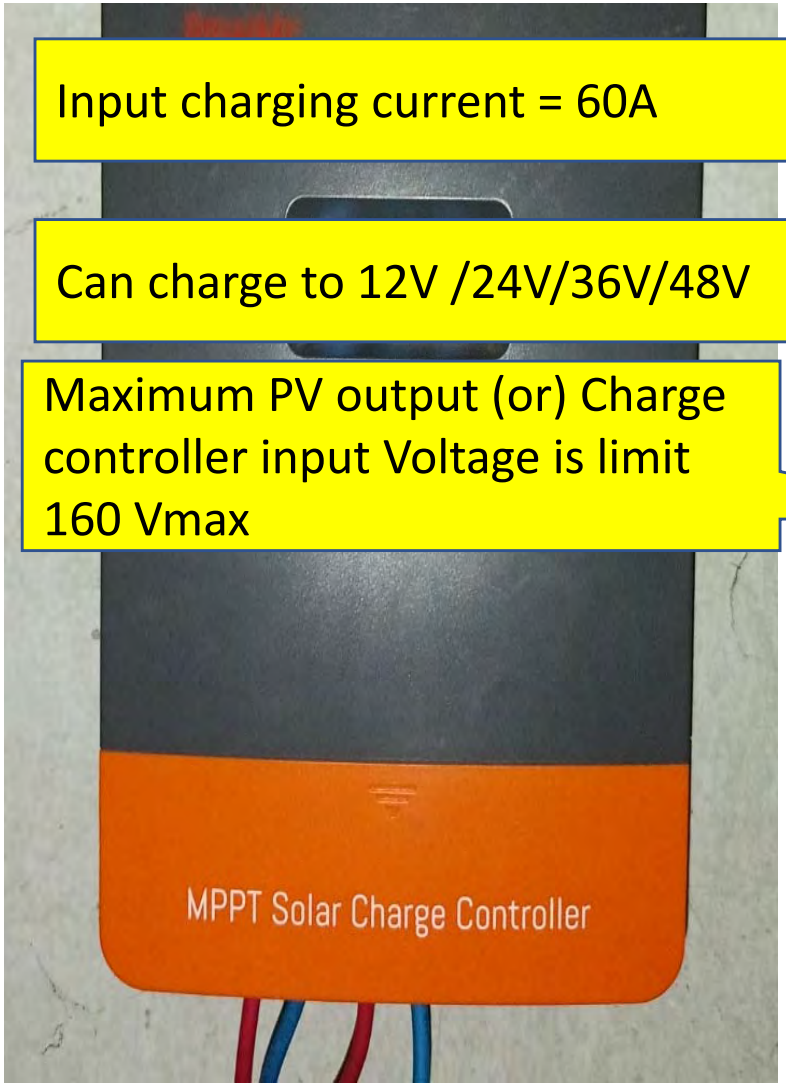
It receives voltage from the solar panels and converts it to charge battery only limited level.

Input DC voltage range = 50V DC

Output DC voltage can charge for 12 V battery
24V battery

PWM controllers provide a cost-effective and reliable solution for small systems.

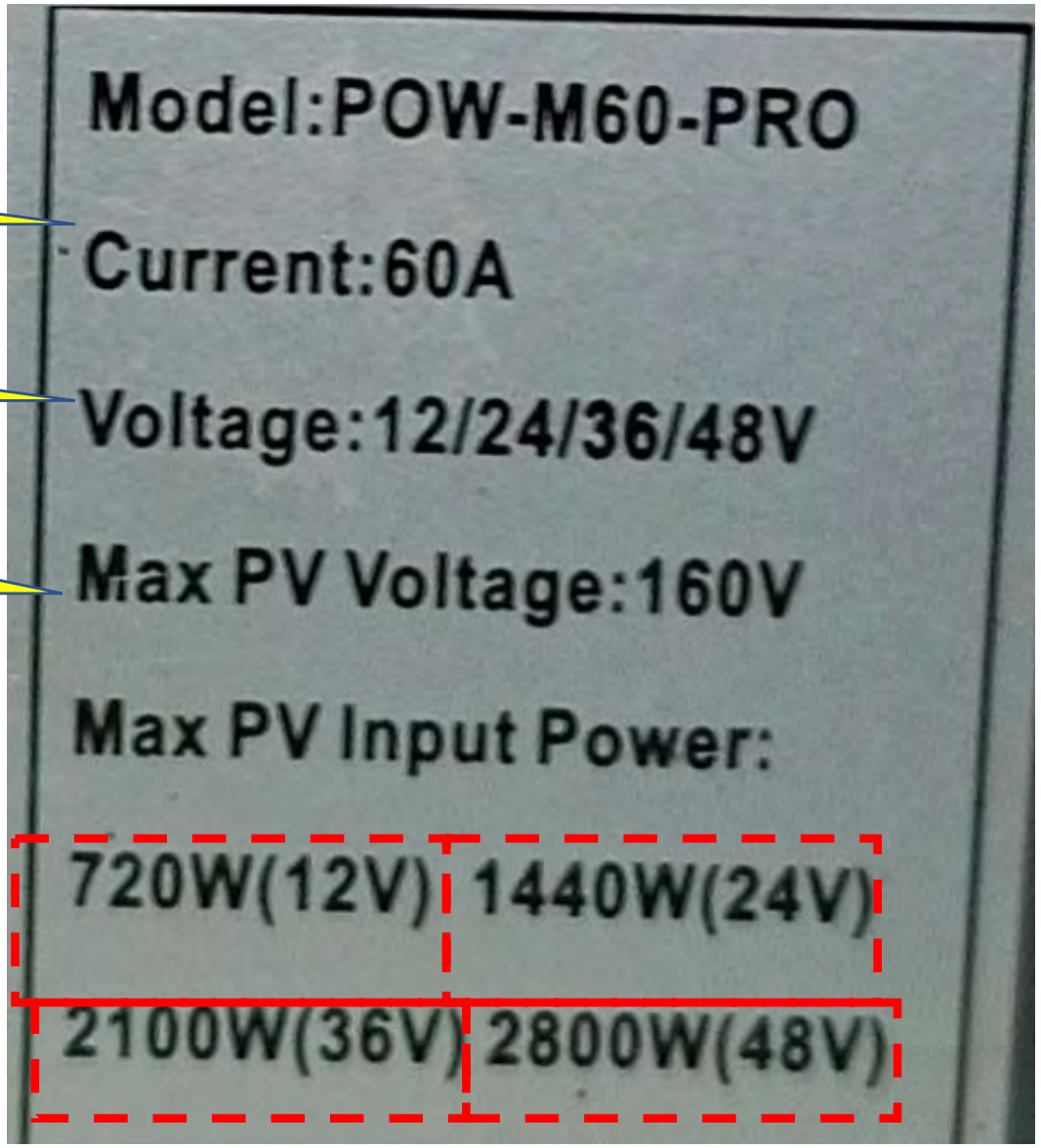
MPPT Solar Charge Controller
Maximum Power Point Tracking



Input charging current = 60A

Can charge to 12V /24V/36V/48V

Maximum PV output (or) Charge controller input Voltage is limit 160 Vmax



P=VI **P=12x 60= 720** **P=24x 60= 1440**

The MPPT solar charge controller is a DC to DC converter for solar power system.

It receives voltage from the solar panels and converts it to charge battery at a more appropriate level.

Input DC voltage wide range = 160V DC or More

Output DC voltage can charge for 12 V battery
24V battery
36V battery
48 V battery
etc:.

MPPT controllers offer higher efficiency, faster charging times, and increase energy harvest, making them suitable for larger solar systems

Various Types of Solar Charge Controller

Inverters

Various Type of Solar Inverters In Myanmar Market

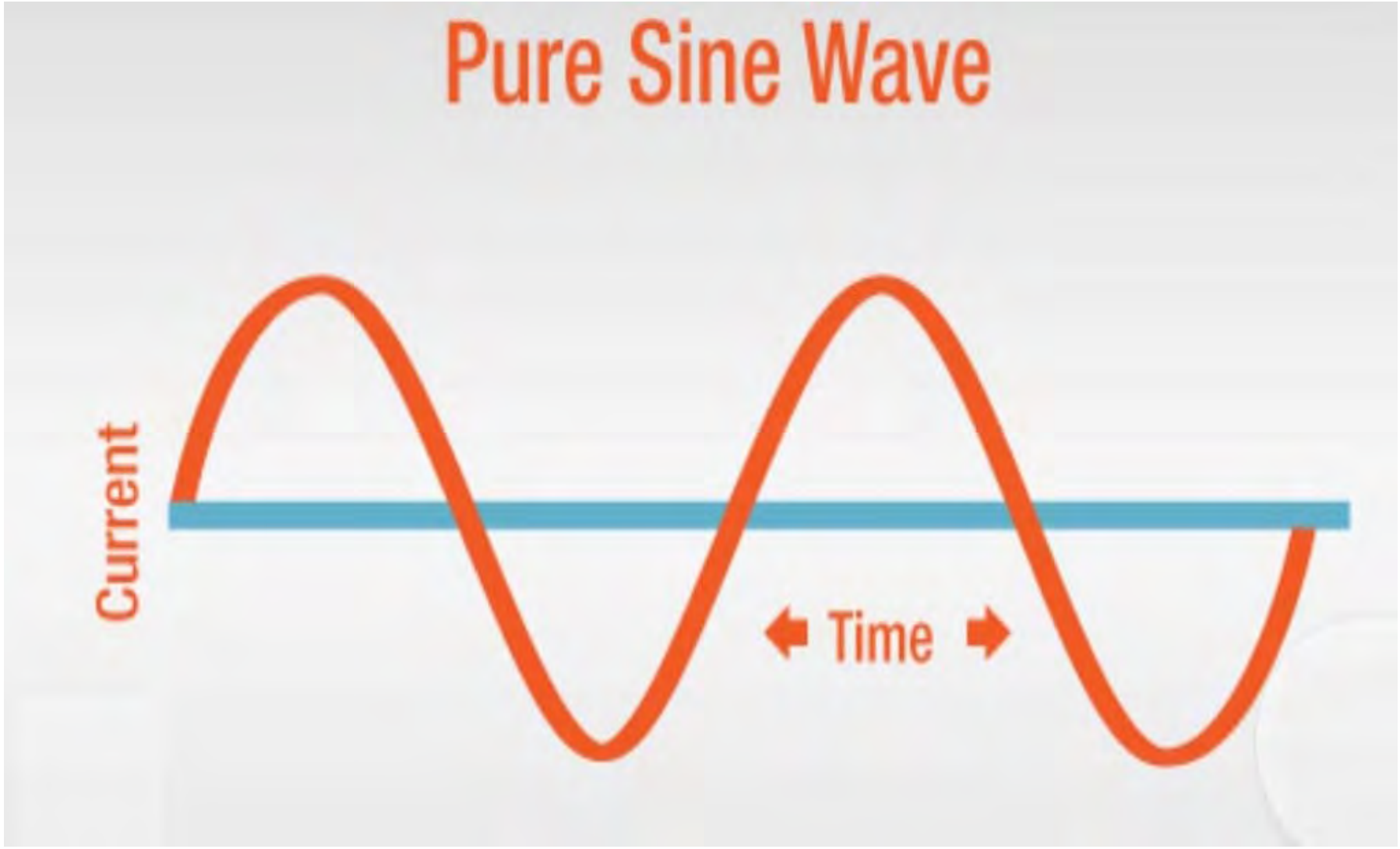
Various Type of Solar Inverters

Wave Form Of Output Alternating Current(AC)

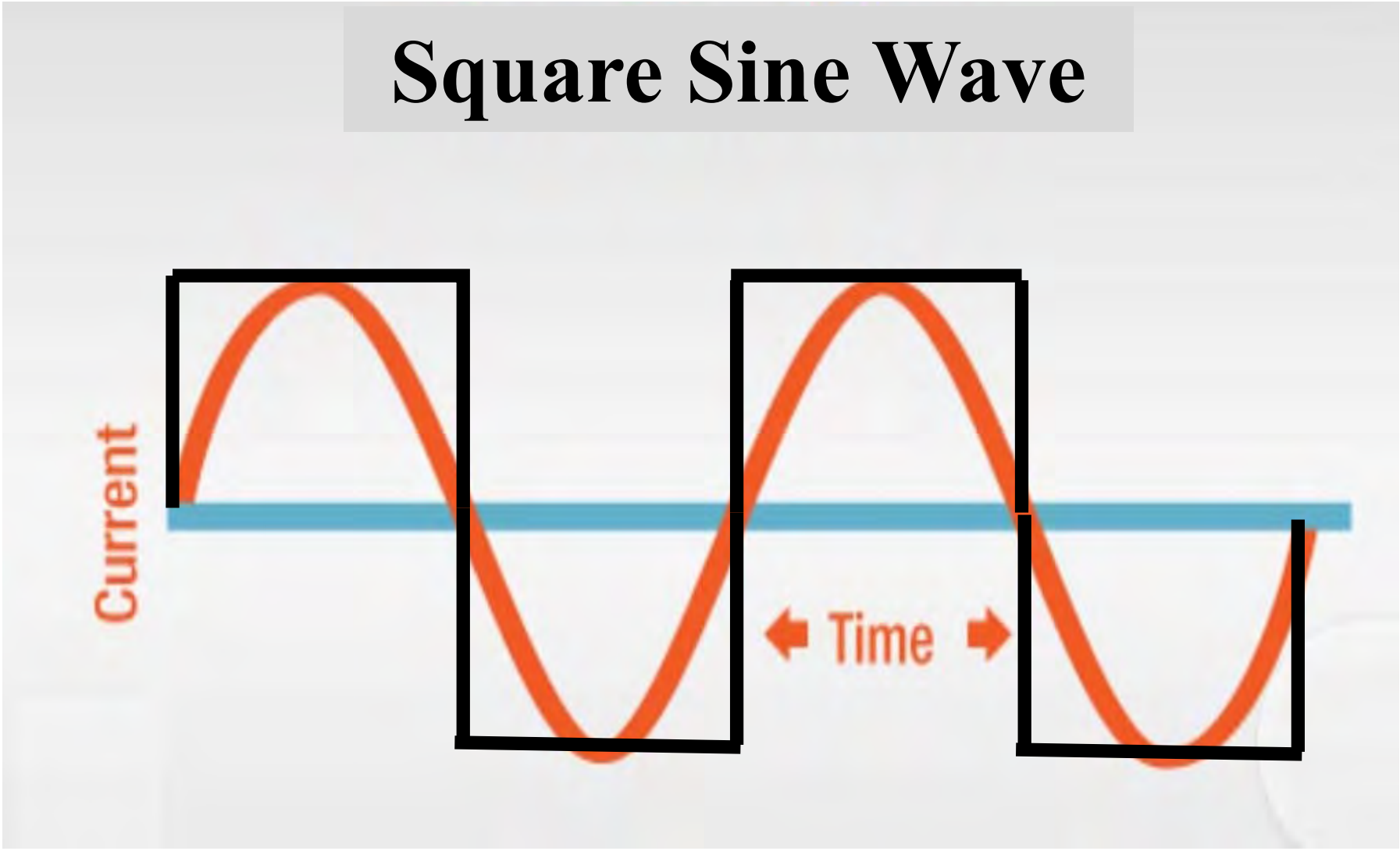
Pure Sine Wave

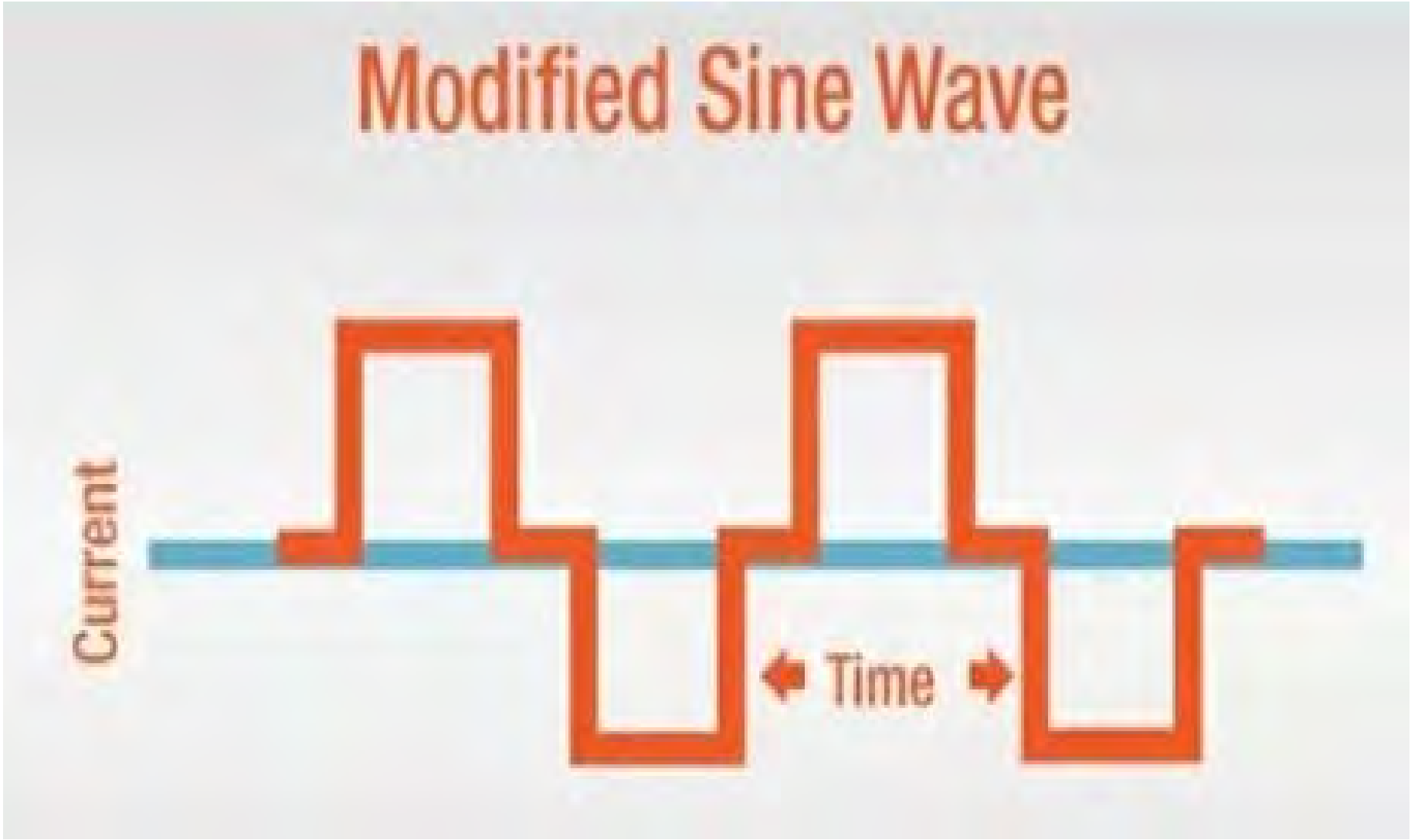
Square Sine Wave

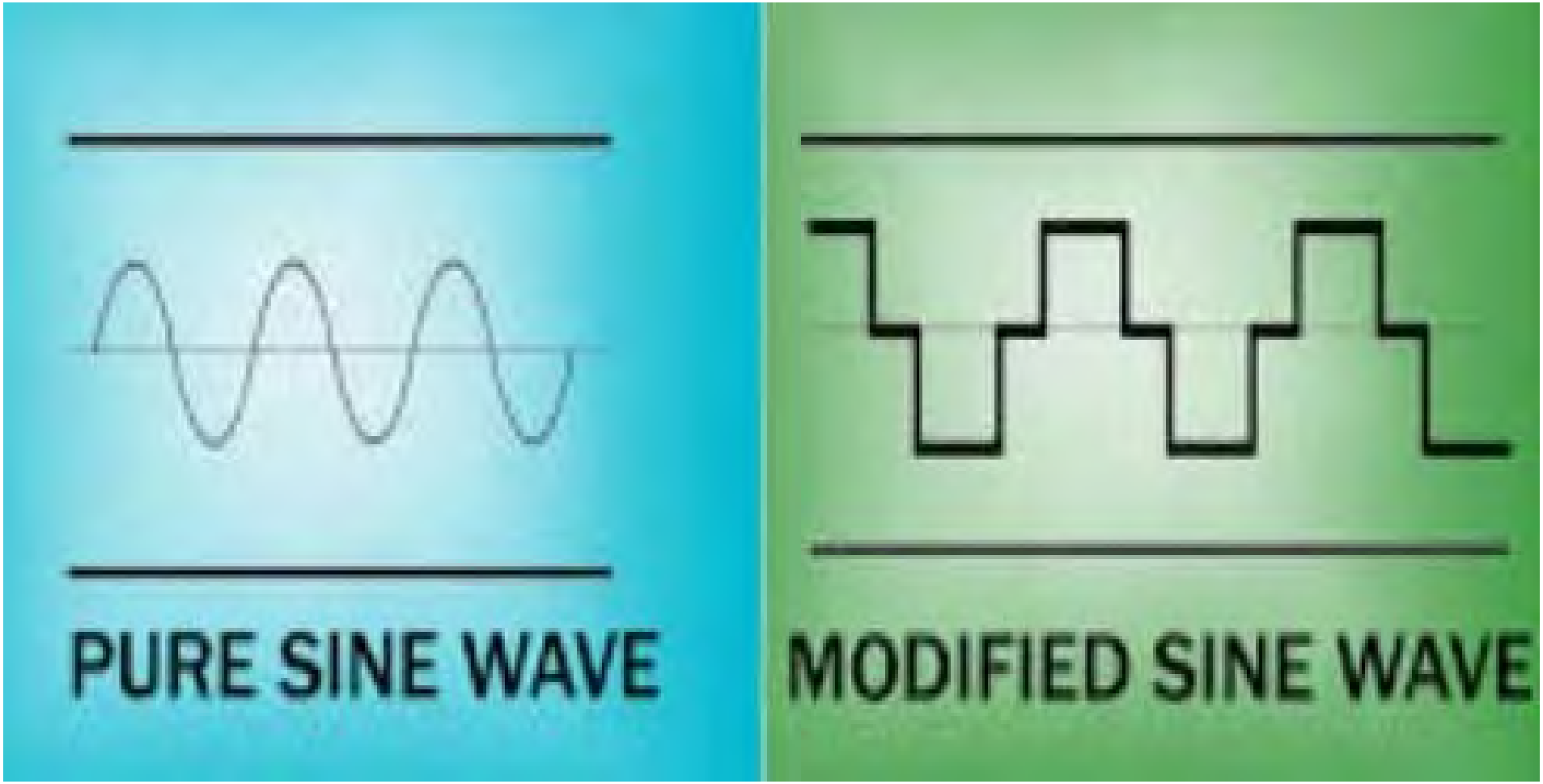
Modify Sine Wave

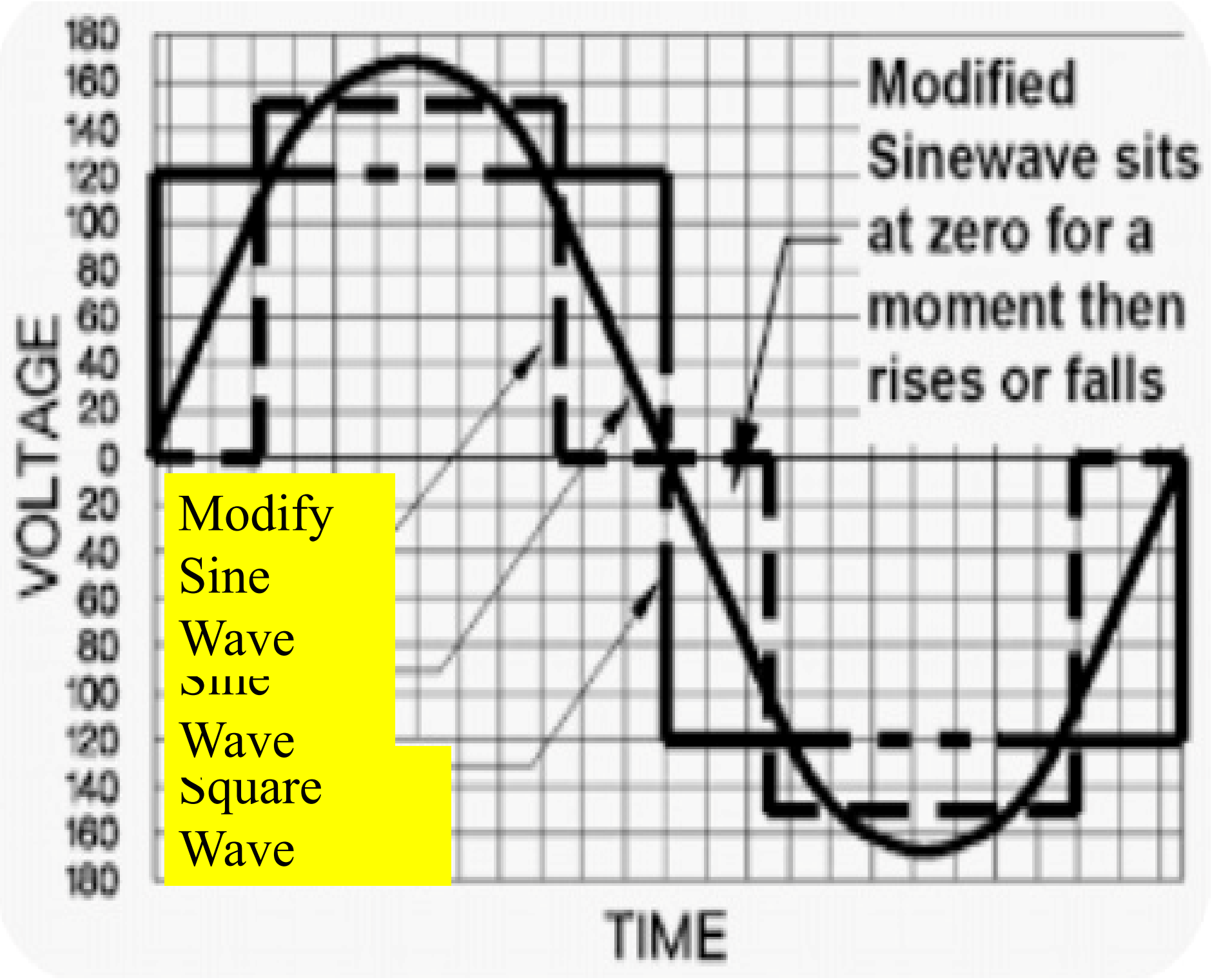

Pure Sine Wave
Current
Time

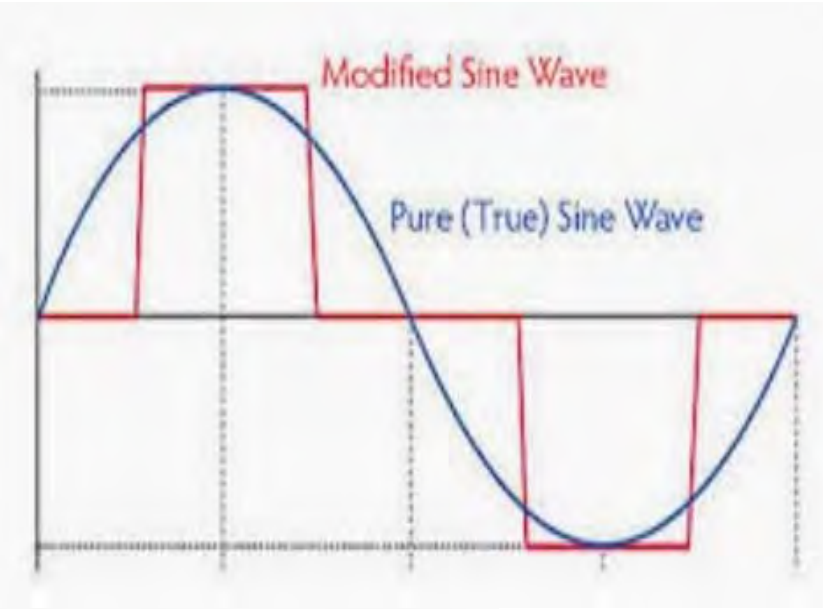
Square Sine Wave

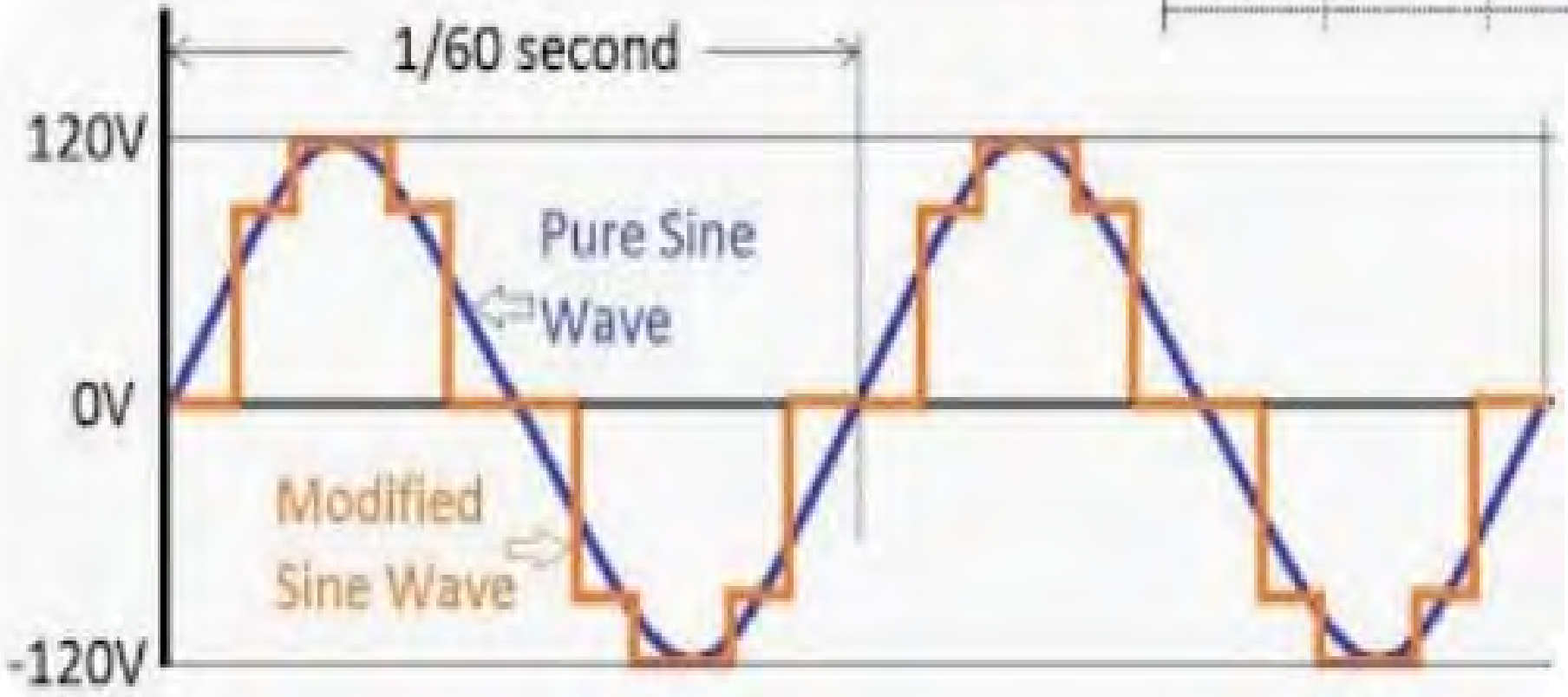



Modified Sine Wave
Current
Time


PURE SINE WAVE
MODIFIED SINE WAVE


VOLTAGE
180
160
140
120
100
80
60
40
20
0
20
40
60
80
100
120
140
160
180
TIME
Modified Sinewave sits at zero for a moment then rises or falls
Modify Sine Wave
Sine Wave
Square Wave


Modified Sine Wave
Pure (True) Sine Wave


1/60 second
120V
0V
-120V
Pure Sine Wave
Modified Sine Wave


LUMINA
LUMINA
HYPER ENERGY
1 YEAR
OFFICIAL
PURE SINE WAVE
Inverter & AC Charger

D1 DELL, 6/25/2023

Pure Sine wave Inverters

Use for

Motors

Medical Equipment

Modify Sine Waves

Use for

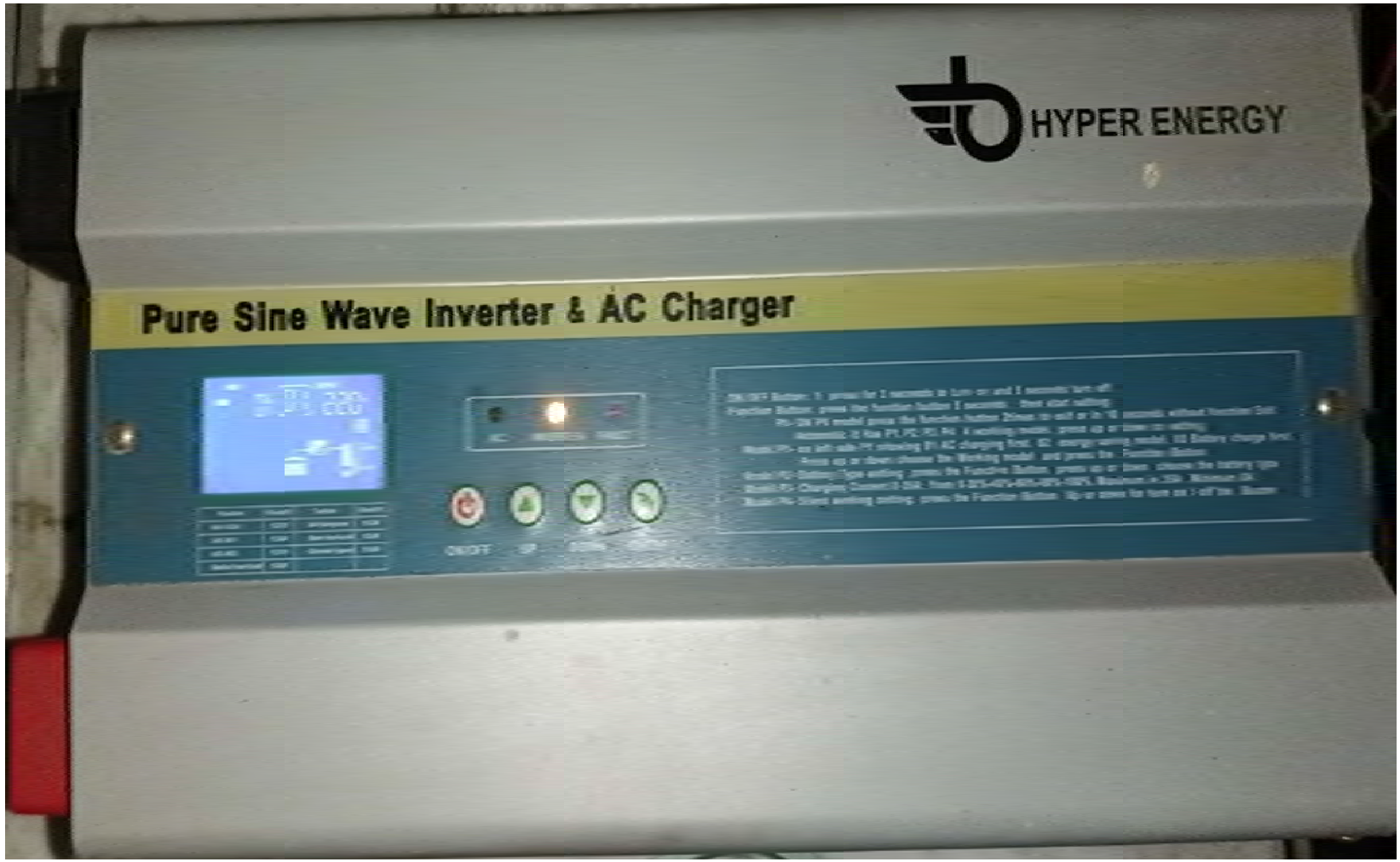
Rectifier Equipment

Power By DC adaptors

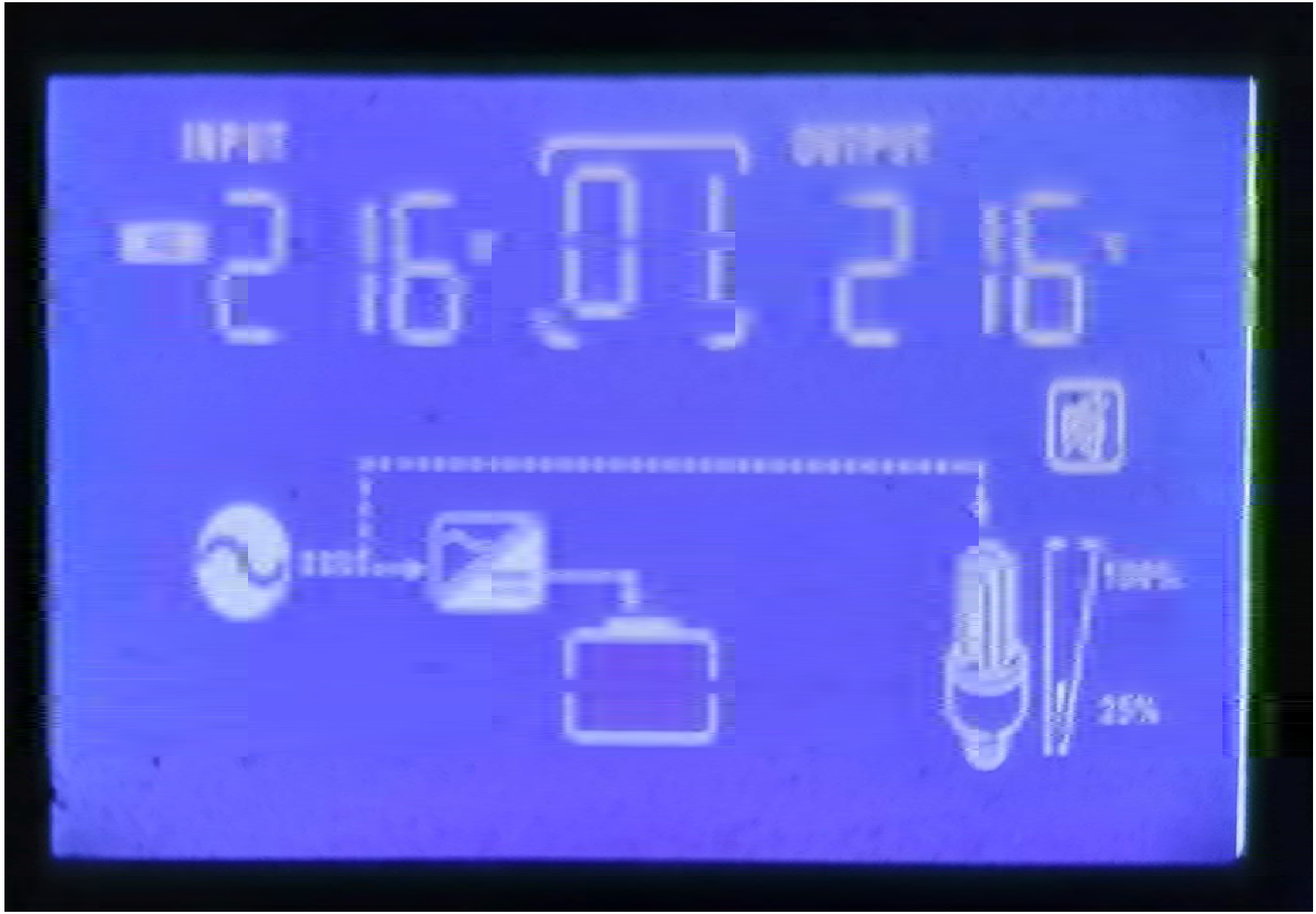
Lighting

High Frequency Inverter and Low Frequency Inverter

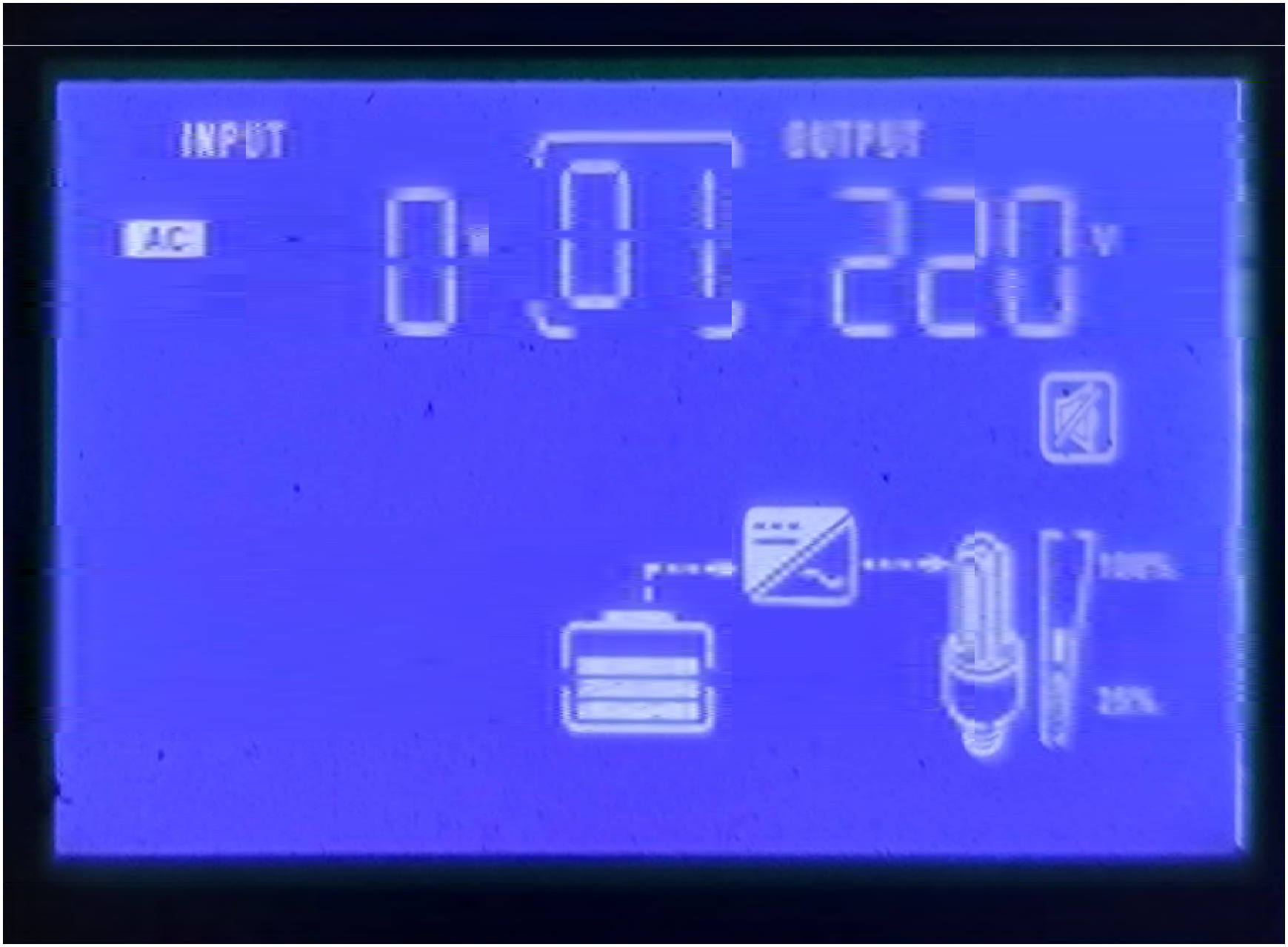
Normal Inverter photo



Normal Inverter display when Grid power OK

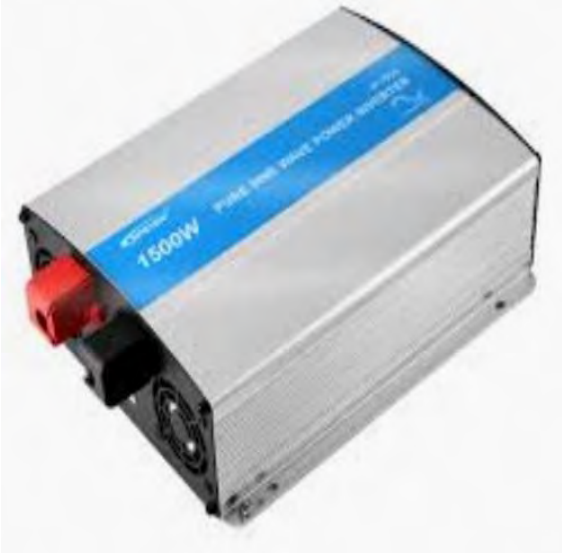


Normal Inverter display when Grid power Failure



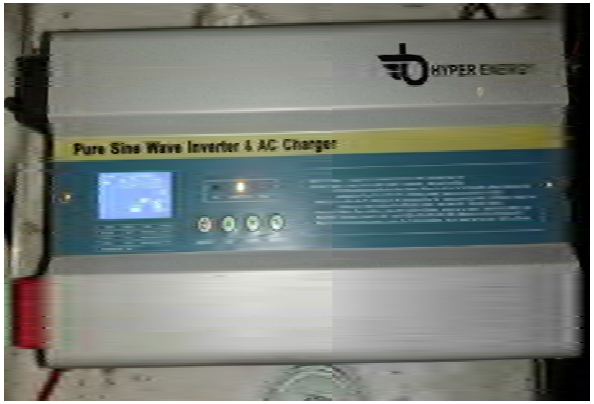
High Frequency Inverter

Electronic Type

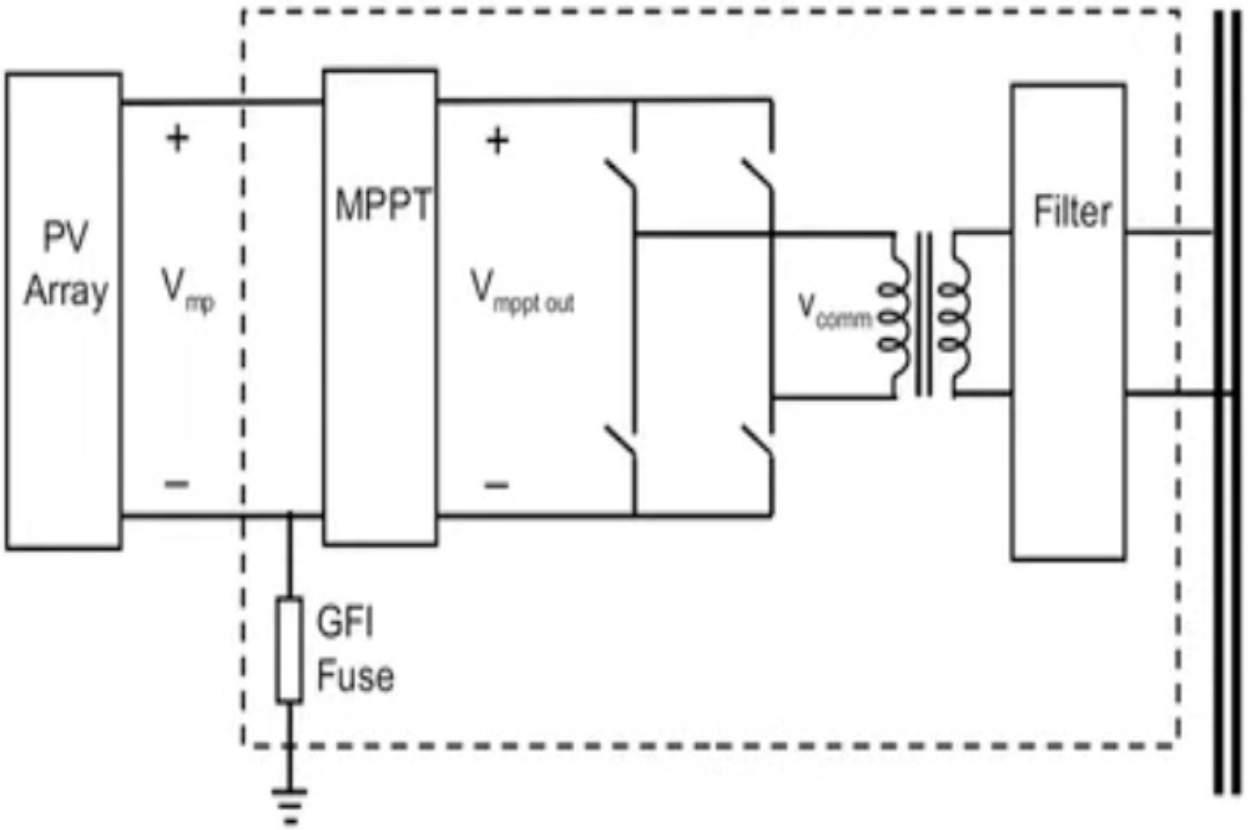


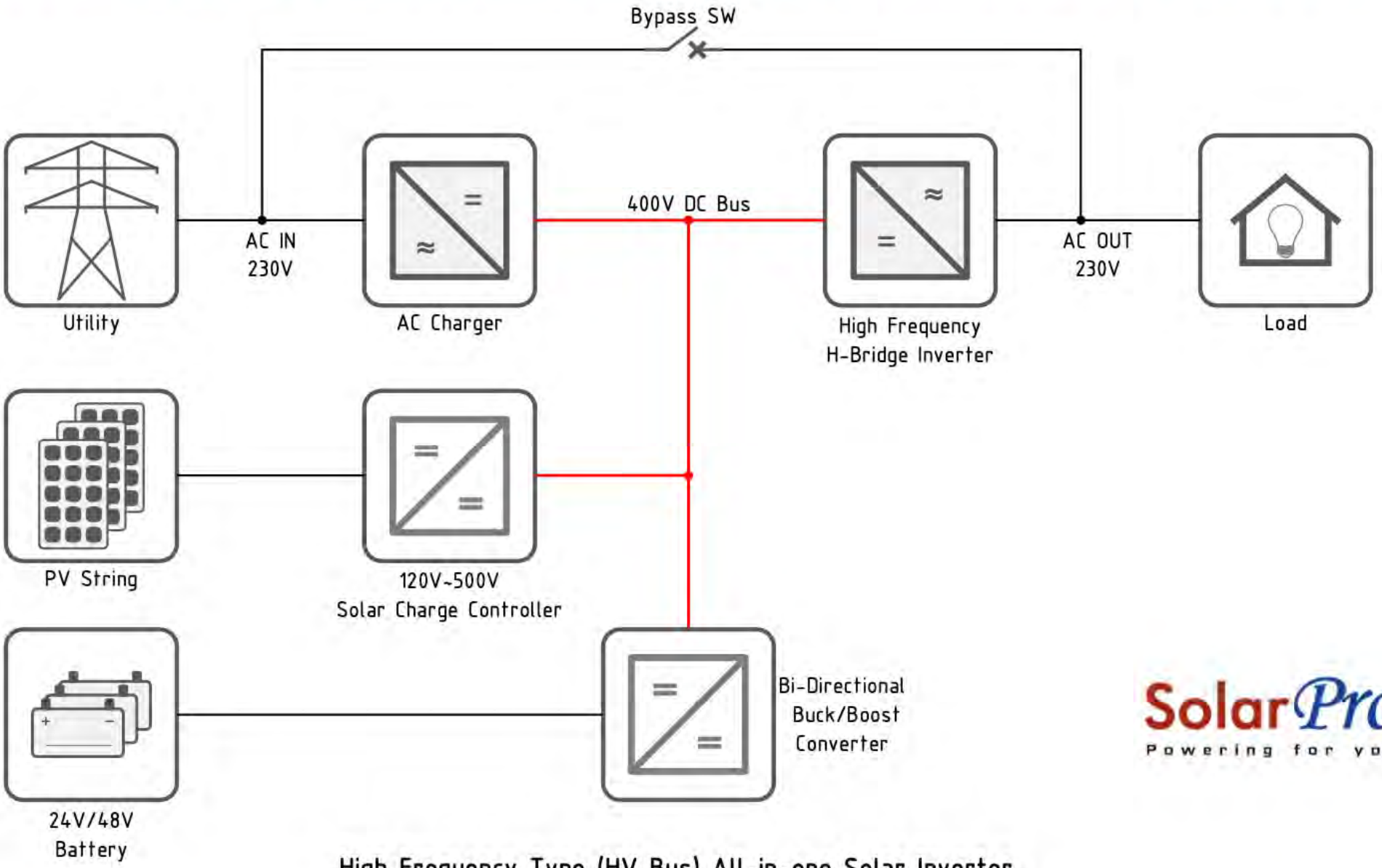
Low Frequency Inverter

Transformer Type

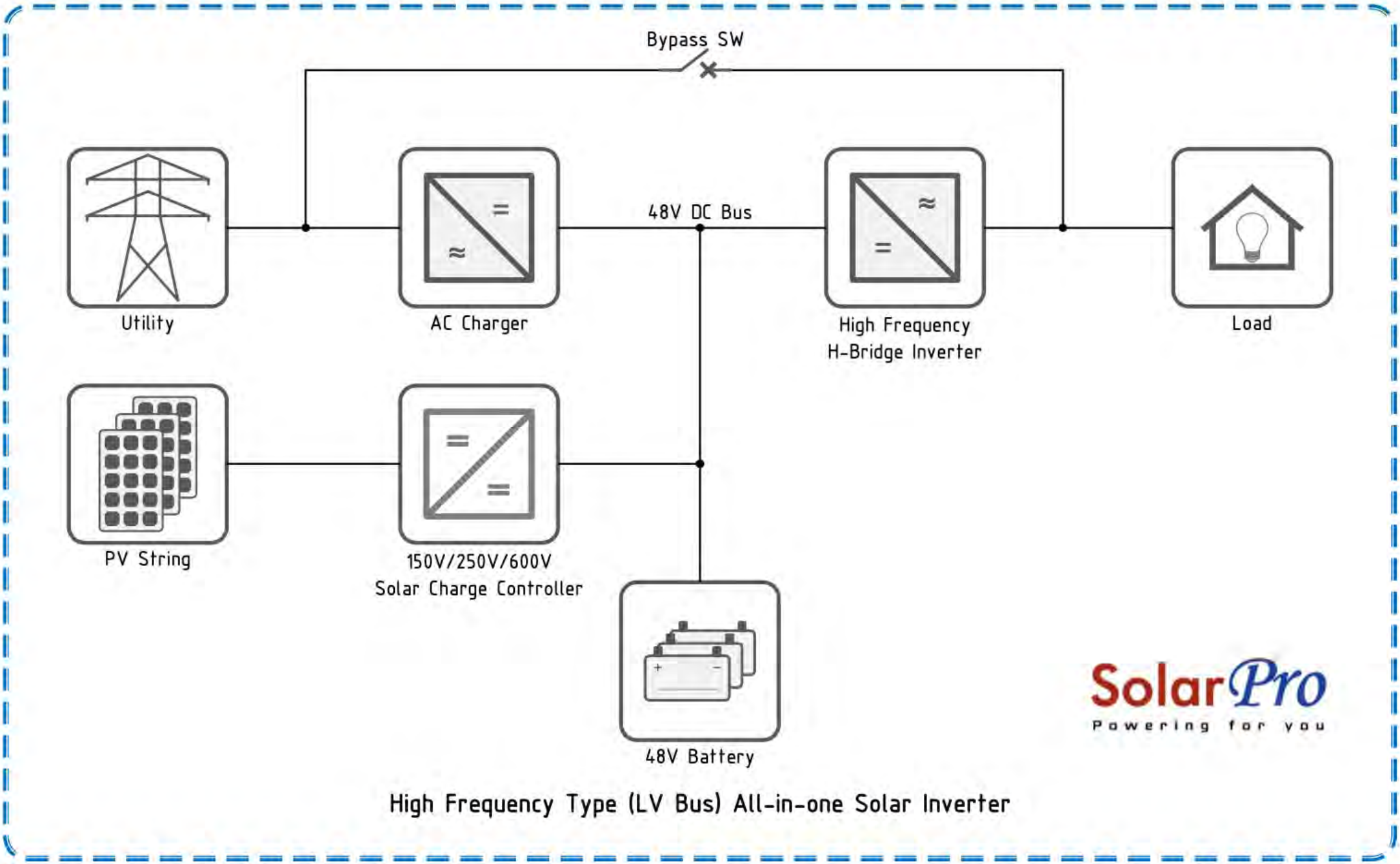


High Frequency Inverter



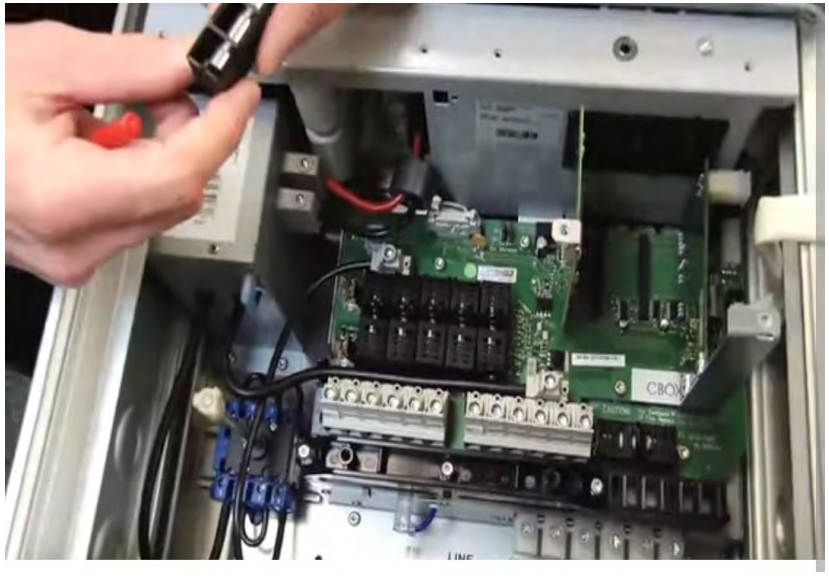


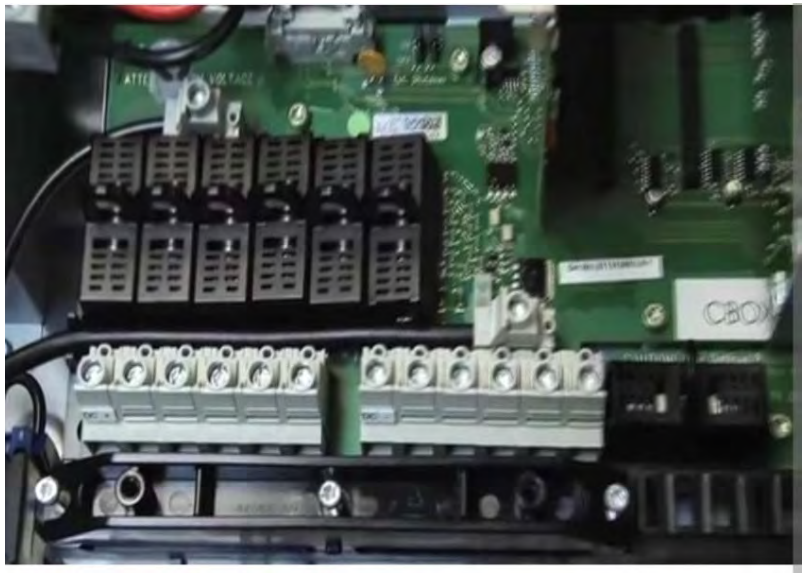
High Frequency Type (HV Bus) All-in-one Solar Inverter



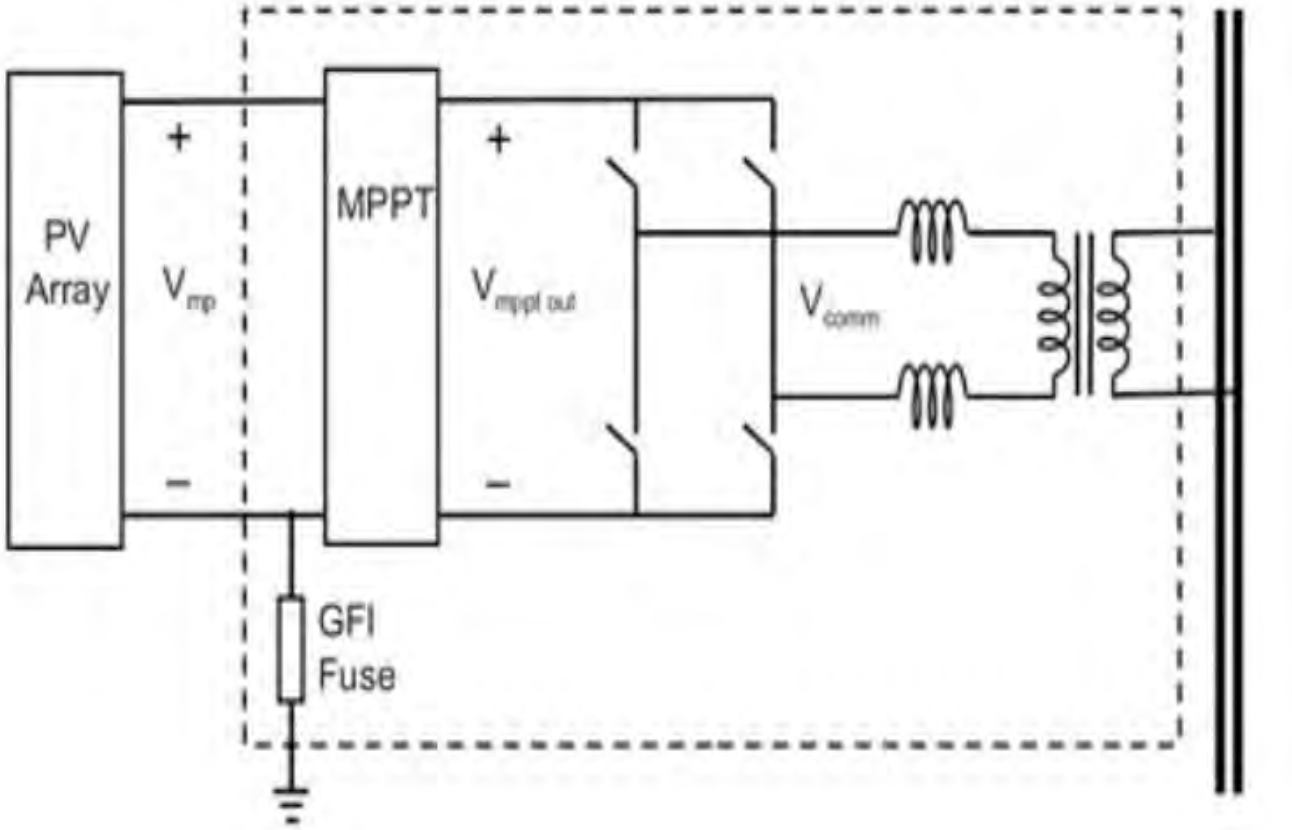
High Frequency Type (LV Bus) All-in-one Solar Inverter

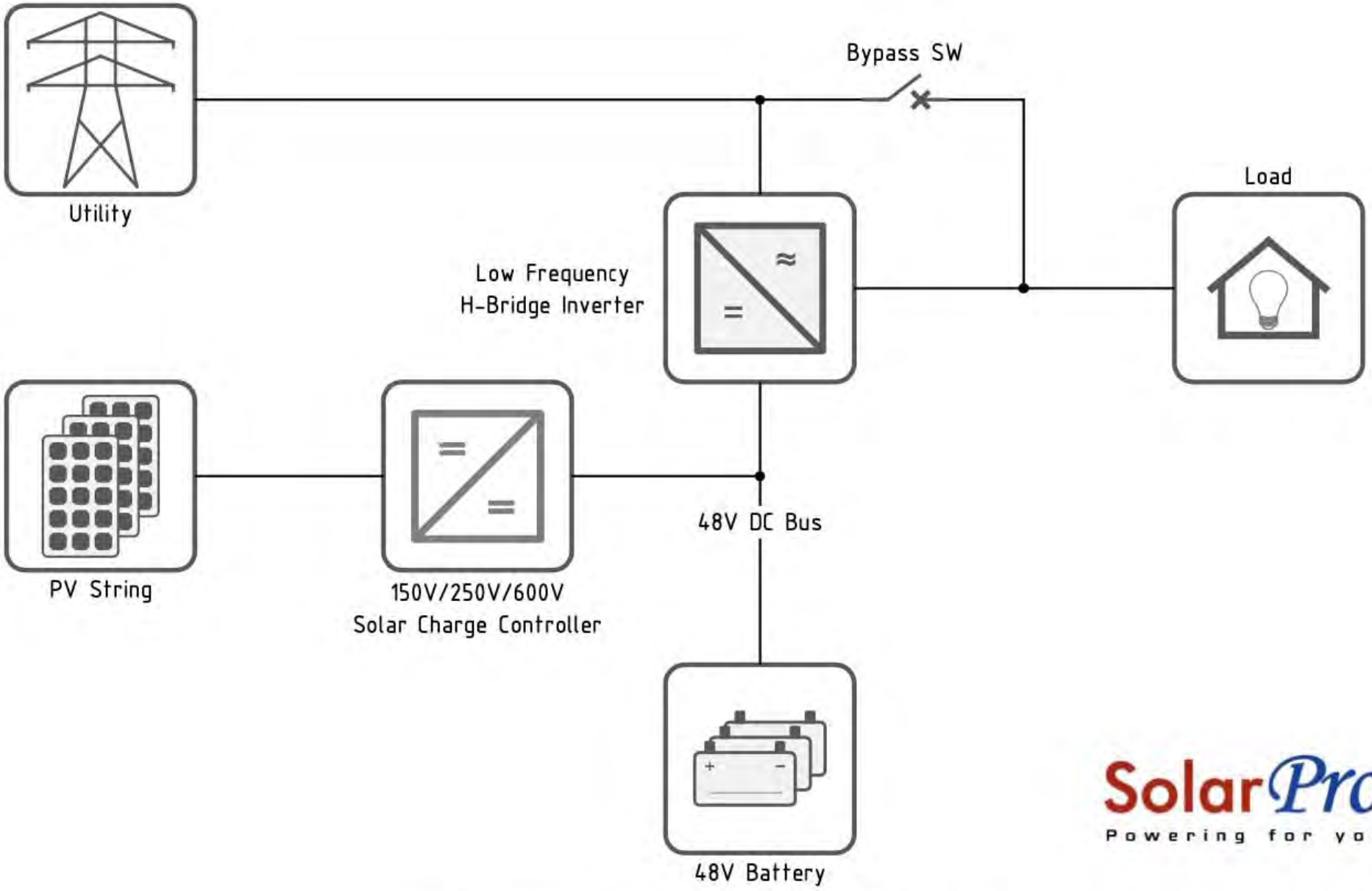
High Frequency Inverter





Low Frequency Inverter

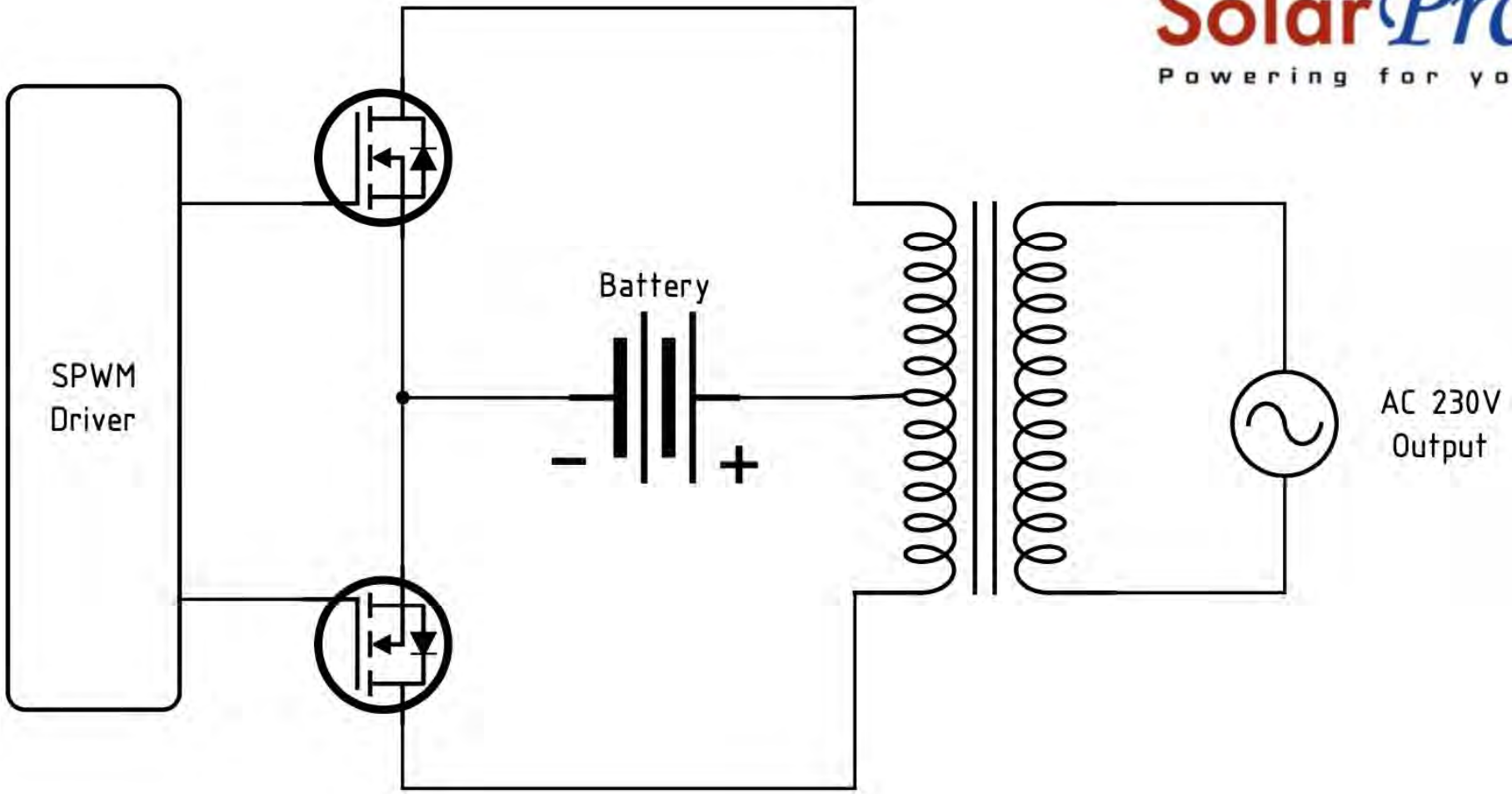




SolarPro
Powering for you

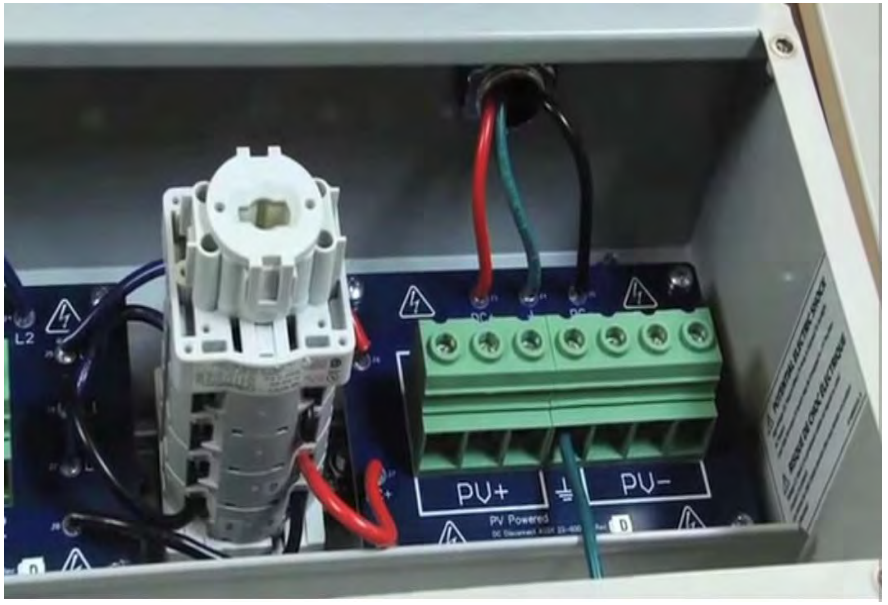
Low Frequency Type All-in-one Solar Inverter

SolarPro
Powering for you



Conventional Low Frequency Type Bi-directional Inverter

Low Frequency Inverter



Different between High Frequency Inverter & Low frequency Inverter

High Frequency Inverter	Low frequency Inverter
Small transformer use	Big transformer use
Light weight	Heavy weight
Primary Capacitance power Store and Mosfet transister as Switch	Transformer base Inverter
Complicated Design	Simple Design
Cheap	Costly
Can operate 150% power level for a small fraction of a second.	Peak power level up to 200% for several seconds

Low –frequency inverter have the advantage over High-frequency inverters in two fields: peak power capacity, and reliability.

Low –frequency inverters are designed to deal with higher power spikes for longer periods of time than High-frequency inverters.

Protection System of Inverters

Important things in inverter

Is it Pure Sine Wave?

Is there include Battery Voltage Manage system?(BMS)

Is there include Battery Charge and Discharge current and protect battery for extend battery life?

Selection of Low-frequency Inverter or High- frequency Inverter.

8 Kinds of Protection Function of Solar Inverters

1. Reverse Polarity Protection
2. Anti-islanding Protection (Shut down inverter if grid power failure on grid system.)
3. Insulation Resistance Detection
4. Residual Current Monitoring
5. Output Overcurrent Protection
6. Output Short Circuit Protection
7. Input Over Voltage Protection (Solar DC volt)
8. AC/DC Surge protection

INVERTER SPECIFICATION (Sample)

Rated Power	5000VA / 5000W
System DC Voltage	48VDC
Parallel Option	Yes, up to 6 units
Monitoring Option	WiFi or GPRS

INVERTER OUTPUT

AC Voltage	220V-230V-240VAC
Surge Power	10000VA
Peak Efficiency	93%
Transfer Time	10ms(For Personal Computers) 20ms(For Home Appliances)
Waveform	Pure Sine Wave

INVERTER OUTPUT

SOLAR CHARGER AND AC CHARGER

Max.PV Array Open Circuit Voltage	450VDC
Max.PV Array Power	6000W
Operating Voltage MPPT Range	120~430VDC
Battery Overcharge Protection	60VDC
Max.Solar Charge Current	100A
Max.AC Charge Current	80A
Max.Charge Current	100A
Max PV Input Current	22A
Protection	Overload, Short circuit, Overcurrent,Overvoltage, Undervoltage, Over-Frequency, Under-Frequency, Overheat, Lightning, Surge Power

PHYSICAL	
Dimension	470*320*135mm
Net Weight	12kg
Communication Interface	USB/CAN/RS485

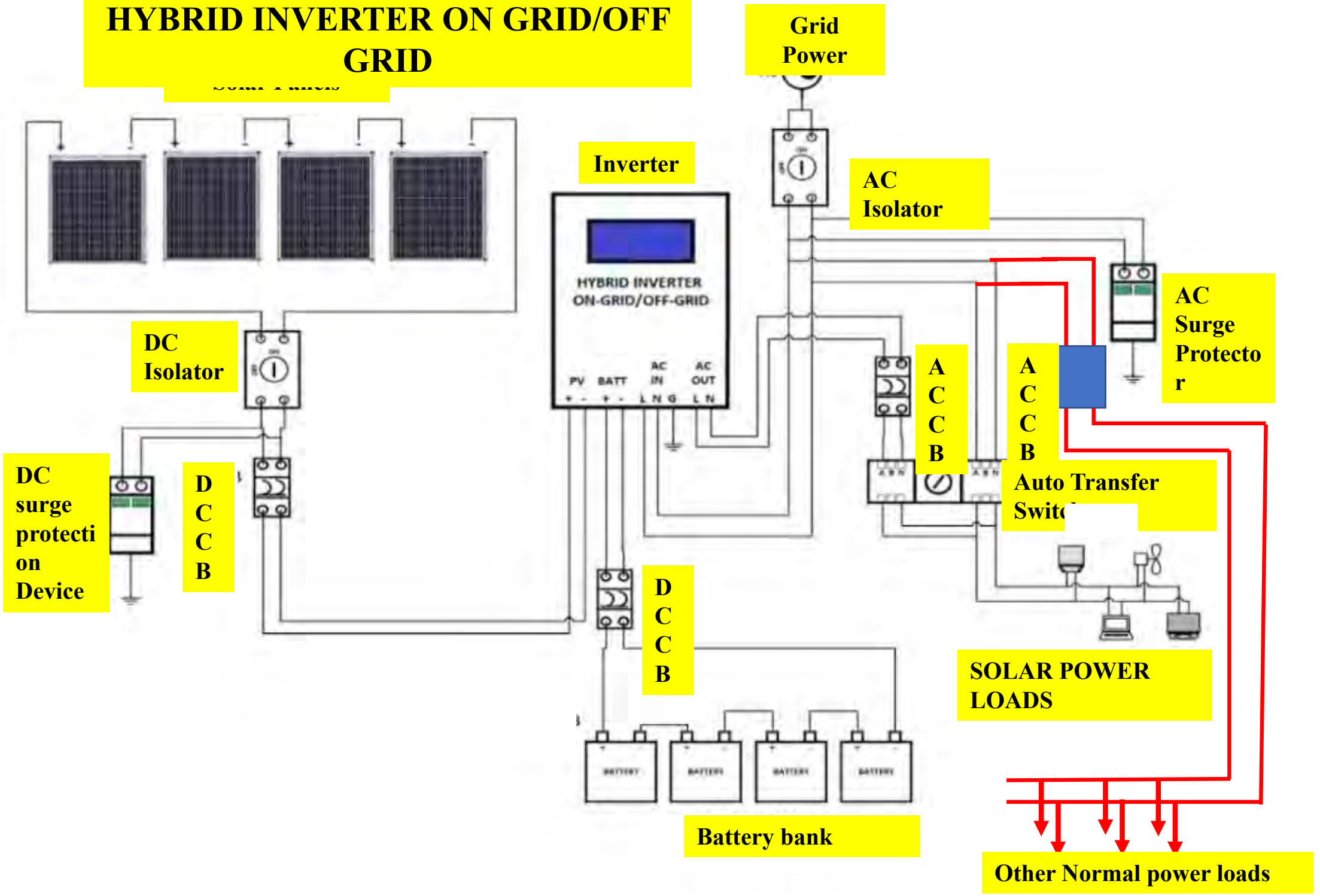
ENVIRONMENT	
Humidity	5% to 95% Relative Humidity(Non-condensing)
Operating Temperature	0℃~50℃
Storage	-15℃~60℃

DC Surge protectors

DC Circuit Breakers

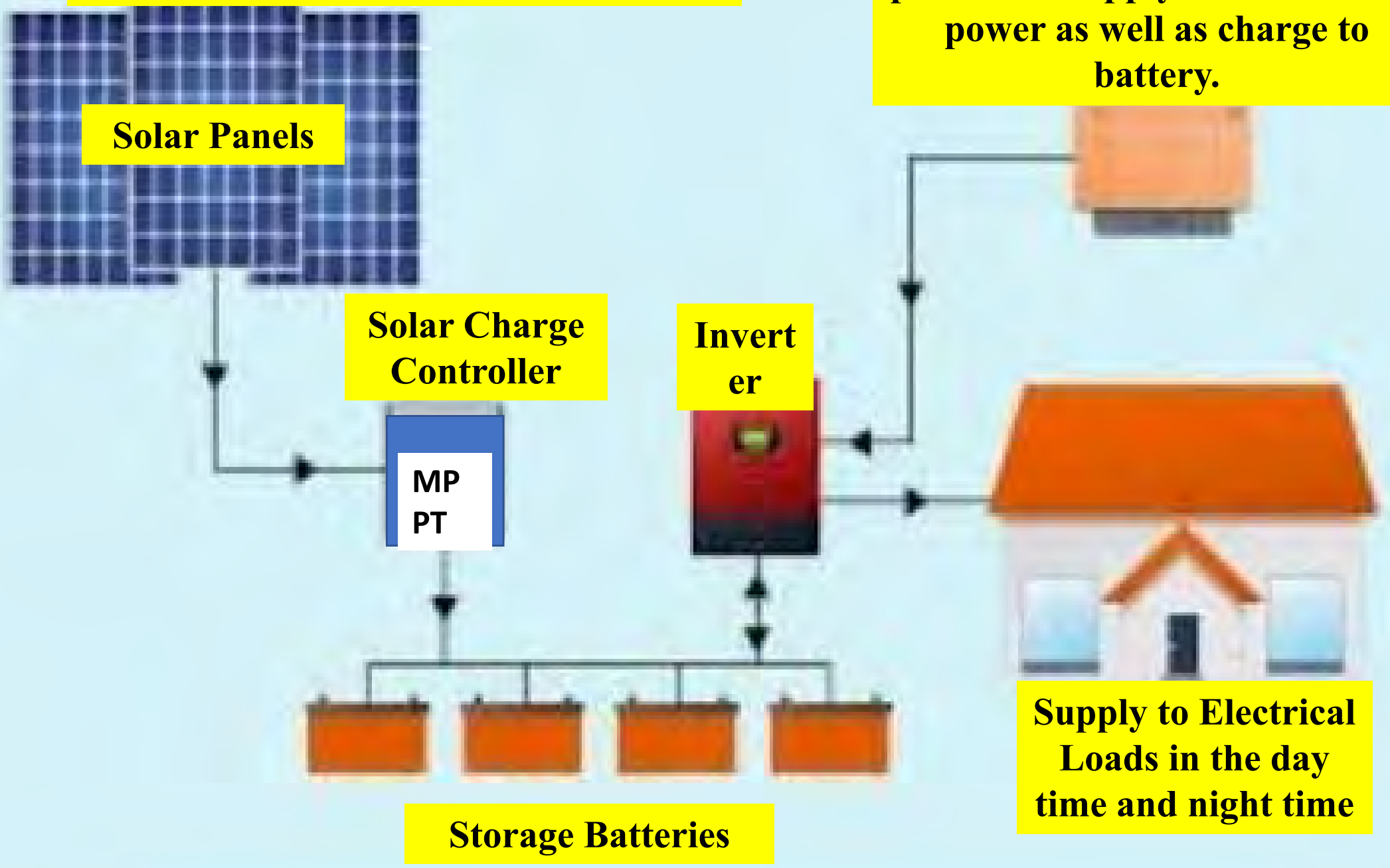
Connection diagram of solar systems

HYBRID INVERTER ON GRID/OFF GRID

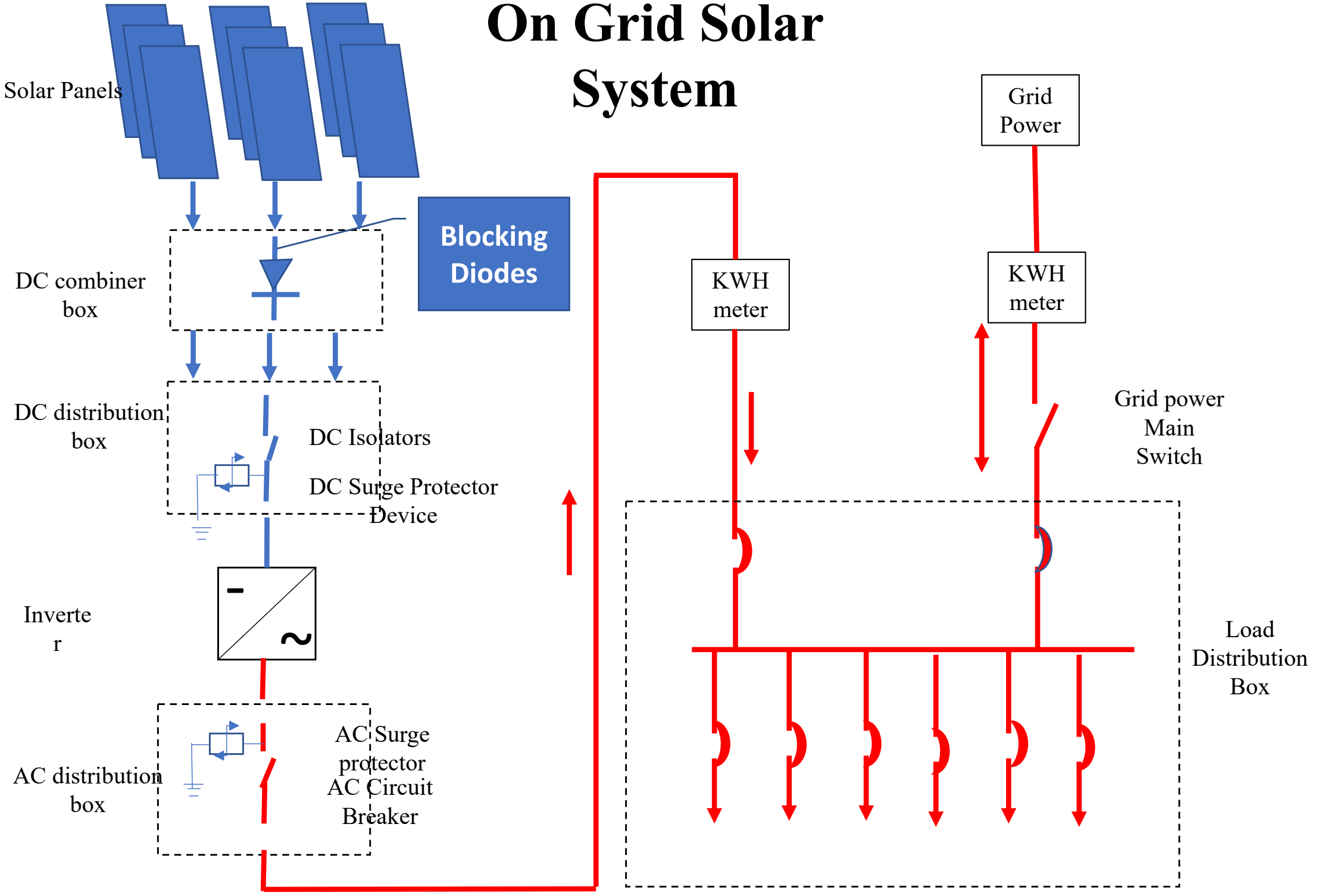


HYBRID INVERTER ON Grid/OFF Grid

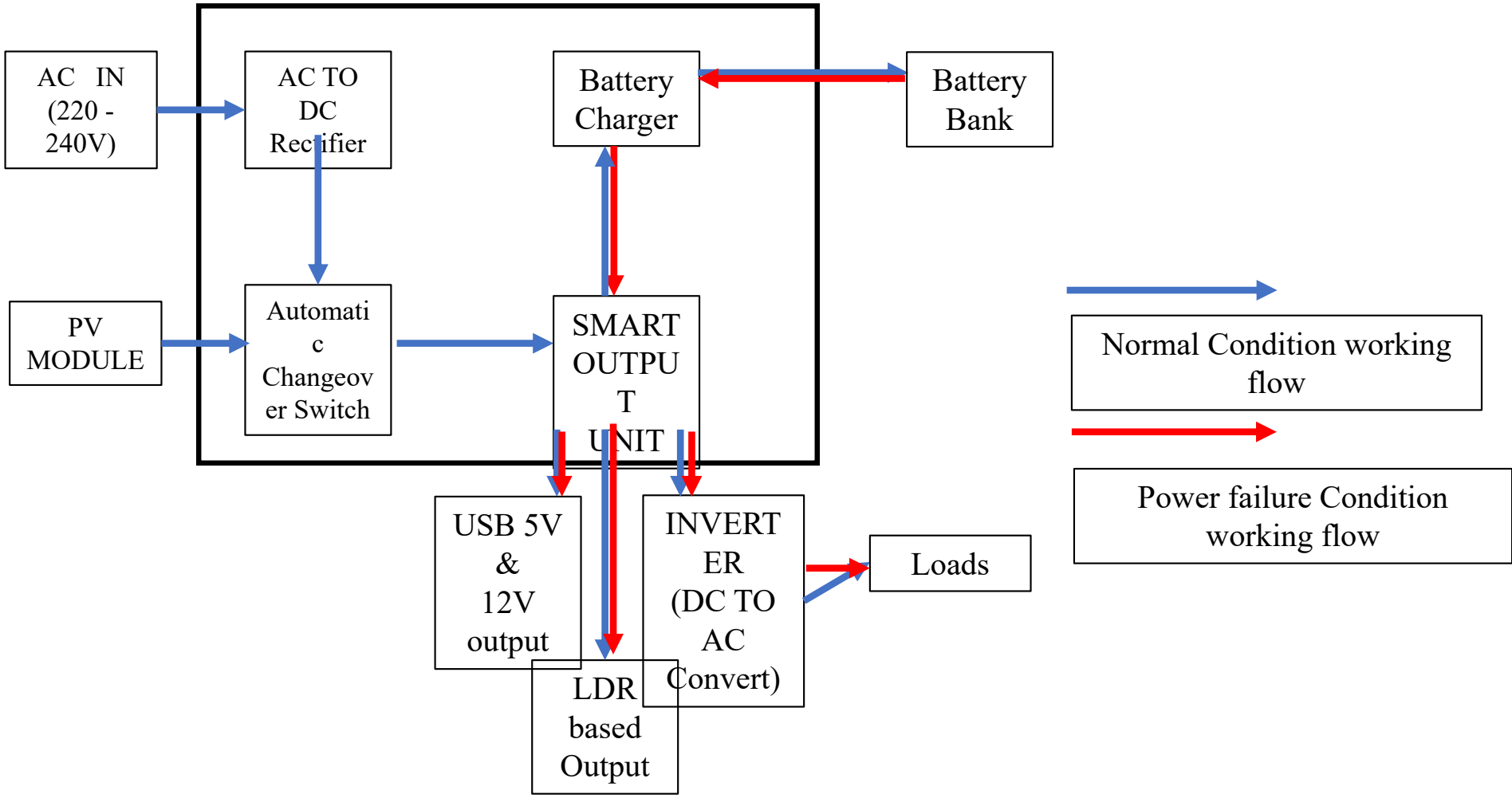
If storage battery power is not enough for night time, generator power can supply to home utility power as well as charge to battery.



On Grid Solar System

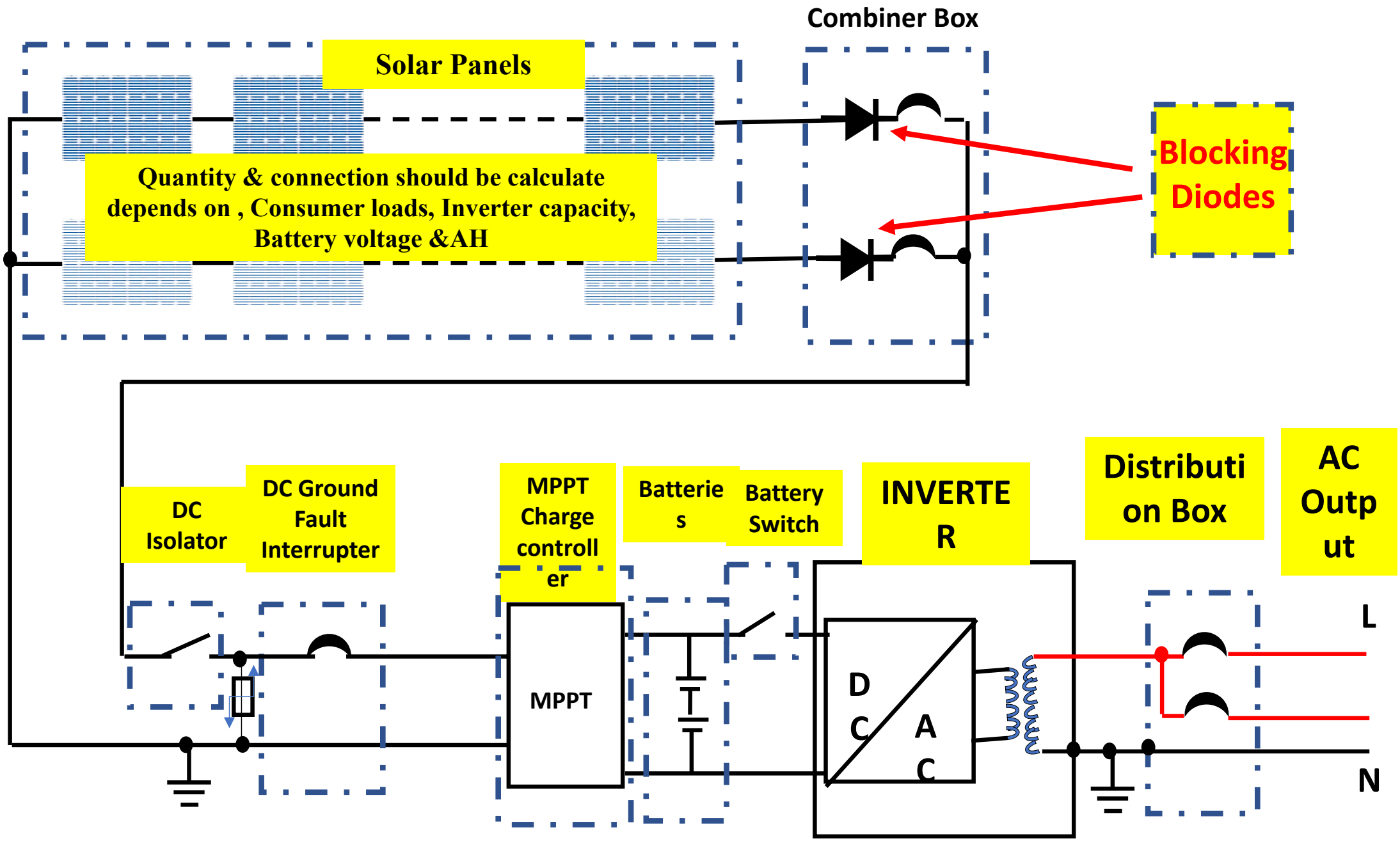


Working Flow Diagrams of Hybrid Solar Inverter



OFF Grid Solar System

Require Materials , devices and accessories



OFF Grid Solar System

Considering of Solar panel requirement depends on Solar charge controller

Solar Specification

Open Volt = 49.3 V DC

Working Max Volt= 41.1 V DC

Working Current = 10.75 A

Short Circuit Current = 11.32A

Maximum Power = 445 Wp

+

-

41.1 x 10.75 =441.825 W

Maximum Input V =160 V
Maximum Current = 60 A
Charge to 12/24/36/48 V

441.825/24 =18.4 A

41.1V

MPPT

24 V

Battery

Solar Specification

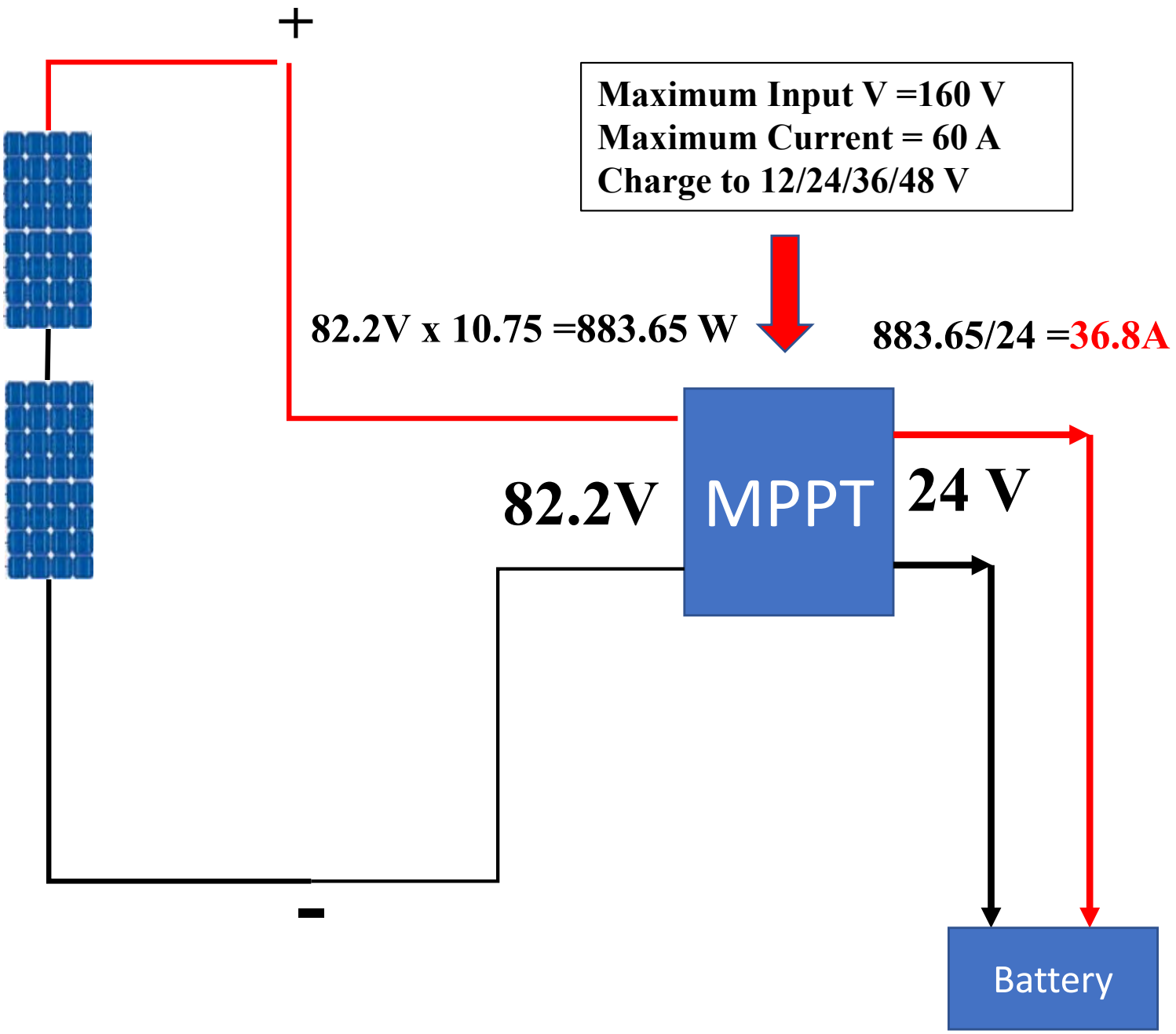
Open Volt = 49.3 V DC

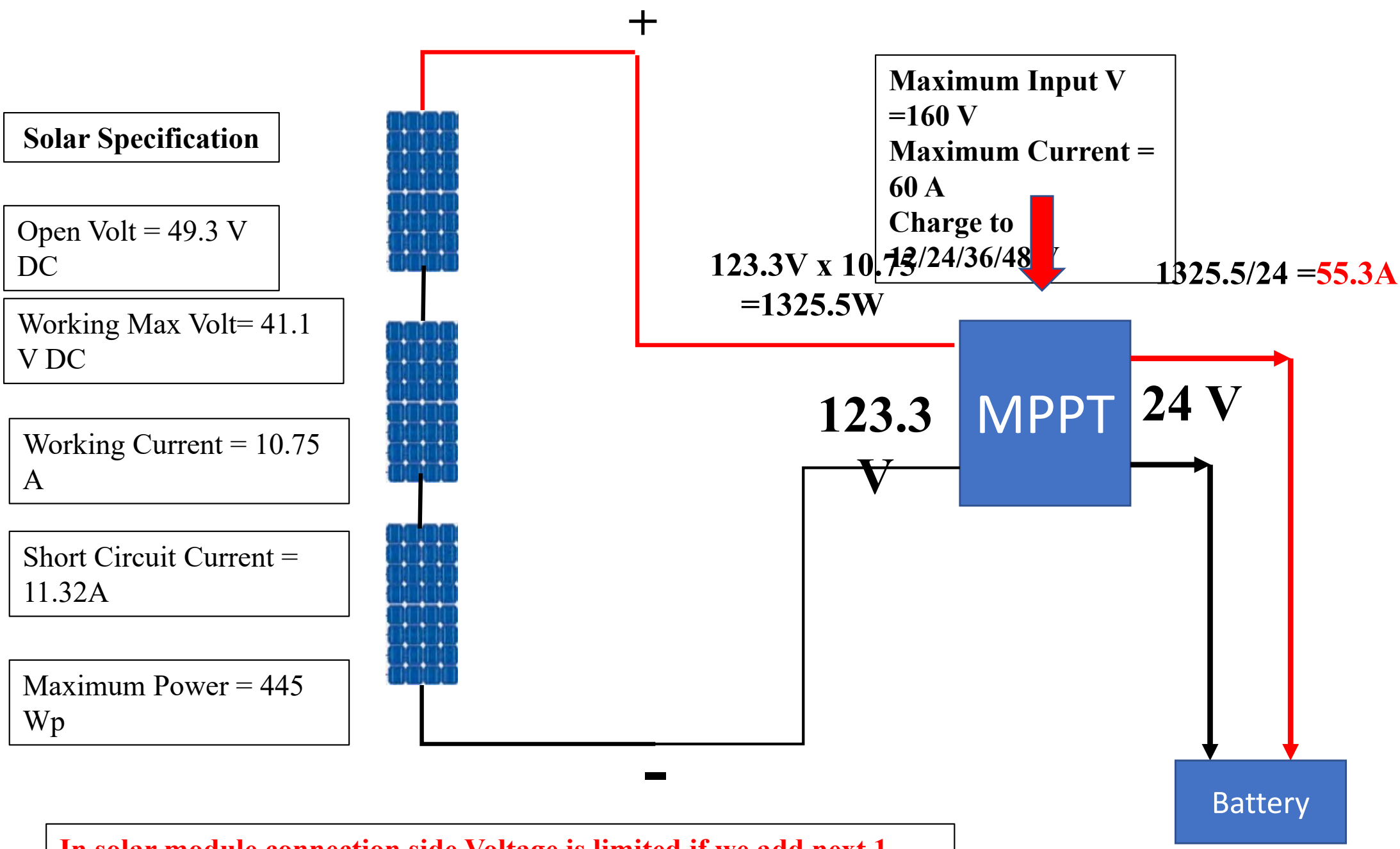
Working Max Volt= 41.1 V DC

Working Current = 10.75 A

Short Circuit Current = 11.32A

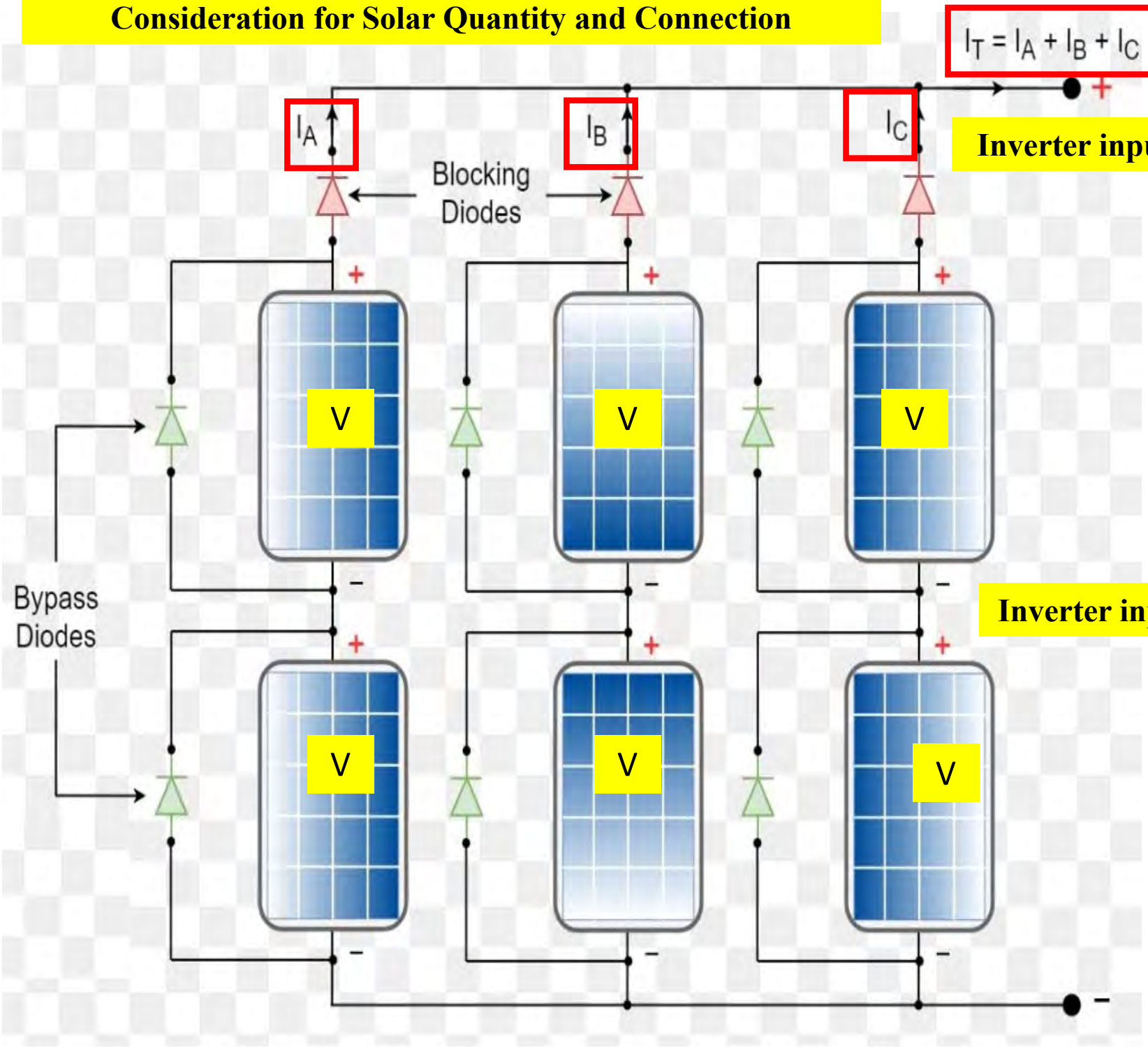
Maximum Power = 445 Wp





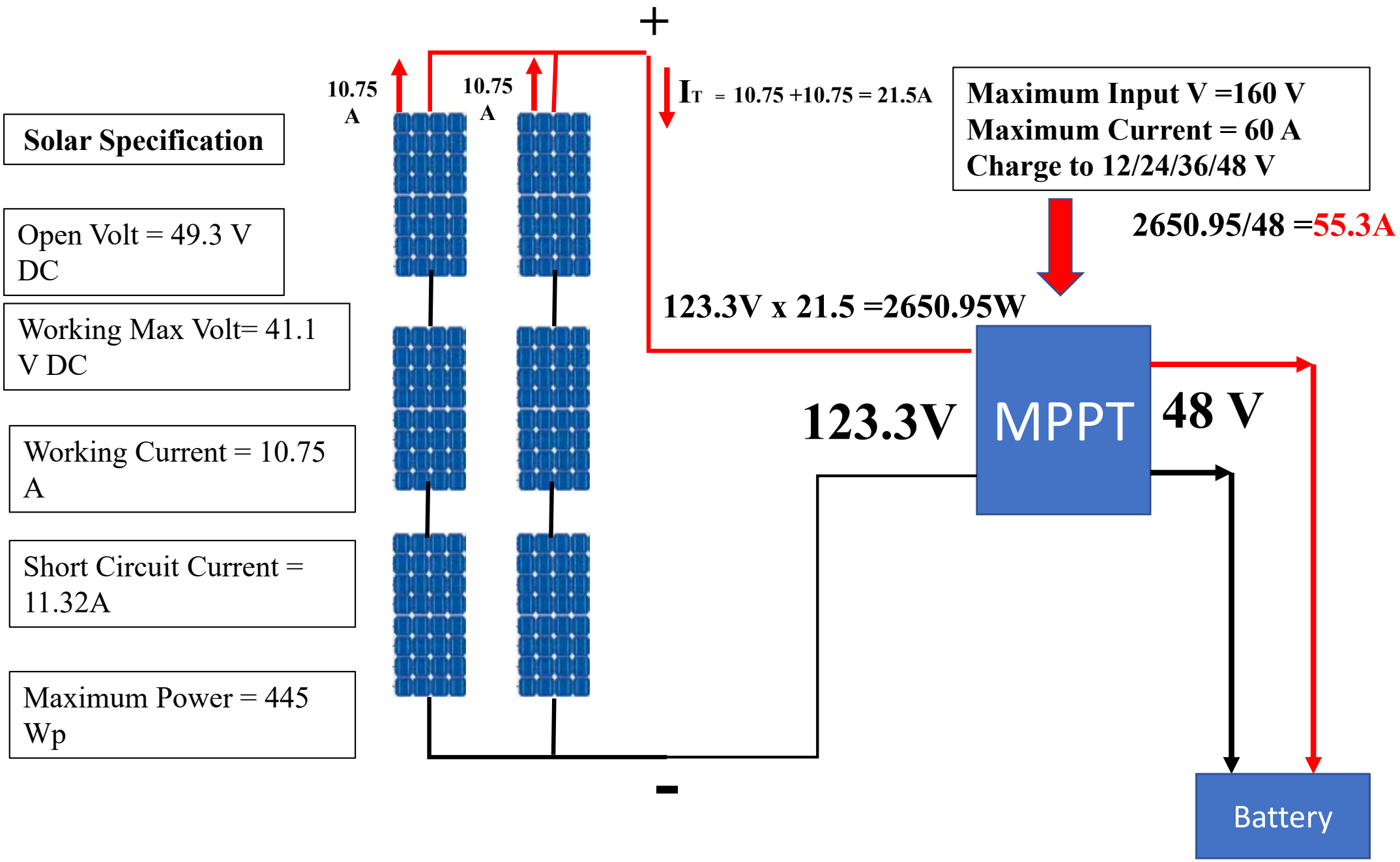
In solar module connection side Voltage is limited if we add next 1 solar panel.
Also battery side current is limited for 24 V inverter system.

Consideration for Solar Quantity and Connection



Inverter input Current = $I_T = I_A + I_B + I_C$

Inverter input Voltage = V+V =2V



This MPPT charge controller is limit for 48V x 60A= 2880 W solar system

1) Power surge protector

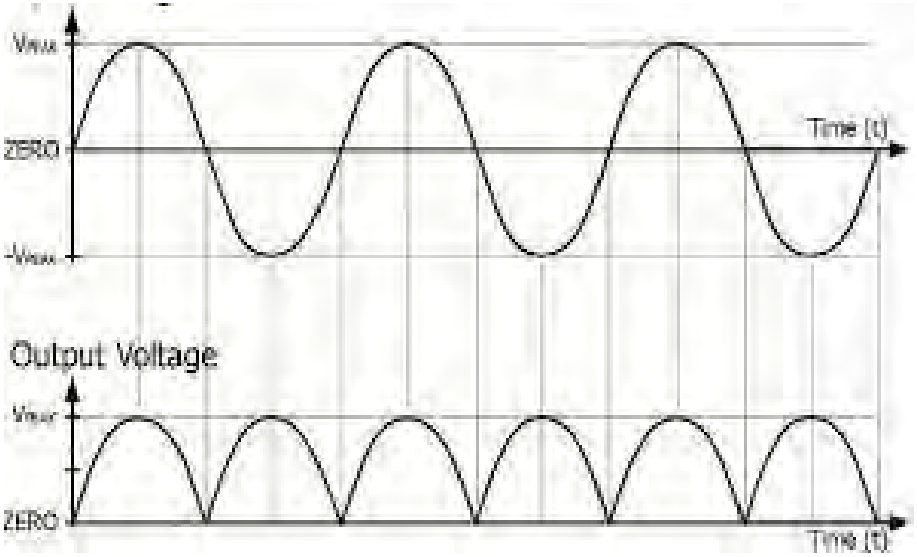
Power surge protectors are divided into DC and AC. **What are the differences between AC surge protectors and DC surge protectors?**

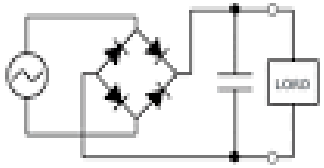
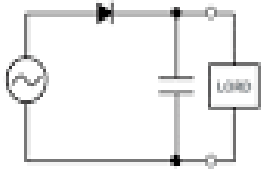
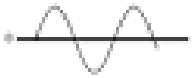
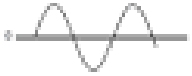
Surge protective suppliers tell you that

The biggest difference between the AC and DC systems is the frequency.

The 50Hz cycle change of the AC system forms three important nodes of zero, positive peak, and negative peak (peak valley), which makes the SPD take turns in the positive and negative directions.

Under the voltage of the positive peak or negative peak, plus the amplitude of positive and negative peak voltage, the cycle time is symmetrical, so that the positive and negative electrons in the SPD chip are also arranged equally and are in a relatively stable state.



	Full-Wave Rectification	Half-Wave Rectification
Circuit Configuration		
Input Voltage Waveform		
Voltage Waveform After Rectification		
Voltage Waveform After Rectification Smoothing		

The DC system has no frequency, and its comprehensive impedance lacks the last two items of the above formula (only the internal resistance and line resistance of the power supply itself), so the internal resistance of the DC system is lower than that of the AC system.

The advantage of low DC internal resistance is high efficiency, and the disadvantage is The reason is that once the short circuit occurs, the discharge current will be very large, and because there is no zero-crossing feature, it is difficult to cut off, which can easily cause a fire accident, and this kind of fire is difficult to control, and the energy in it is often exhausted before it is turned off.

Therefore, in the power supply system, the price of DC surge protectors, DC circuit breakers, and DC relays is higher than that of similar products in the AC system, which is also due to the difficulty of DC breaking, high production process and technical requirements, and high cost.

Surge protective supplier tells you the difference between AC surge protectors and DC surge protectors. In addition to the higher, more stable, and more uniform heat generation of the chip, the design of the disconnection mechanism of the DC surge protector is very important, and the disconnection mechanism is required to respond more quickly and the disconnection distance is larger.

Not only is it required to be able to drive the disengagement mechanism to act under a small amount of heat, but also the creepage distance must be large enough to reduce the risk of accidents. In a word, the DC surge protector is required to operate before the chip breaks down, so as to ensure that the DC SPD does not catch fire.

However, due to the limited internal space of the SPD, how to design the detachment mechanism is a test of the technical strength of a surge protector manufacturer.

.

(2) Signal surge protector

Because the electromagnetic interference (EMI) generated by the communication equipment has a certain impact on the surrounding environment, the surrounding electronic equipment cannot work normally.

The signal surge protector is a device used to suppress various transient over-voltages and pulses. It is mainly used in power supply systems of electric power, railway, aviation, transportation, and other systems and computer information system equipment.

How Signal Surge Protectors Work

The surge protector supplier will tell you that when there is a high-frequency peak pulse current passing through the input terminal (such as the moment of a lightning strike in the mains power grid), a large-amplitude impulse current Ip (Input Pulse Impedance) will be generated in the input circuit.), this current will enter the constant current diode VDD2 (Current Detector Diode) after stepping down through the isolation transformer for absorption, filtering, amplification, and shaping, and then provide a stable DC voltage source Ie (Induction Power) to the load.

To sum up, the difference between AC surge protectors and DC surge protectors is quite large and **cannot be used universally**.

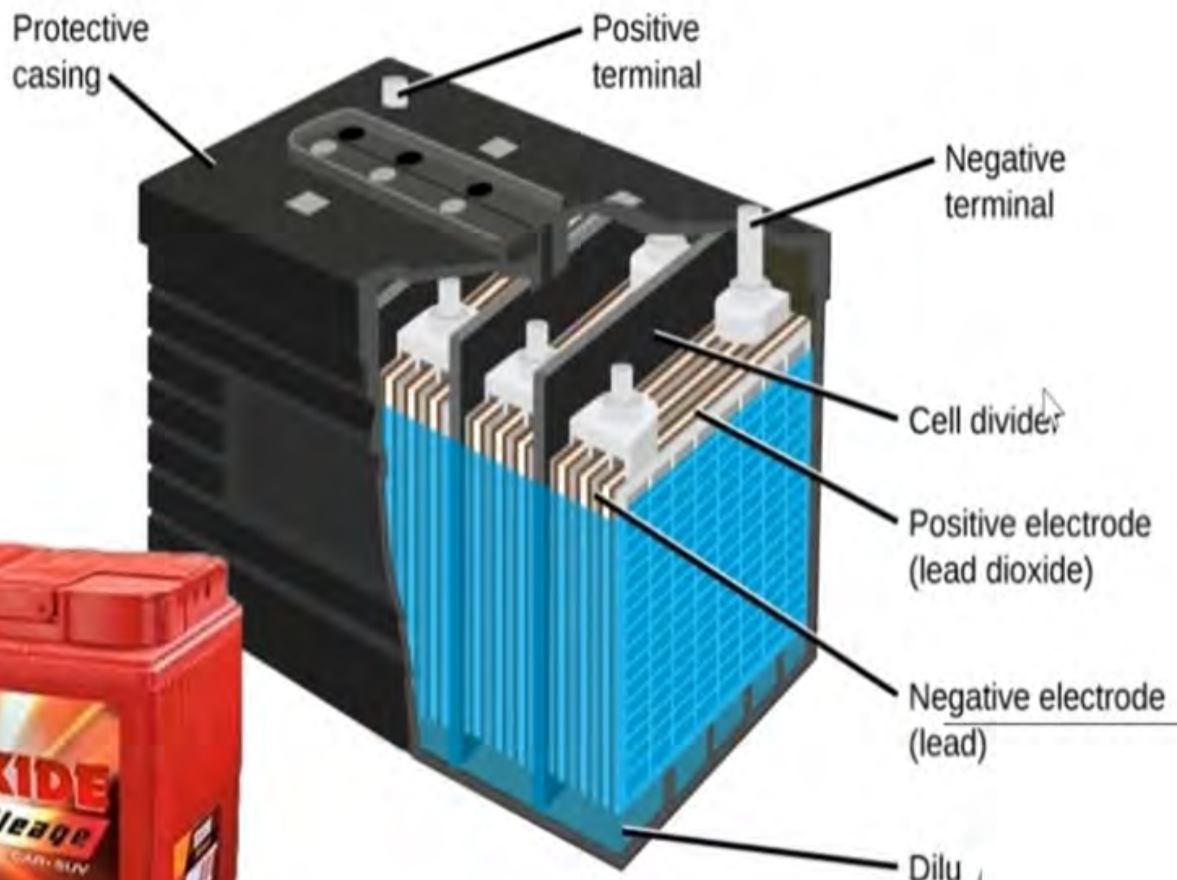
BATTERIES

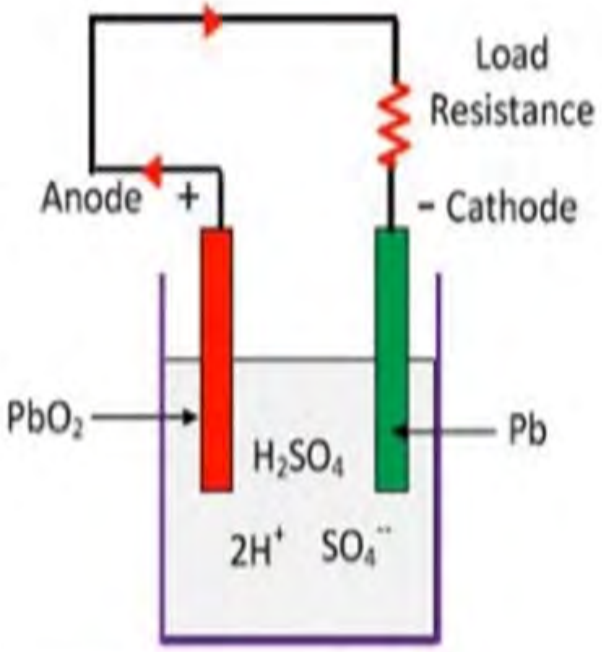
Inverter Capacity and battery usage

Up to 1000 VA inverter use with	12 V battery
1000VA to3000VA or(3000W) inverter use with	24V battery
5000 VA or 5000W(3kW)inverter use with	48V battery

Batteries

Lead Acid Battery





D2 DELL, 6/26/2023

What type of batteries are use for solar power storage?

There are four main types of batteries used to store solar energy:-

Lead-Acid,
Lithium-ion,
Flow batteries,
Nickel cadmium

What type of batteries is best for at home solar?

Lithium-ion batteries

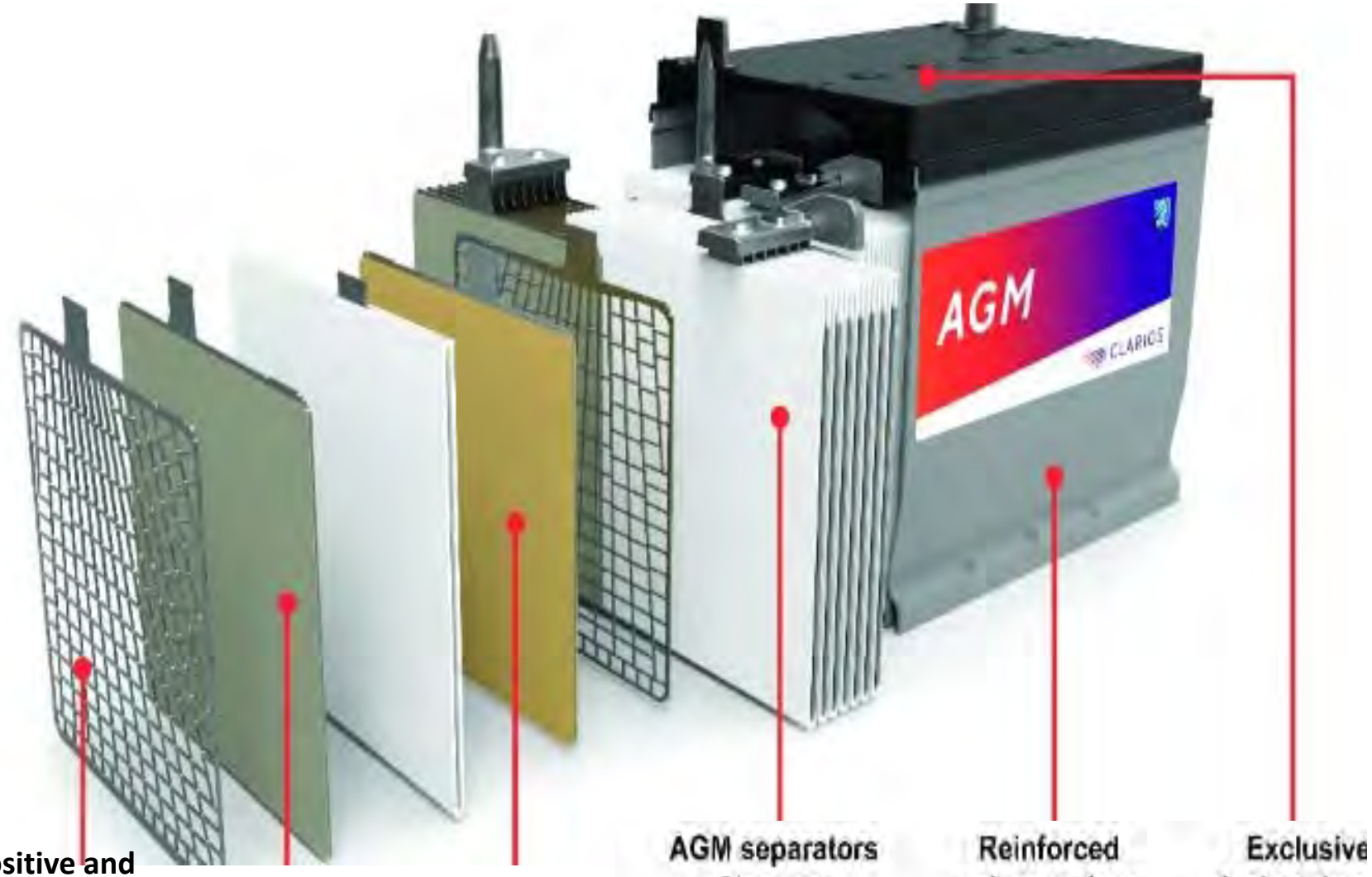
Lithium Nickel Manganese Cobalt Oxide (NMC)

Lithium ion Phosphate (LFP)

Lithium Ion Phosphate 4 (LiFePo4)

What is AGM Battery type?

AGM means absorbent glass mat and refers to the fine glass fiber separator between the positive and negative plates that helps absorb all the battery acid. AGM Batteries are **advanced lead-acid batteries**.



Positive and negative stamped grids
Patented stamped grids Technology for produce strong efficiency grids for High performance

Proprietary negative paste
Increases charge acceptance.

High-density positive paste
Provides strong bonds for more cycles.

AGM separators
Glass mat separators immobilize electrolyte for stable cycle performance and results in a NON-SPILLABLE design.

Reinforced polypropylene case
Holds the plates under compression — even in high-vibration applications.

Exclusive dual-seal va assembly
Valves open low pressur and close automatically prevent air fr leaking in.

What factors are important to choose battery.

Please consider following factors

Rechargeability	အားသွင်းနိုင်မှု အကြိမ်
Energy density	Energy density is the amount of energy a battery contains compared to its weight or size. Energy density is the measure of how much energy a battery contains in proportion to its weight .
Power density	Power density is the measure of power output per unit. (Current Availability)
Shelf life	သက်တမ်းခံနိုင်မှု
Safety	အန္တရာယ်ကာကွယ်မှု
Form factor	အရွယ်အစား ပုံစံ အချိုးကျမှု
Cost	ဈေးနှုန်း
flexibility	ပြောင်းလဲသုံးစွဲနိုင်မှု ဝန်အားတောင့်ခံနိုင်မှု

Lead-acid Battery VS Lithium Battery

>>>>>>	COMPARISON	<<<<<<
300-350	Cycle	6000
3-5 years	Design Life	10 years
20 degree C	Operating Temperature	10 – 50 degree C
Harmful	Environment	friendly

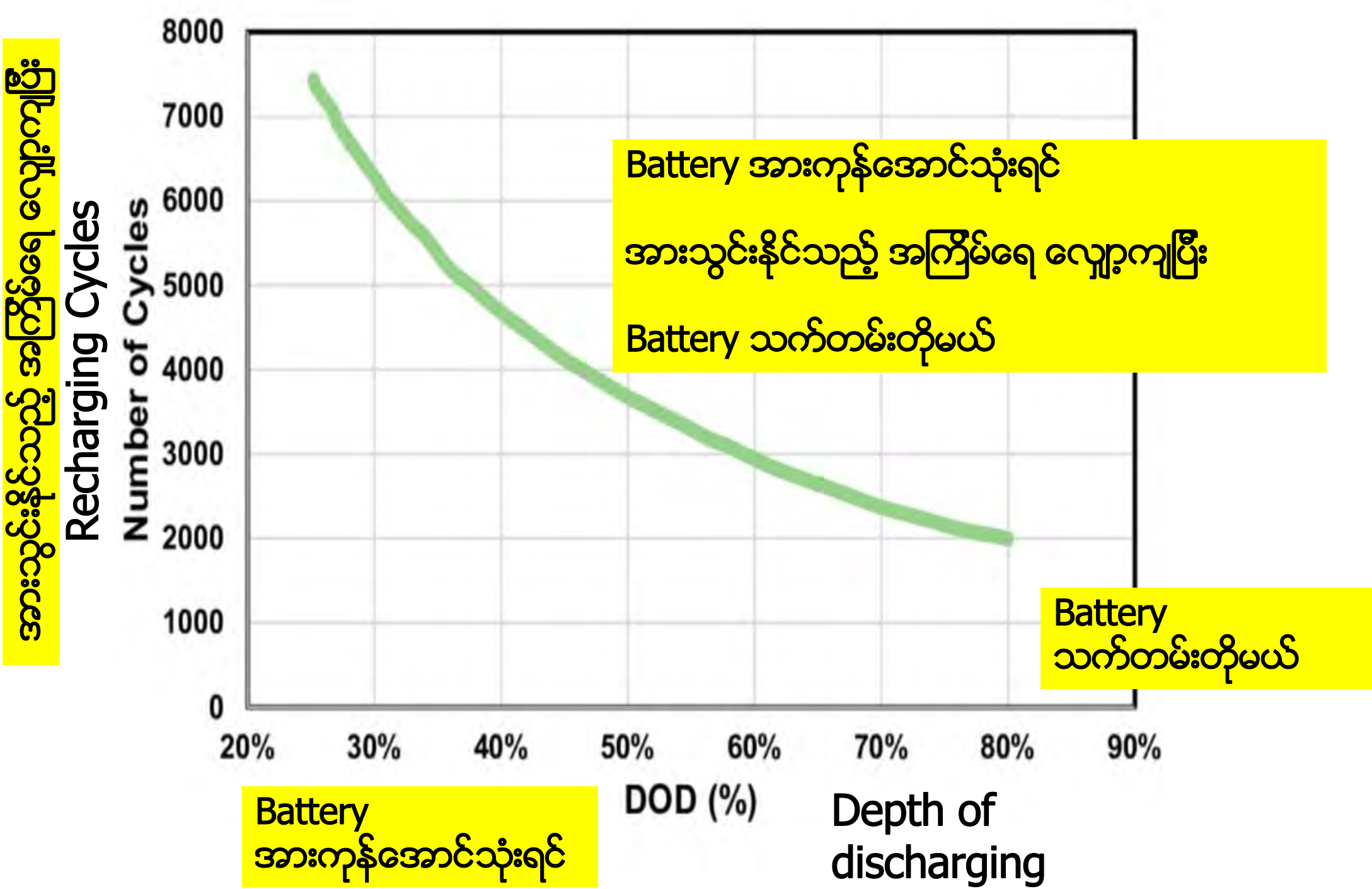
Understanding the DOD of battery?

DOD = Depth Of Discharging

What batteries are good DOD ?

Most **lead-acid** batteries experience significantly reduce cycle life if they are discharged below 50%DOD.

LiFePO4 batteries can be continually discharged to 100% DOD and there is no long-term effect. However, we recommend you only discharge **down to 80%** to maintain battery life.


အားသွင်းနိုင်သည့် အကြိမ်ရေ လျော့ကျပြီး
Recharging Cycles
Number of Cycles
8000
7000
6000
5000
4000
3000
2000
1000
0
20%
30%
40%
50%
60%
70%
80%
90%
DOD (%)
Depth of discharging
Battery အားကုန်အောင်သုံးရင်
အားသွင်းနိုင်သည့် အကြိမ်ရေ လျော့ကျပြီး
Battery သက်တမ်းတိုမယ်
Battery အားကုန်အောင်သုံးရင်
Battery သက်တမ်းတိုမယ်

Reading taken via Voltmeter after resting for more than 2 hrs(I.e. no charging or discharging)		
State of Charge **(SoC)**	12V	Comments
100%	12.70	
95%	12.60	
90%	12.5	
80%	12.42	
70%	12.32	
60%	12.2	
50%	12.06	
40%	11.9	
30%	11.75	
20%	11.58	
10%	11.31	
Below 10% DEAD	10.5 or Less	

Suggestion of discharge and charge of Lead Acid Battery

100% = 12.7 V

95% = 12.6 V

90% = 12.5 V

80% = 12.42 V

70% = 12.32 V

60% = 12. 2 V

50% = 12.06 V

40% = 11.90 V

30% = 11.75 V

20% = 11.58 V

10% = 11.31 V

Below 10% = 10.5 V

Cycling your battery in this zone will ensure reasonable life expectancy

(50% - 100%)

Occasionally dropping into this zone is OK but is not recommended. Repeated discharge to these levels will shorten battery Life

(20% - 0%)

Permanent damage will occur

(10% Below)

Notice

If you used Lead- Acid battery >90% DoD
< 10% SoC

Battery will permanently damage

State of Charge
(SoC)

What is 50 DoD in 12 V battery?

For example, 50% DoD means that half of the energy in the battery has been used 80% DoD means that 80% of the energy has been discharged So the battery now holds only 20% of its full capacity.

How do you calculate DoD from SoC?

Soc is usually expressed as percentage(0% =empty, 100% = full)

An alternative from of the same measure is the depth of discharge(DoD) Calculated as 100-SoC (100% = empty, 0% = full)

What does 100% DoD means?

This means that if the battery is drained fully, the depth of discharge is 100%

On the other hand, if the battery is fully charged, the DoD is 0%

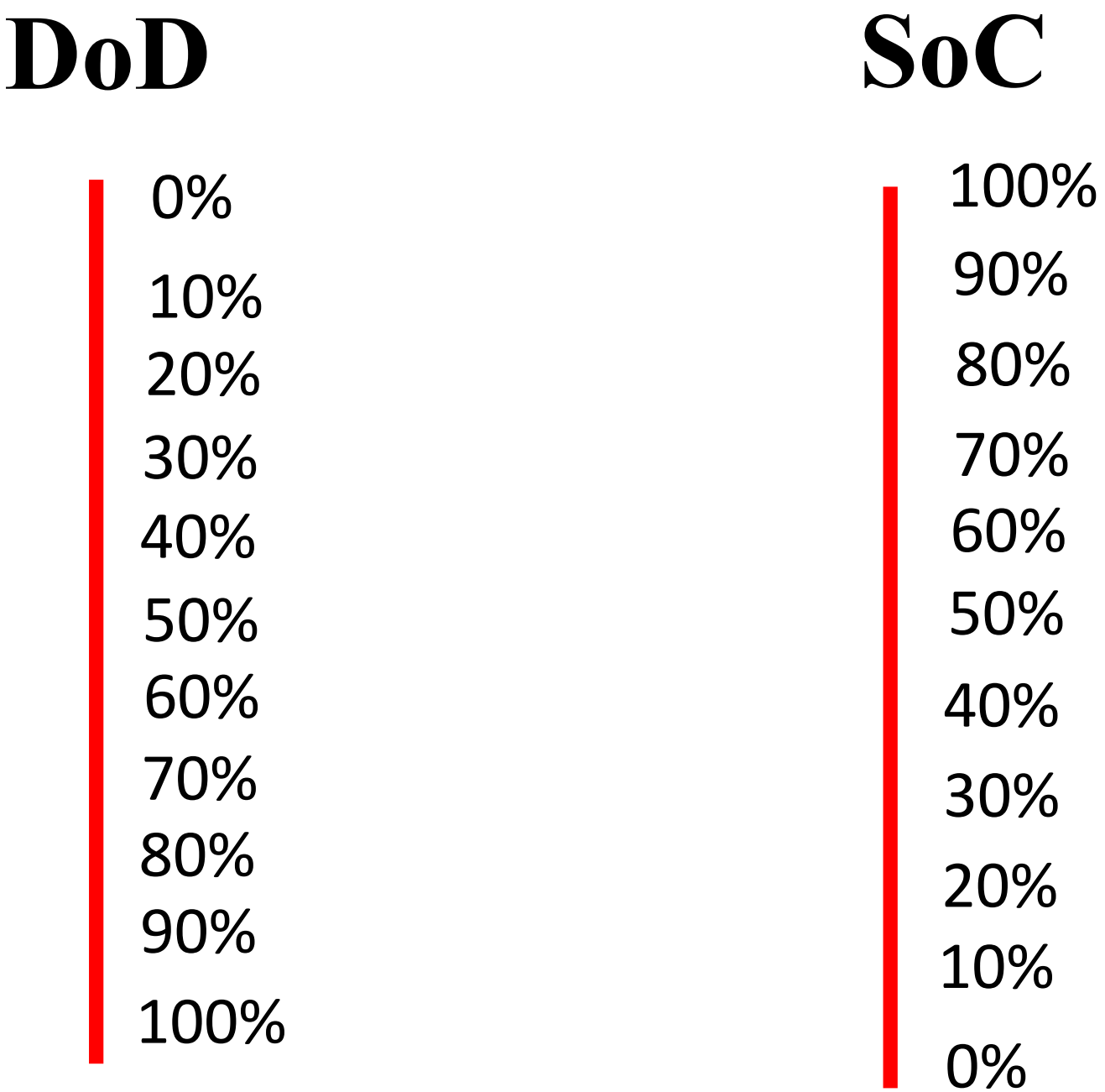
State of Charge (S0C) of Battery

Battery SoC: SoC is the level of charge of an electric battery relative to its capacity.
The unit of SoC are percentage points (0% = empty; 100% = full)

The SoC is the ratio of charge stored (μ (t)) in the battery to the nominal capacity (μn).

The SoC can be defined as :

$$SoC(t) = \mu (t) / \mu_n \times 100\%$$


DoD
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
SoC
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%

Tutorial

A 12 V battery with capacity of **500Ah is at 80% SoC.**
Find the charge stored and energy delivered to be load.

Solution

Given
SoC = 80% V = 12V

Capacity (μ_n) = 500Ah

U_n = ဘက်ထရီပေါ်ရေးထားသည့် Ah
SoC = ဘက်ထရီတွင်သိုလှောင်ထားသည့်အား
$U_{(t)}$= ဘက်ထရီတွင်သိုလှောင်ထား သည့်အား
ရာခိုင်နှုန်းကို ဖြင့်တွက်ချက်ပြခြင်း

Ans (i) Charge stored at 80% SoC $[\mu(t)]$

$$\mu(t) = \mu_n \times SoC/100 = 500 \times (80/100) = 500 \times 0.8 = 400 \text{ Ah}$$

Ans (ii) Power being delivered to load = 400 Ah x 12 V
= 4800 watt-hour
4.8 kWh

မှတ်ချက်

ဘက်ထရီတွင်သိုလှောင်ထား သည့် အားသည် 400 Ah ဖြစ်သော်လည်း Lead Acid Battery တွင် အကုန်သုံး၍ မရပါ 50% သာသုံးရမည်ဖြစ်၍ (400-250) = 150Ah သာ သုံး၍ရမည်။ ထို့ကြောင့် (150 Ah x 12V = 1800 Watt hour = 1.8kWh သုံးနိုင်မည်

Lithium Iron Battery တွင် SOC 20% ချန်သုံးရမည်ဖြစ်၍ (400-100) = 300Ah သုံး၍ရမည်။ ထို့ကြောင့် (300 Ah x 12V = 3600 Watt hour = 3.6kWh သုံးနိုင်မည်

Choosing the right type of Inverter

If we are not 100% sure about which type of inverter would suit the best ask ourself these questions:-

Does our device or appliance use motor?:-

Is our device a delicate piece of medical equipment?

} Need pure sine wave inverter

Does our device or appliance use a rectifier?

Can our device be power by a DC adapter?

Use for Lighting

} Can use Modify sine wave inverter

Knowledge Lithium iron Phosphate (LFP)

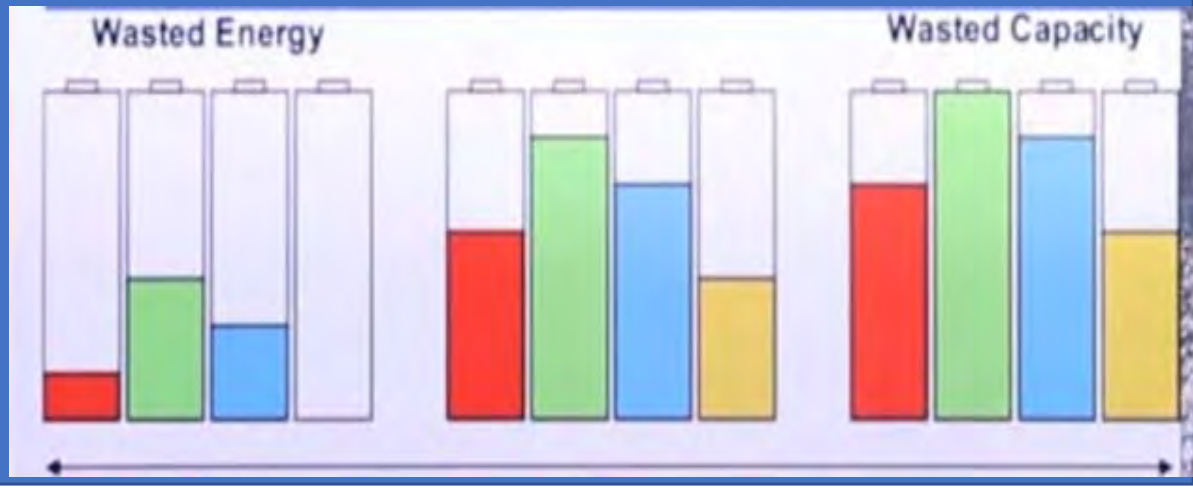
What is it?

* Lithium battery are group of Cell.
* Each cell is a chemical System
* Each cell is Different
* Miss Management is BAD.
* Whole battery bank can fail

Knowledge Lithium iron Phosphate (LFP)

Why?

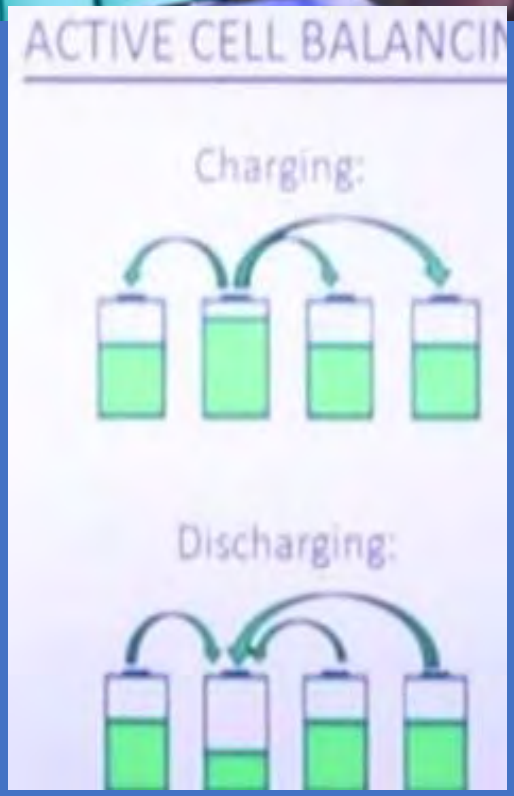
* C & D & Ah is not same in each cell
* Electrochemistry changes over time
* Feedback loop can make worst
* BMS is a must for long term use
* Make battery pack unstable



Knowledge Lithium iron Phosphate (LFP)

How

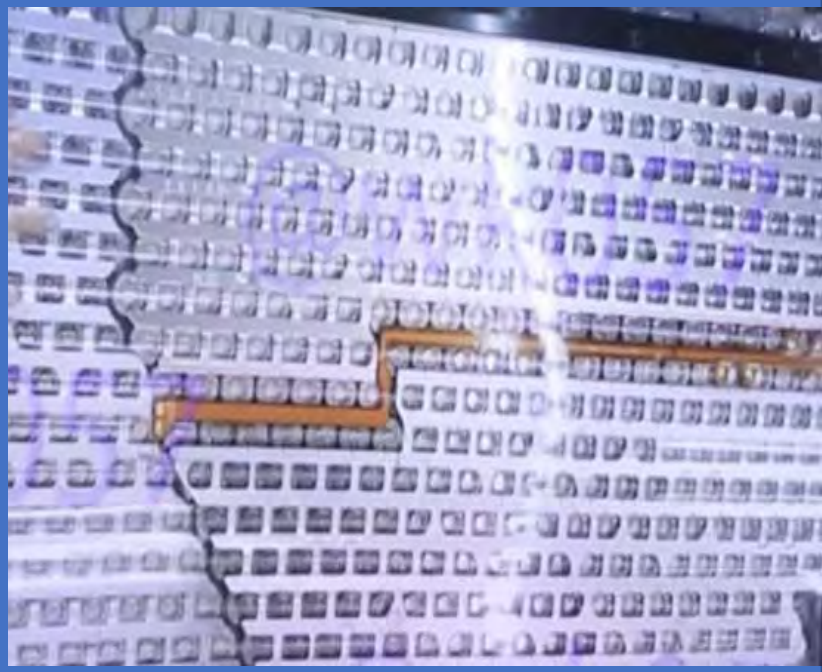
* Topology optimization
* Parallel cell auto balances
* Active systems can control charge
* Cell voltage is constantly monitored



Knowledge Lithium iron Phosphate (LFP)

FUTURE

* Better algorithm & High efficiency
* Smarter Topology & DATA Logging



If you are using LiFePo4 batteries in Rooftop solar system

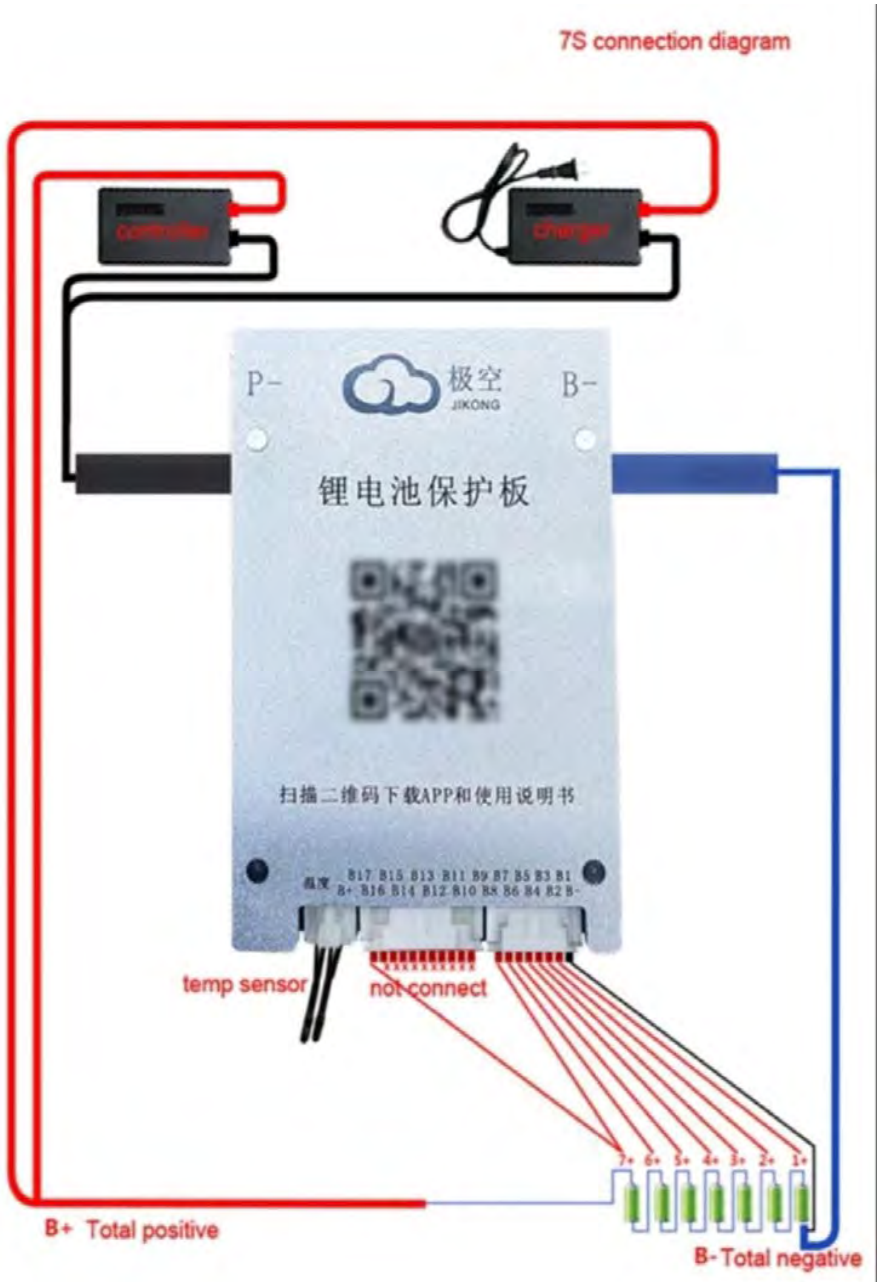
Need BMS in your LiFePo4 batteries

BMS = Battery Management System

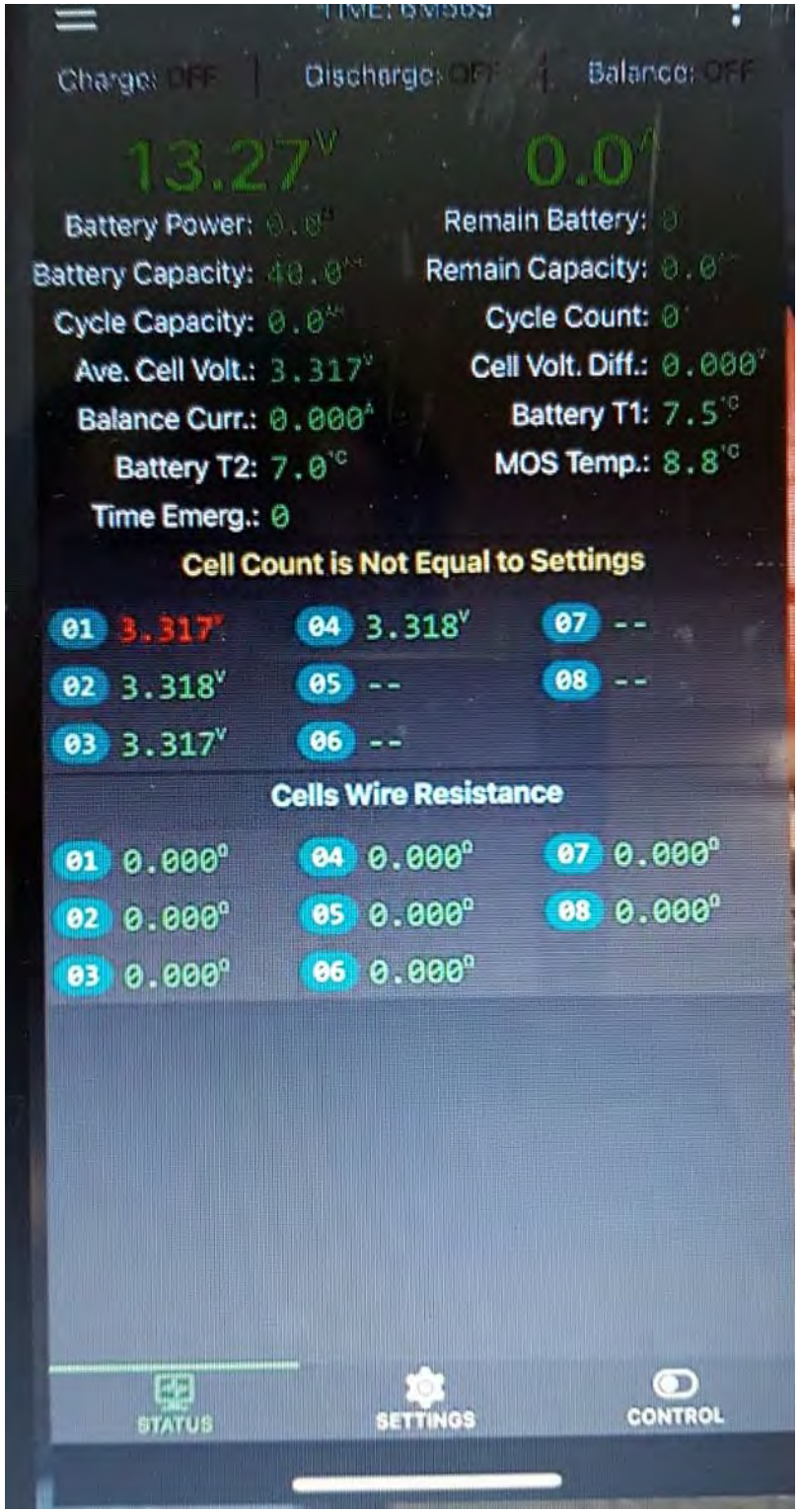
LiFePo4 battery with Daly BMS control unit

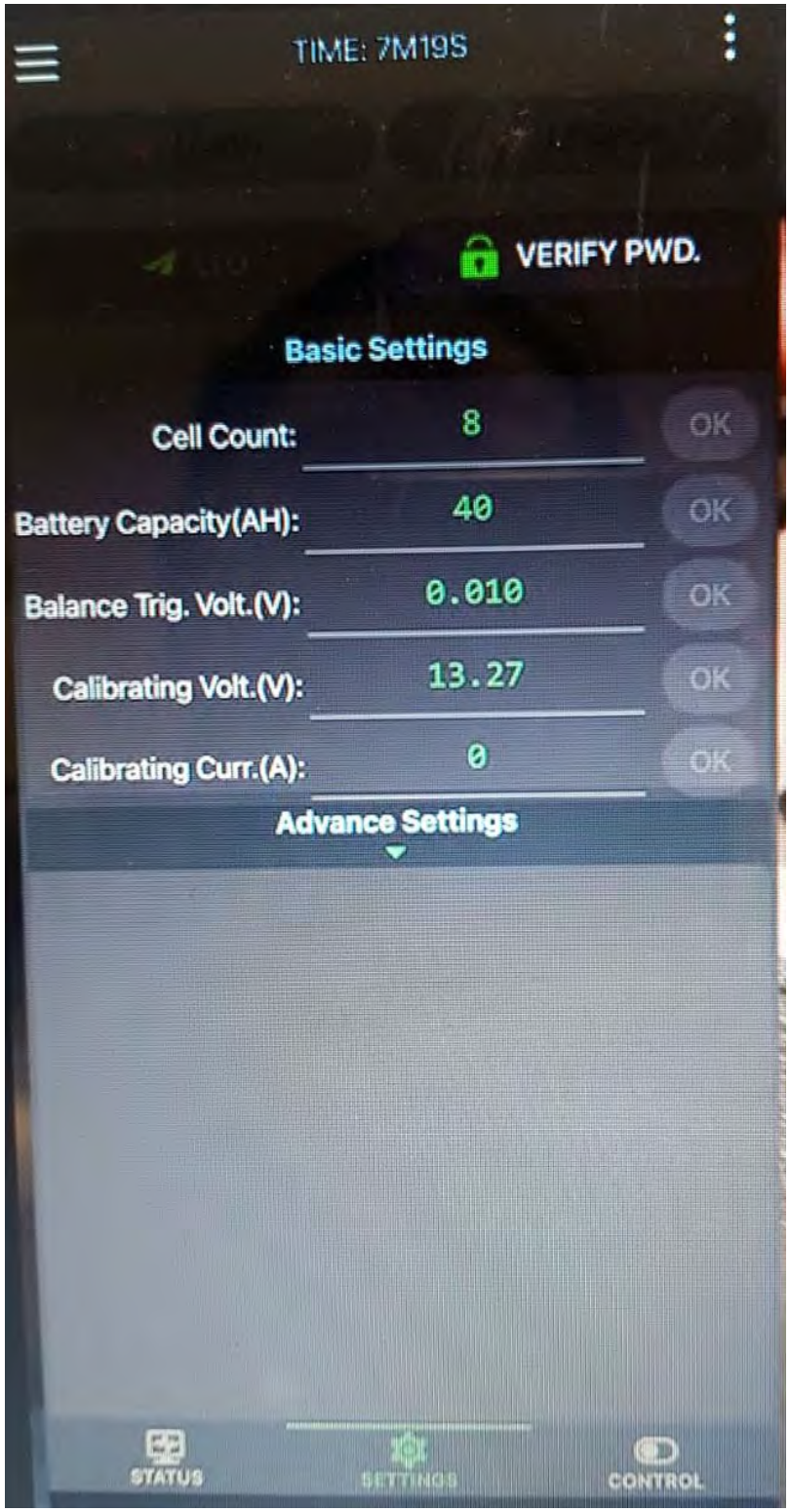
LiFePo4 battery with Jikong BMS control unit

Battery Management System units in local Myanmar Market

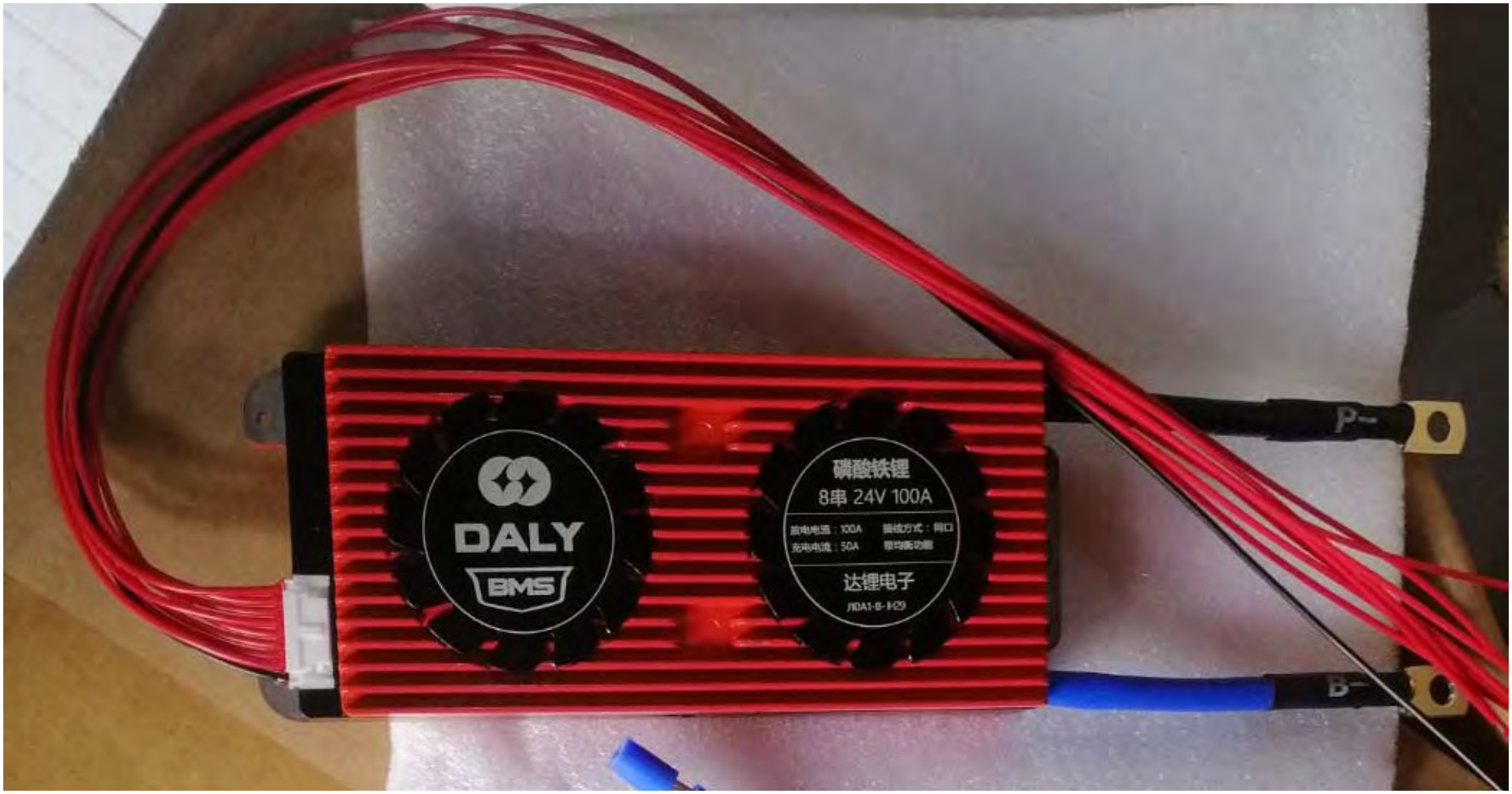


Jikong BMS control unit


Charge: OFF
Discharge: OFF
Balance: OFF
13.27V
0.0A
Battery Power: 0.0W
Remain Battery: 0
Battery Capacity: 40.0AH
Remain Capacity: 0.0AH
Cycle Capacity: 0.0AH
Cycle Count: 0
Ave. Cell Volt.: 3.317V
Cell Volt. Diff.: 0.000V
Balance Curr.: 0.000A
Battery T1: 7.5°C
Battery T2: 7.0°C
MOS Temp.: 8.8°C
Time Emerg.: 0
Cell Count is Not Equal to Settings
01 3.317V
04 3.318V
07 --
02 3.318V
05 --
08 --
03 3.317V
06 --
Cells Wire Resistance
01 0.000Ω
04 0.000Ω
07 0.000Ω
02 0.000Ω
05 0.000Ω
08 0.000Ω
03 0.000Ω
06 0.000Ω
STATUS
SETTINGS
CONTROL


TIME: 7M19S
VERIFY PWD.
Basic Settings
Cell Count: 8 OK
Battery Capacity(AH): 40 OK
Balance Trig. Volt.(V): 0.010 OK
Calibrating Volt.(V): 13.27 OK
Calibrating Curr.(A): 0 OK
Advance Settings
STATUS
SETTINGS
CONTROL

Battery Management System units in local Myanmar Market



Daly BMS control unit

CS BMS WIRE DIAGRAM FOR COMMON PORT

3.2V/Ce
ll

For 12 V battery = 3.2V/Cell x 4 Nos = 12.8V

For 24 V battery = 3.2V/Cell x 8 Nos = 25.6V

Daly BMS control unit wiring installation Procedure

I. Pls do not insert balance wires into BMS before connecting batteries, must make sure connecting with batteries correct.

II. The sequence of connecting wires for BMS: Note : Pls ensure to use balancing wires for Daly!

1 .From thin black balance wire to start, the 2nd wire (thin red wire) connect with the 1st battery's positive pole. Then connect each cell's positive pole in order until the last one B+

2. Do not insert the connector directly after the wires were connected .Measure the voltage between two adjacent metal terminals on the back of the connector , if it is Li-ion battery, the voltage should be between 3.0~4.2V ,Lifepo4 battery should be between 2.0~3.6V , and LTO battery should be between 1.5~7.5V;

3. After the wiring sequence and voltage are confirmed to be correct, then insert into BMS;

4. Adjust the multimeter to the buzzer position and measure the internal resistance between B- and P- when the internal resistance is 0 , there will be a beep , which means that the BMS is good .Otherwise ,do not weld and contact the customer service ;

5. The last step to connect B- (thick blue wire) with battery pack's total negative pole

I. After finished wiring :

Measure whether the B+ and B- voltage and B+ and P- voltage of the battery are equal, if yes, it means the BMS works normally and can be used. If not, please recheck according to the above wiring sequence

C rating of battery

The battery C rating is **the measurement of current in which battery is charged and discharged at.**

The capacity of a battery is generally rated and labelled at the 1C Rate (1C current), this means a fully charged battery with a capacity of 10 Ah should be able to provide 10Amps for one hour.

Charge and discharge rates of a battery are governed by C – rates.

The capacity of a battery is commonly rated at 1C, meaning that a fully charged battery rated at 1Ah should provide 1A for one hour.

The same battery discharging at 0.5C should provide 500mA for two hours, and at 2C it delivers 2A for 30minutes.

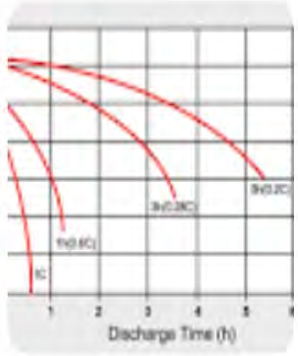
Table 1 illustrates typical times at various C-rates.

C-RATE	TIME
5C	12 min
2C	30 min
1C	**1h**
0.5C or C/2	2h
0.2C or C/5	5h
0.1C or C/10	10h
0.05C or C/20	20h

What is C5 C10 C20 battery rating?

C-rating describes how much current the battery will deliver over the set time period. Being 20 hours for C20, 10 hours for C10 and 5 hours for C5.

Due to sluggish behavior, lead acid is rated at **0.2C (5h) and 0.05C (20h)**.



ဆိုလာစနစ်ဖြင့် အိမ်သုံးလျှပ်စစ်ထုတ်လုပ်သုံးစွဲနိုင်ဘို့အတွက် မဖြစ်မနေလိုအပ်မဲ့

ဆိုလာပြား ဆိုလာကွန်ထရိုလာ အင်ဗာတာ ဘက်ထရီ အကြောင်းတွေကို
ဖေါ်ပြရှင်းလင်းခဲ့ပြီးဖြစ်သည်။

ဆိုလာမီးစနစ်ကို တပ်ဆင်ရခြင်း၏ ရည်ရွယ်ချက်

Energy Saving (အီးပီစီ မှ မီတာခ သက်သာချင်လို့ ON Grid Solar Inverter Systemတပ်ပါ(Battery မပါ) တပ်မှာလား)

လျှပ်စစ်မီးမရှိသေးတဲ့နေရာမှာဆိုရင် OFF Grid Solar Inverter System တပ်ပါ(Battery ပါ)

မီးပျက်တဲ့ အချိန်မှာလည်း လျှပ်စစ်သုံးစွဲချင်လို့ Hybrid Solar Inverter System တပ်ပါ(Battery ပါ) တပ်မှာလား

ဆိုလာမတတ်ဘဲ မီးပျက်တဲ့ အချိန်မှာလည်း လျှပ်စစ်သုံးစွဲချင်ရင် Normal Inverter System တပ်ပါ(Battery ပါ)

တပ်ဆင်သုံးစွဲချင်တာတွေက

Lighting only or Lighting + TV

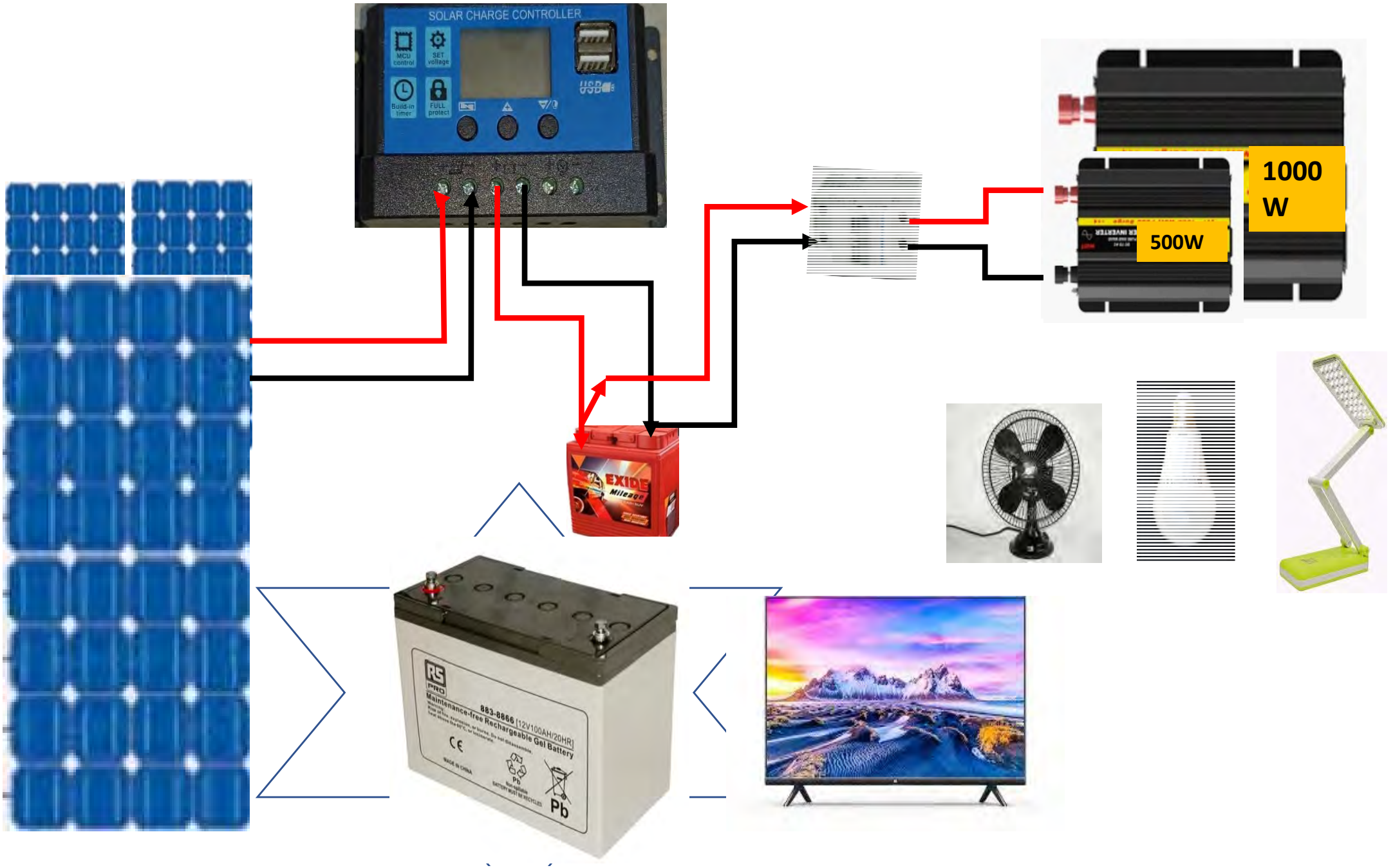
Lighting + TV + Refrigerator + water Pump

Lighting + TV + Refrigerator + water Pump + Air con

More ----more

တွက်တတ်ချက်တတ်တဲ့ အင်ဂျင်နီယာတွေ ခန်အပ်တာဝန်ပေးထားတဲ့ Solar sale Company တွေကနေ ဝယ်ယူတတ်ဆင်ပါ။
After sale service ပါပေးနိုင်ရပါမယ် အခက်အခဲရှိမှ ဟိုခေါ်ဒီခေါ်မရပါက အခက်အခဲရှိနိုင်ပါသည်။

ရိုးရိုး မီးအလင်းရောင် အသုံးပြုဘို့ ဆိုရင်



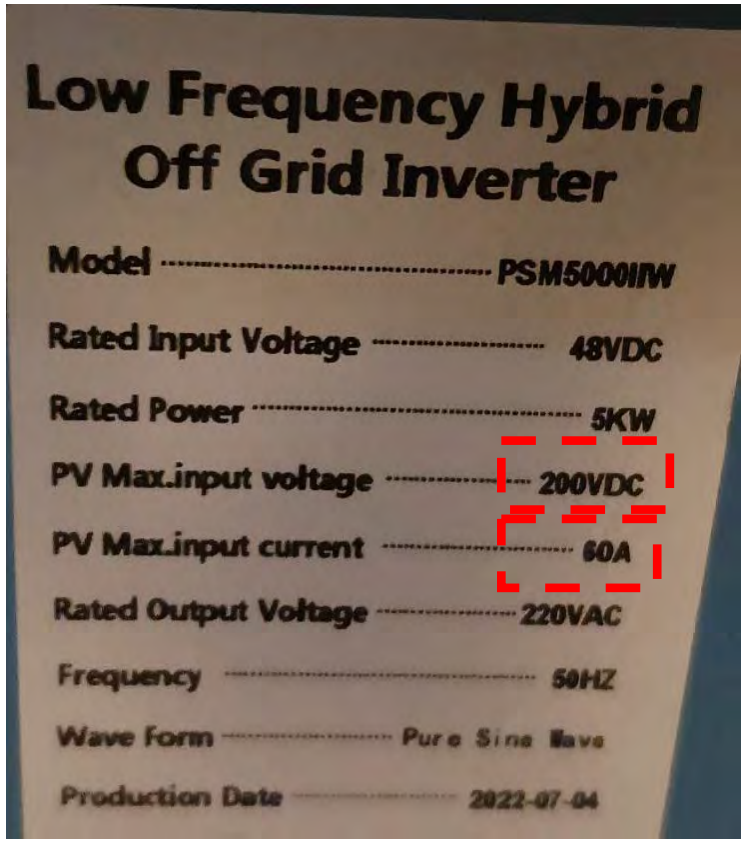
ဆိုလာစနစ်ဖြင့် အောက်မှာဖော်ပြထားတဲ့ အိမ်သုံးလျှပ်စစ် အသုံးအဆောင်တွေကို သုံးစွဲခြင်ရင်တော့

ဒီဇိုင်းနားလည်တတ်ကျွမ်းသူတွေနဲ့ ဆွေးနွေးတိုင်ပင်ပြီးမှ တပ်ဆင် သင့်ပါတယ်

ဒါမှမဟုတ်လို့အပ်ချက်နဲ့ ကိုက်ညီပြီး စိတ်ကျေနပ်မှု ငွေကုန်ကျရကျိုးနပ်မှာဖြစ်ပါတယ်

Sample Estimation

Consuming Loads	
Aircon 1 HP	= 746 W
Refrigerator (100W ~ 400W)	= 180 W
Television (50W~ 150W)	= 150 W
Lighting	= 100 W
Total Assuming loads	= 1176 W
Say	= 1200 W



Consider for Battery

Say 1.2 kW x 1 h = 1.2 kWh

For 4 hr Storage 1.2 kW x 4 h = 4.8 kWh = 4800 W h

If we consider with Lead Acid Battery only 50% DoD use = 4800 x 2 = 9600WH = 9600VA h

If we use 48V inverter system = 9600VAh /48 V = 200 Ah battery x 4 nos require

So Battery requirement = 200Ah battery x 4 nos (Lead Acid battery)

Consider for Inverter

Day Time Hourly require loads	= 1200 W
Charging to battery for night time	= 1200 W
Total usage Loads	= 2400 W

Consider for Solar Panels

Total usage Loads = 2400 W

Solar panel 's efficiency 80% 2400 / 0.8 = 3000 Wp

Maximum Inverter input voltage = 200 V DC

Solar panel working Max voltage = 41.1 V DC

So we can connect solar panel 4 nos series Volt = 41.1 x 4 = 164.4 V

Connected solar panel 4 nos series Watts = 445 x 4 =1780 Wp

If we connect 2 arrays parallel total watt =1780 x 2 = 3560 Wp

We can calculate input current 3560/164.4 = 21.65 A

We can calculate input current with solar spec: =(10.75 + 10.75) = 21.5 A

Inverter is quite enough for consuming loads = 3560 X 0.8 = 2848 W

Inverter Specification	Solar Specification
Rated Power = 5KW	Open Volt = 49.3 V DC
Rated Input Voltage = 48VDC	Working Max Volt= 41.1 V DC
PV maximum input Volt = 200VDC	
PV Max Input Current = 60A	Working Current = 10.75 A
Rated AC output Volt = 220V	Short Circuit Current = 11.32A
Low Frequency Hybrid Off Grid Inverter	Maximum Power = 445 Wp

Storage energy for night time = 1200 W /H

Consuming energy day time = 1648 W /H

Sunshine time estimate wattage = 2848 W /H

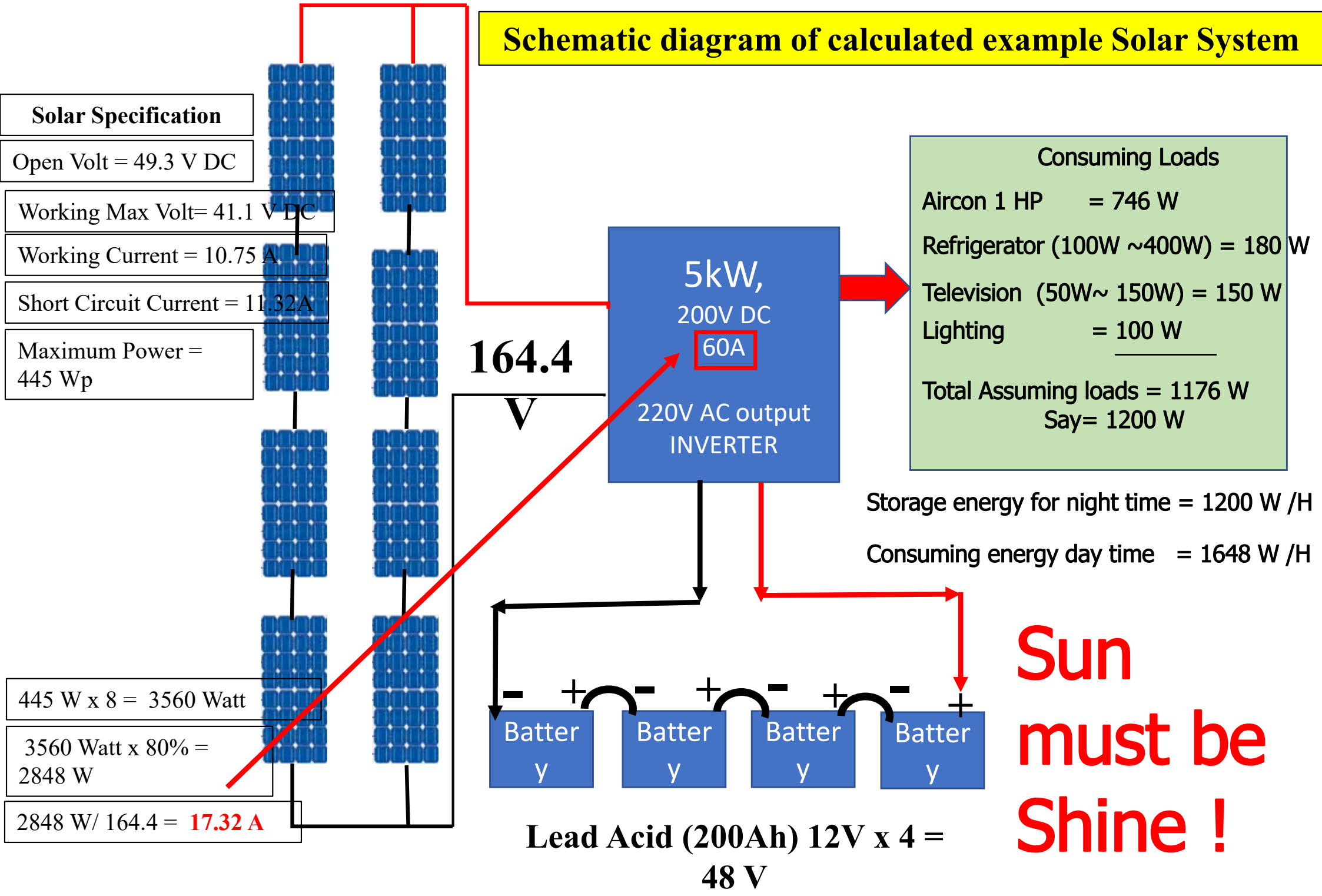
48V system Inverter, 5 kW= 1 Nos
12V , 200 AH, Lead Acid battery = 4 Nos
445 W solar panel = 8 Nos

It is mean This design can use at the day peak sunny time load can use 1648 W/H and it is not sunshine will reduce load , otherwise Load will pull from 4 hour storage battery.

But this inverter is hybrid inverter, battery will storage back from Grid power.

In This design importance is never discharge Lead Acid battery DoD >90 %.

Schematic diagram of calculated example Solar System



If your home is more grid power failure zone you can add Solar panels and battery like below calculation

If we add next 4 solar panels to system (1780 W x 3 = 5340 Wp)

Input Current become = 5340/ 164.4 = 32.48 A

Inverter is quite enough for consuming loads = 5340 X 0.8 = 4272 W

Storage energy for night time = 2400 W /H

Consuming energy day time = 1875 W /H

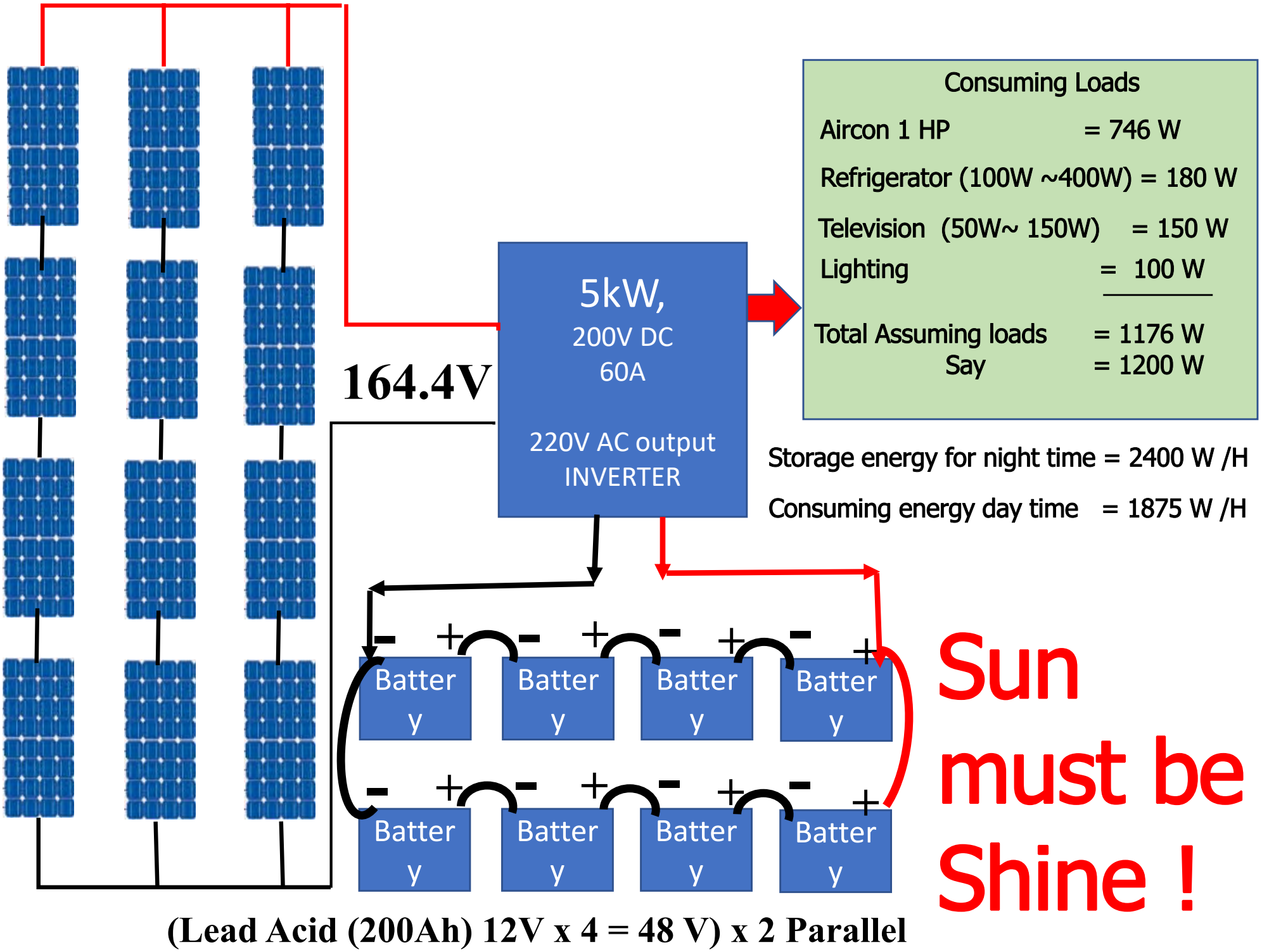
Sunshine time estimate wattage = 4272 W /H

To use 8 hours night time add battery
200 AH 4 nos

48V system Inverter, 5 kW	= 1 Nos
12V , 200 AH, Lead Acid battery	= 8 Nos
445 W solar panel	= 12Nos

Take note that
Inverter I capacity is 5000 W

5000 W/0.8 = 6250 VA/ 48 = 130 A


Consuming Loads
Aircon 1 HP = 746 W
Refrigerator (100W ~400W) = 180 W
Television (50W~ 150W) = 150 W
Lighting = 100 W
Total Assuming loads = 1176 W
Say = 1200 W
5kW,
200V DC
60A
220V AC output
INVERTER
164.4V
Storage energy for night time = 2400 W /H
Consuming energy day time = 1875 W /H
Batter y
Batter y
Batter y
Batter y
Batter y
Batter y
Batter y
Batter y
Sun must be Shine !
(Lead Acid (200Ah) 12V x 4 = 48 V) x 2 Parallel

Consider with Lithium Iron Battery

Say 1.2 kW x 1 h = 1.2 kWh

For 4 hr Storage 1.2 kW x 4 h = 4.8 kWh = 4800 W h

If we consider with LiFePo4 Battery only 80% DoD use = 4800 /0.8 = 6000WH = 6000 VA h

If we use 48V inverter system = 6000VAh /48 V = 125 Ah battery x 4 nos require

So Battery requirement = 125Ah battery x 4 nos (Lithum Iron battery)

ဆိုလာစနစ်ဖြင့် အိမ်သုံးလျှပ်စစ်ထုတ်လုပ်သုံးစွဲရာတွင်ဂရုစိုက်ရန်အချက်များ

ဆိုလာပြားရွေးချယ်ခြင်းနှင့်တပ်ဆင်ခြင်း

အမျိုးအစားအရည်အသွေးမှန်ကန်သော ဆိုလာပြားများရွေးချယ်မှုမှန်ကန်ပါစေ။

Brand Name	Open Volt	Working Max Volt	Working Current	Short Circuit Current	Maximum Power

မိမိရွေးချယ်သည့်ဆိုလာပြားသည် မိမိတပ်ဆင်မည့်အင်ဗာတာနှင့်ကိုက်ညီမှုရှိရပါမည်။

ဆိုလာပြား၏Working Max Volt	ဆိုလာပြား၏ Working Current

အင်ဗာတာ အတွင်းတပ်ဆင်ပါရှိသည့် MPPT ၏ Rated Input Voltage, Rated Power, PV maximum input Volt, PV Max Input Current , အင်ဗာတာ ၏ battery Voltage

မိမိရွေးချယ်သည့်ဆိုလာပြား၏ ထုတ်လုပ်သည့်နှစ်ပါရှိလားစစ်ဆေးရန်နိုင်ပါကစစ်ဆေးရပါမည်။

ဆိုလာပြားအောက်ဘက်မျက်နှာပြင်တွင် (Blocking Diodes, Bypass Diodes)တပ်ဆင်ပါရှိမှုရှိမရှိစစ်ဆေးရပါမည်။ မပါရှိက တပ်ဆင်ချိန်တွင် နားလည်တပ်ကျွမ်းသူနှင့် ဖြည့်စွက်တပ်တင်ရပါမည်။ (တချို့ဆိုလာပြားများတွင် ယင်းဒိုင်အုတ်များမပါရှိပါ)

ဆိုလာပြားတပ်ဆင်ရာတွင် နေရောင်ရှိရာဘက်သို့ အတတ်နိုင်ဆုံးမျက်နှာမူတပ်ဆင်ရပါမည်။

ဆိုလာပြားတပ်ဆင်ရာတွင် supporting frame များဖြင့်တပ်ဆင်ရပါမည်။ လေဒါန်မိုးဒါန်ခိုင်ခန့်မှုရှိမရှိ နားလည်တတ်ကျွမ်းသူနှင့် တပ်ဆင်ခြင်း ပြန်လည်စစ်ဆေးခြင်းဆောင်ရွက်ရပါမည်။

ဆိုလာပြားဖြင့်လျှပ်စစ်ထုတ်လုပ်မှုစနစ်တွင် ကာကွယ်မှုအနေဖြင့်တပ်ဆင်ပါရှိသော Bypass diode သည် အခန့်မသင့်လျှင် အပူလွန်ကဲပြီး မီးလောင်တတ်သဖြင့် မီးလောင်လွယ်သောအမိုး သို့မဟုတ် အမှိုက်ကျတတ်သည့်အမိုးများပေါ်တွင် တိုက်ရိုက်တပ်ဆင်မှု မပြုဘဲ အောက်ခံဒေါက်များပေါ် တွင်တပ်ဆင်အသုံးပြုရပါမည်။ ယင်းဒိုင်အုတ်များပတ်လည်တွင် မီးလောင်စေနိုင်သည့် အရာများမရှိစေရပါ။

ဆိုလာပြားထုတ်လုပ်သူ၏ တပ်ဆင်ရန်နည်းစနစ်ပါရှိပါကလည်း ၄င်း၏လမ်းညွှန်ချက်အတိုင်းတပ်ဆင်ရပါမည်း

ဆိုလာပြားဖြင့်လျှပ်စစ်ထုတ်လုပ်ခြင်းသည် နေရောင်ရရှိမှုပေါ်မူတည်သဖြင့် နေရောင်အရိပ်ထိုးသည့်နေရာများတွင်တပ်ဆင်မှုမပြုရပါ

ဆိုလာပြားပေါ်တွင် ဖုန်မှုန့် အညစ်အကြေးများတင်ရှိပါကလည်း လျှပ်စစ်ထွက်ရှိမှုနည်းသဖြင့် မကြာခဏ သန့်ရှင်းရေးဆောင်ရွက်ပေး ရပါမည်။

အထူးသဖြင့် ဆိုလာပြားပေါ်တွင် ငှက်ချေးအညစ်အကြေးများကြာရှည်တင်ရှိပြီး မဆေးကြောပါက ယင်းနေရာတွင် Hot spot ဖြစ်ပြီး ဆိုလာပြားပျက်စီးခြင်း Short circuit ကြောင့် မီးဘေးဖြစ်နိုင်သဖြင့် ဆိုလာပြားသန့်ရှင်းရေးကို အထူးဂရုစိုက်ဆောင်ရွက်သင့်သည်။

အင်ဗာတာရွေးချယ်ခြင်းနှင့်တပ်ဆင်ခြင်း

အမျိုးအစားအရည်အသွေးမှန်ကန်သော အင်ဗာတာရွေးချယ်မှုမှန်ကန်ပါစေ။ မိမိ အသုံးပြုမည့်ဝန်အားနှင့်ကိုက်ညီမှုရှိပါစေ။

နားလည်တတ်ကျွမ်းသူနှင့်သာတတ်ဆင်သင့်သည်။ After sale service ဆောင်ရွက်နိုင်သူနှင့်သာ တပ်ဆင်သင့်သည်။

အထူးသဖြင့် ဝန်အားထက် မြင့်သည့် ကီလိုဝပ် သာသည့် အင်ဗာတာကိုရွေးချယ်တပ်ဆင်သင့်သည်။
နိုင်နိုင်နင်းနင်းအသုံးပြုနိုင်မှုထက် အသုံးတည့်၍ ဝန်အားပိုမိုသုံစွဲလိုသည့်အခါ ဆိုလာပြားတိုးတပ်ခြင်း
ဘက်ထရီတိုးတပ်ခြင်းဖြင့် ဝန်အားပိုသုံစွဲခြင်းကို ကုန်ကျစရိတ် အနည်းငယ်တိုးမြင့် သုံးစွဲခြင်းဖြင့် ဆောင်ရွက်နိုင်မည်ဖြစ်သည်။
သို့မဟုတ်ပါက အင်ဗာတာအသေးမှာ မိမိထံတွင်ကျန်ရှိနေမည်ဖြစ်သည်။

အင်ဗာတာ ၏ ကာကွယ်မှုစနစ်များတွင် အတက်တွင်ဖေါ်ပြထားသော ကာကွယ်မှုစနစ်များပါရှိမရှိ သေခြာစွာစီစစ်သင့်ပြီး
အထူးသဖြင့် Battery over charge ကာကွယ်မှုစနစ်နှင့် ဘက်ထရီအားကုန်အောင် သုံးစွဲမှုမဖြစ်အောင် ရပ်တန့်ပြစ်သည့်
ကာကွယ်မှုစနစ် အထူးပါရှိသည့် အင်ဗာတာများကို မှန်ကန်စွာရွေးချယ်သင့်သည်,

အင်ဗာတာ တပ်ဆင်အသုံးပြုနေသည့်အခါ နေ့စဉ် သို့မဟုတ် မီးလာချိန် မီးပြတ်ချိန် နေသာချိန် မိုးအုံ့ချိန် မိုးရွာချိန်စသဖြင့်
အလျင်းသင့် သလို စောင့်ကြည့်လေ့လာသင့်သည်။ တနေ့အသုံး တလအသုံး

တနေ့အသုံး တလအသုံး အခြေအနေ Inverter display တွင် ပြနေသော ဗို့အား ဘက်ထရီရာခိုင်နှုန်း ဝန်အားသုံးစွဲမှုရာခိုင်နှုန်း
စသဖြင့် အခြေအနေတို့ကို စိတ်ဝင်တစားကြည့်ရှုခြင်းဖြင့် Rooftop solar system ၏လိုအပ်မှုမလိုအပ်မှု အသုံးဝင်မှု မဝင်မှု
စိတ်ချမ်းသာမှု စိတ်ညစ်မှု တို့ကို ကိုယ်တိုင်လေ့လာသုံးသပ်နိုင်မည်ဖြစ်သည်။

အင်ဗာတာသည် အီလက်ထရောနစ်စက်ဖြစ်၍ အပူထွက်သည် လေဝင်လေထွက်ကောင်းသည့်နေရာတွင်တတ်ဆင်သင့်သည်။
သို့မဟုတ် ထုတ်လုပ်သူ၏ လမ်းညွှန်ချက်အတိုင်းတတ်ရမည်။

အင်ဗာတာကို အမိုးအကာအောက်တွင်သာတတ်ဆင်သင့်သည့် မိုးပက်သည့်နေရာနှင့် နေရောင်တိုက်ရိုက် ထိတွေ့သည့်
နေရာများတွင် မတတ်ဆင်သင့်ပါ

ဘက်ထရီရွေးချယ်ခြင်းနှင့်တပ်ဆင်ခြင်း

နိုင်ငံအတွင်းရရှိနိုင်သည့် ဘက်ထရီများမှာ

Lead Acid Battery (Wet Type)

Lead Acid Battery (Seal Type)

Lead Acid Battery (Tubular)

Lead Acid Battery (Gel Type)

Battery ကို သန့်ရှင်းခြောက်သွေ့စွာထားရမည်

Battery အကန့်တခုခြင်းစီ၏အဖုံး ကို သေခြာစွာပိတ်ထားရမည်။

Acid Level ကို အခါအားလျော်စွာ စစ်ဆေးပေးရမည်

Acid Level လျော့နည်းနေပါကပေါင်းခံရေ (distilled water) သို့မဟုတ် မိုးရေ ကို battery အိုး၏ သတ်မှတ် level ထိဖြည့်ပေးရမည်။

အပြင်လှုံကျသည် အရည်များသည်အက်စစ်များဖြစ်၍ ဆပ်ပြာရည်ဖြင့် သေခြာစွာ ဆေးကြောရမည်

ဘက်ထရီဖို့အားမှန်မမှန် စစ်ဆေးပေးရမည် အထူးသဖြင့် မီးပျက်ချိန် ကြာသွားသည့်အချိန် နှင့် နေ့လည်နေသာသည့်အချိန်များတွင် ဖို့အားသွင်းမှု ကောင်းမကောင်း သိရှိနိုင်ရန်

ဘက်ထရီ ကာကွယ်မှုစနစ်မကောင်းပါက ဘက်ထရီချို့ယွင်းပျက်စီးတတ်၍ အရွယ်အစား ပုံမှန်ဟုတ်မဟုတ်ကိုလည်းစစ်ဆေးပေးရန်ဘိုသည်။

အင်ဗာတာနှင့် ဘက်ထရီ တို့ ကို လူများနားနေသည့်နေရာတွင်မတတ်ဘဲ ဝေးကွာသည့်နေရာတွင် တတ်ဆင်သင့်သည်၊ သို့သော်ပုံမှန်စစ်ဆေးရလွယ်ကူသည့်နေရာဖြစ်သင့်သည်။

အင်ဗာတာနှင့် ဘက်ထရီ တို့ ကို လူများနားနေသည့်နေရာတွင်မတတ်ဘဲ ဝေးကွာသည့်နေရာတွင် တတ်ဆင်သင့်သည်၊ သို့သော်ပုံမှန်စစ်ဆေးရလွယ်ကူသည့်နေရာဖြစ်သင့်သည်။

ဘက်ထရီ ကို လည်း အင်ဗာတာနည်းတူ လေဝင်လေထွက်ကောင်းသည့်နေရာတွင် တွဲရက်တတ်ဆင်သင့်သည်။


EXIDE
INVA TUBULAR
IT500
48
RS PRO
883-8856 [12V31AH/20HR]
Maintenance-free Rechargeable Gel Battery
CONSTANT VOLTAGE CHARGE
Standby use: 13.5-13.8 V
Cycle use: 14.4-15.0 V
Initial current: Less than 7.75A
MADE IN CHINA
Pb
Pb

Lead Carbon vs AGM / GEL vs Lithium Comparison

Below is the table showing how lead carbon batteries compare against AGM / GEL and Lithium battery options.

		Lead Carbon		AGM / GEL		Lithium
Max / Design Life	✓	20 Years		3-6 Years		6-10 Years
Cycle Life 30% DOD	✓	6000		1300-1400		5000
Cycle Life 50% DOD	✓	3500		600-900		3500
Cycle Life 80% DOD	✓	2400		200-300	✓	2400-3000
Max DOD %	✓	100%		50%		80%
Partial State of Charge	✓	Hardly Affected		Sulphation Issues	✓	Hardly Affected
Dendrite Growth Issues	✓	No	✓	No		Yes
Risk of Fire / Explosion	✓	Low / None		Low / None		High / Yes
Maintanence		Maintanence Free		Maintanence Free		Maintanence Free
Warranty	✓	3 years		1-2 years		Varies
Years in the market		5+	✓	30+		< 4
Current upfront cost price		$$$	✓	$$		$$$$$$
Cost of ownership over 10 yrs		$		$$$		$$$$
Cost per kWh of Usable Storage	✓	$		$$		$$$$$$
Retro-Fit onto existing systems	✓	EASILY		EASILY		DIFFICULT / CAN'T
On-Grid + Off-Grid Application	✓	Yes, easy for both	✓	Yes, easy for both		On-Grid Only mostly
Charge vs Discharge Efficiency %	✓	90-92%		50-55%	✓	90-92%

Lithium Iron Phosphate Battery

Battery Specification

Electrical Performance

Nominal Voltage	3.2V/cell X 16 cells = 51.2 V DC
Nominal Capacity	200 Ampere hour
Energy	51.2 x 200 = 10240 Wh
Communication	Communicated with Network cable, RS232, RS485
Resistance	< & = 45 mili Ohm @ 50% SOC
Efficiency	> 96% DOD
Module Parallel	Can connect up to 15 pack of battery

Lithium Iron Phosphate Battery

Charge Performance

Recommended Charge Current	75A
Maximum Charge Current	150A
Recommended Charge Voltage	57.6 V
BMS Cut-OFF Voltage	58.4V(3.65V/cell)
Reconnect Voltage	53.6V(3.35V/cell)
Balancing Starting Voltage	(3.4V/cell)

Lithium Iron Phosphate Battery

Discharge Performance

DISCHARGE PERFORMANCE	51.2 V x 100A = 5120 W	
Peak Discharge Current	51.2 V x 160A = 8182 W (1 Second)	Test
BMS Discharge Cut-Off Current	51.2 V x 200A =10240W (0.1 Second)	Test
Recommended Low Voltage Disconnect	3V/cell x 16 = 48V	
BMS Discharge Cut-Off Voltage	2.7V/cell x 16 = 43.2V (1 Sec)	Stop battery Supply
Reconnect Voltage	>3V/cell x 16 = 48V	Loads must be reduced
Short Circuit Protection	Have Short Circuit protection	

Lithium Iron Phosphate Battery

Mechanical Performance

Dimension (L x W x H)	
Approx. Weight	
Terminal Type	
Terminal Torque	
Case Material	SPCC Steel Plate Cool rolled coil
Enclosure Protection	IP 21 Indoor use

Lithium Iron Phosphate Battery

Temperature Performance

Discharge Temperature	-4 ~140˚F(-20 ~60˚C)	-4 ~140˚F(-20 ~60˚C)
Charge Temperature	32~113˚F (0~45˚C)	- 4 ~113˚F(-20 ~45 ˚C)
Storage Temperature	14 ~86˚F (-10 ~30˚C)	23 ~95˚F(-5 ~35 ˚C)
BMS High Temperature Cut-Off		149˚F(65˚C)
Reconnect Temperature		131˚F(55˚C)

ဘယ်ဟာအမှန်ယူရမလဲ

Lithium Iron Phosphate Battery

Compliance

Certification	CE(battery) UN38.3(battery)
Shipping classification	UN 38.3, MSDS, Class 9

UN 38.3

The United Nations established the UN DOT 38.3 test methods and procedures to ensure lithium-ion batteries are suitable for transport. These test methods are designed to simulate many possible extreme conditions a battery may be subjected to during international transportation.

MSDS

The material safety data sheet – better known as MSDS is a supporting document for your shipment. It contains detailed information on the contents of your shipment with a technical breakdown of the components or substances in your item to prove that it does not fall under the dangerous goods (DG) category.

Class 9

Note: For a single cell battery, such as a typical coin cell or standard AA or AAA replacement battery, refer to the size for cells. Cells and batteries that exceed these “smaller” cell or battery size thresholds must be shipped as fully regulated Class 9 hazardous material.

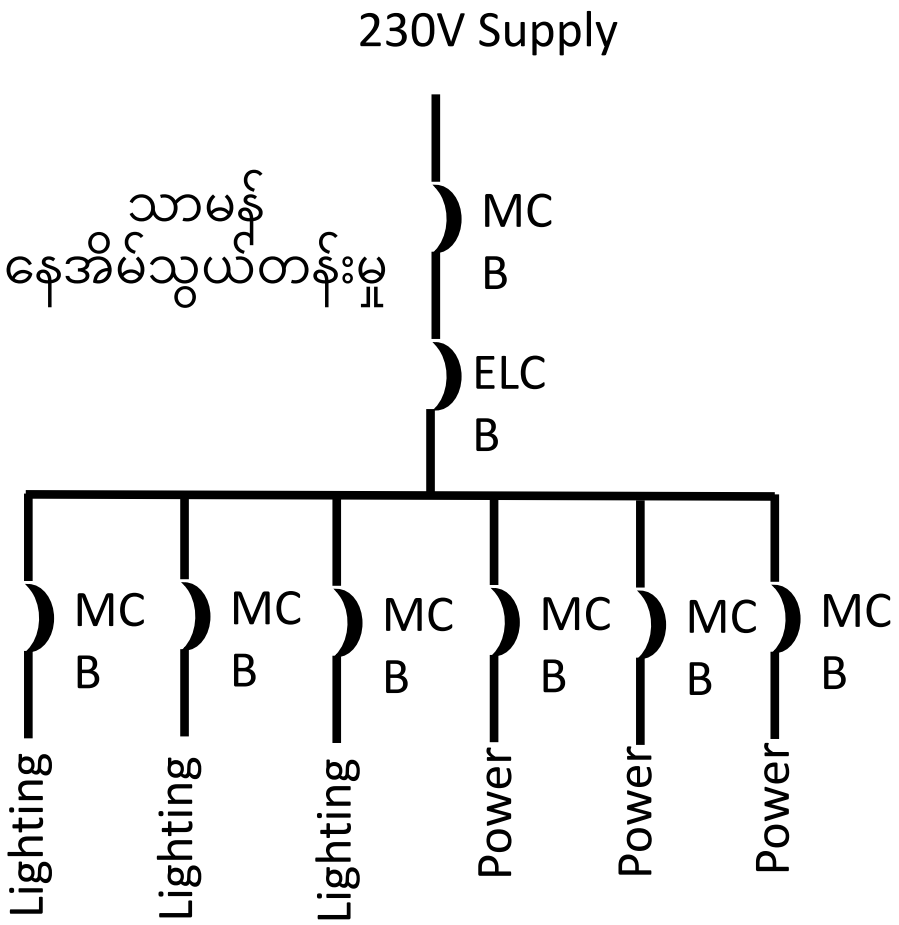
ဘယ်ဘက်တရီကို သုံးမလဲ

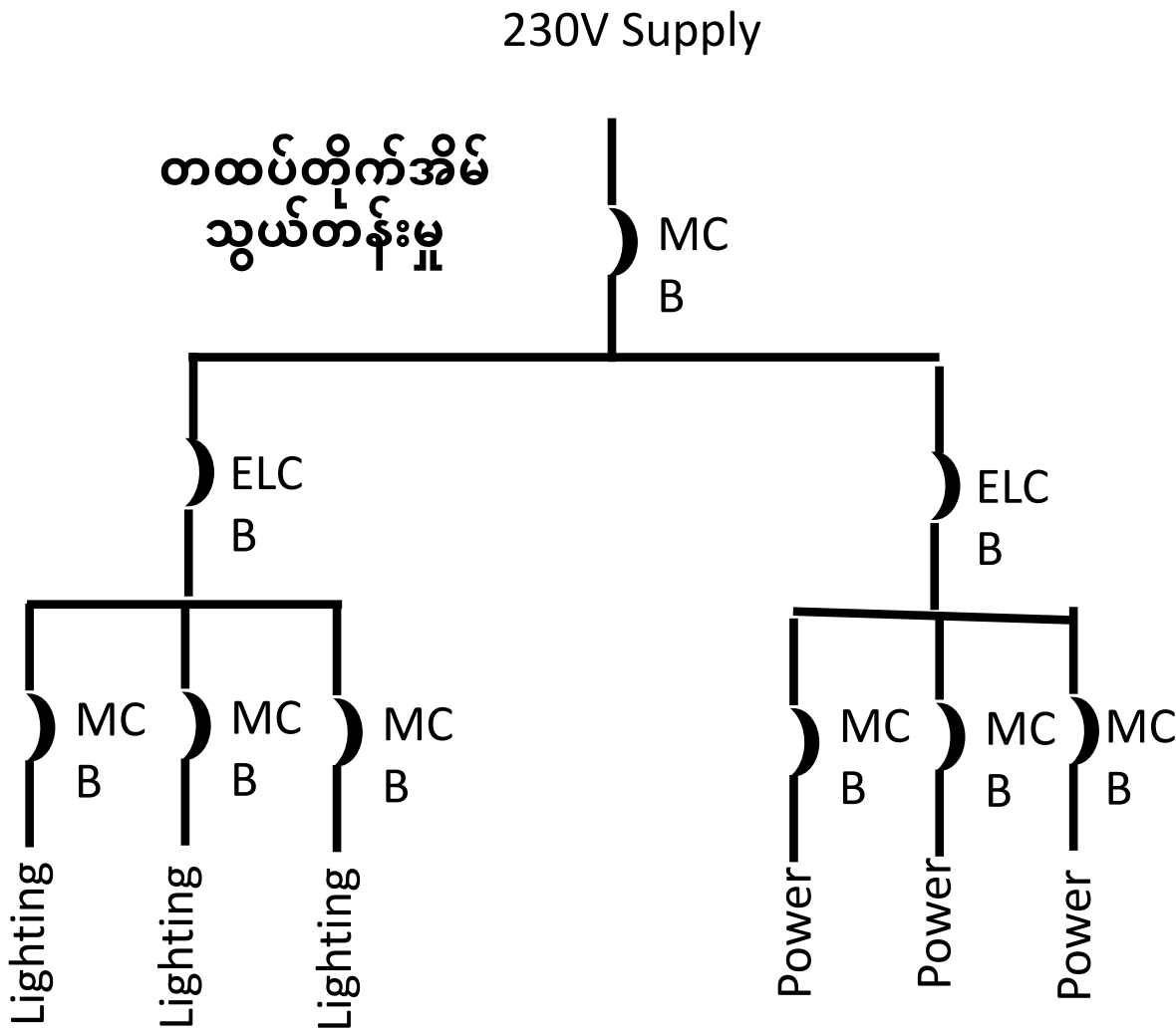
ဘတ်ဂျက်အနေအထားမတတ်နိုင်သေးလျှင် Lead Acid Battery (Wet Type)

ဘတ်ဂျက်အနေအထားအနည်းငယ်တိုးတတ်နိုင်လျှင် Lead Acid Battery (Tubular)

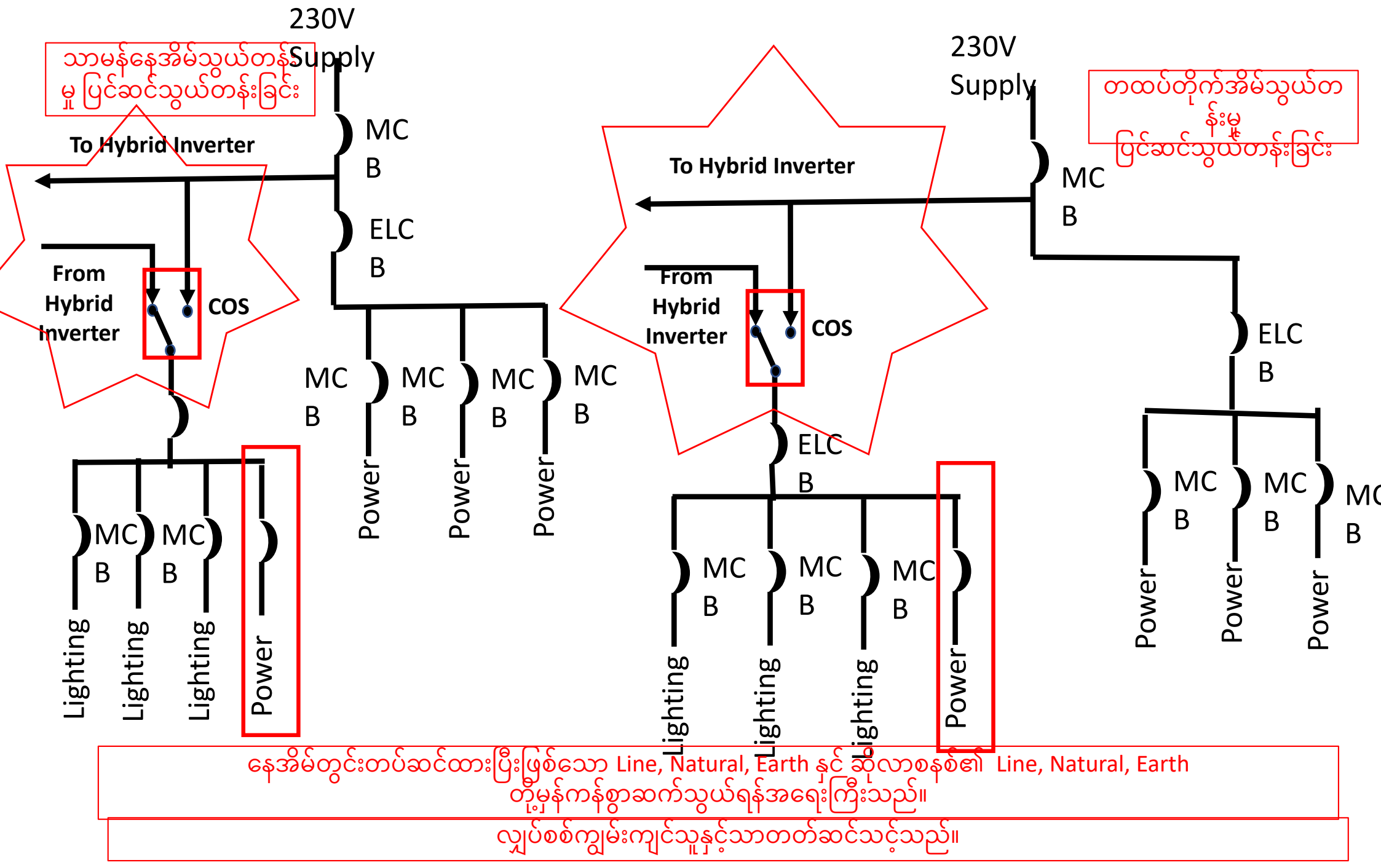
ဘတ်ဂျက်အနေအထားတတ်နိုင်လျှင် LiFePo4 battery

နေအိမ်တွင်း လျှပ်စစ်ဝါယာများ မူလအနေအထားသွယ်တန်းခြင်း



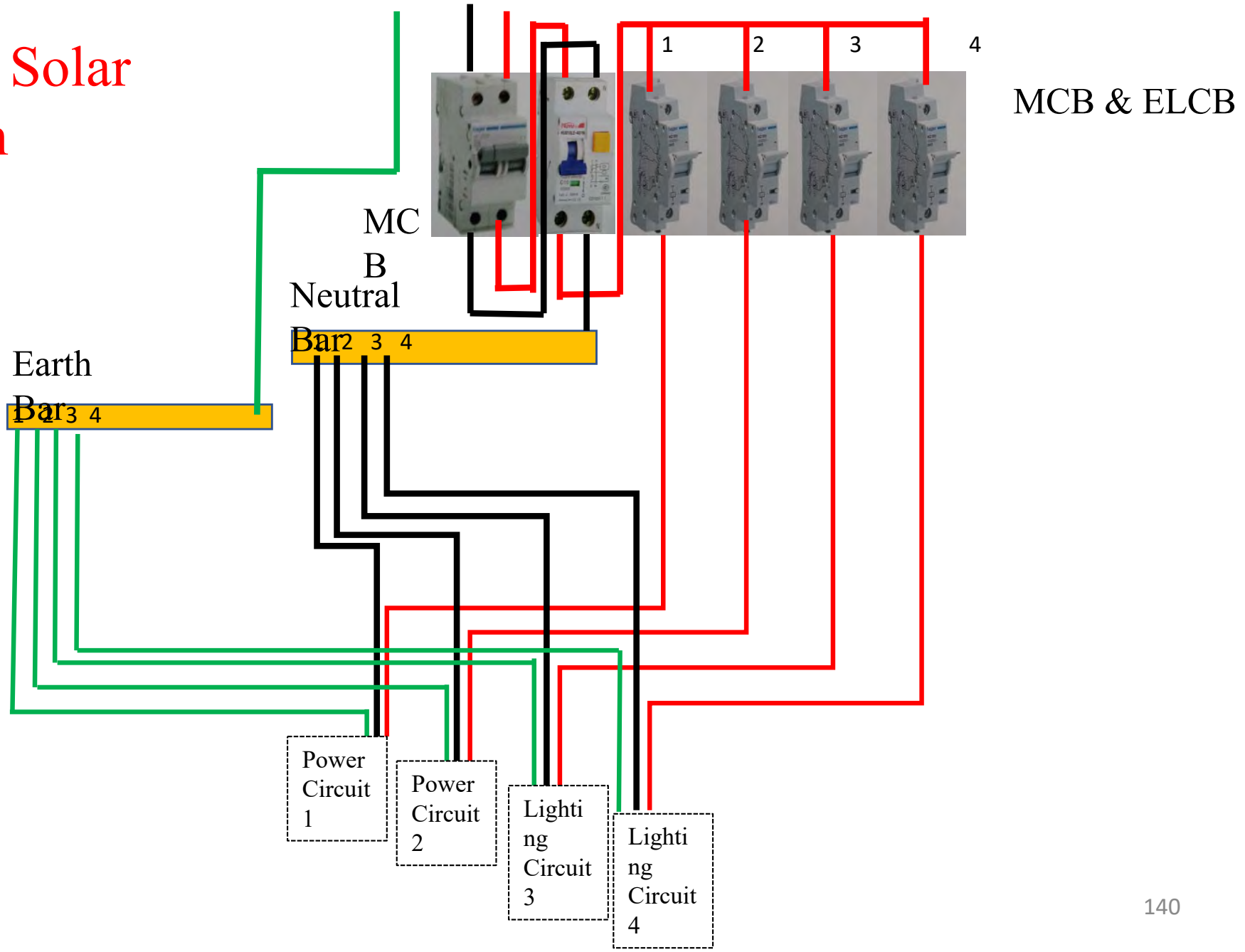


နေအိမ်တွင်း လျှပ်စစ်ဝါယာများ ဆိုလာစနစ်နှင့်ကိုက်ညီအောင် ပြုပြင်သွယ်တန်းခြင်း

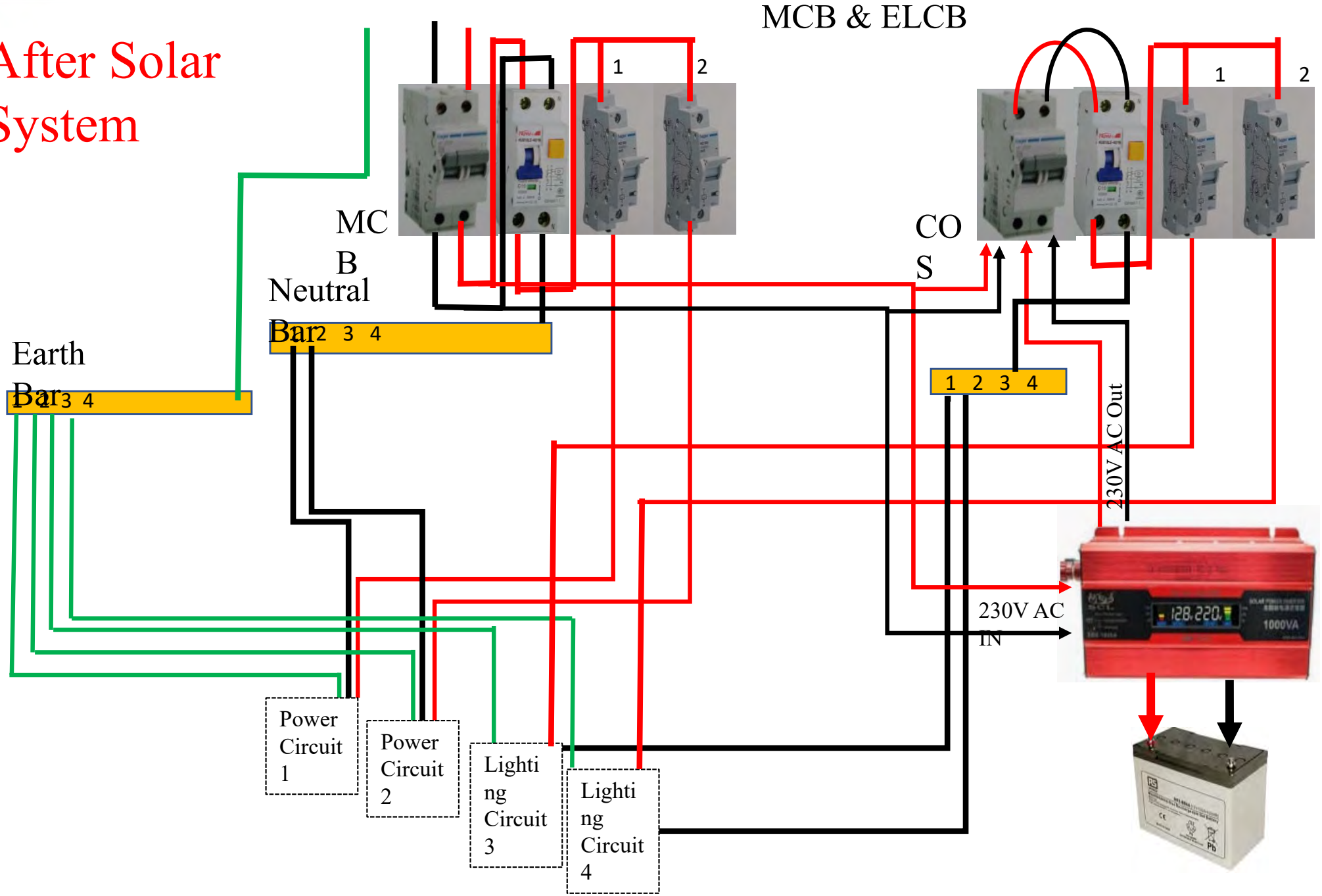


Lighting & Power Circuits wire termination inside DB

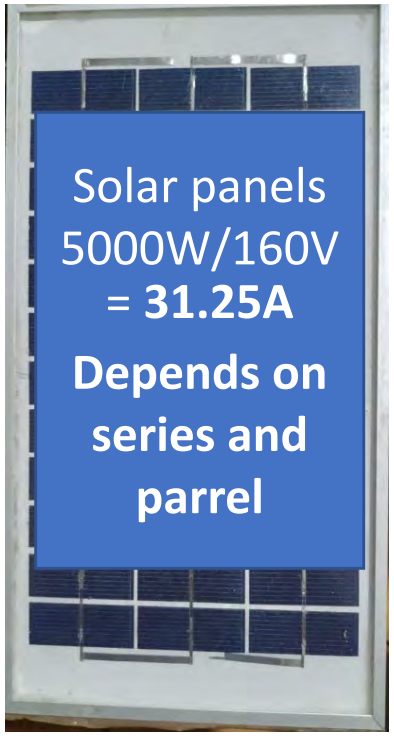
Before Solar System



Lighting & Power Circuits wire termination inside DB



Concept of Solar System usage Time



W = V x I

5 KW Inverter
5000 Watt

W = V x I

Loads
5000 W = VI cos ø
I = 5000/(230* 0.8)
I = 27A

W = V x I x cos ø

တွက်ချက်မှုများမှာ (DC အပိုင်း Volt , Amp,) (AC အပိုင်း Volt, Amp) ခွဲခြားစဉ်းစားဘို့လို

Lead Acid battery ဆိုရင် ဝန် ပြည့်သုံးက 1 hour ဘဲ သုံးလို့ရမယ် ။ ဝန်အားတဝက်သုံးရင် ၂ နာရီ သုံးရမယ်။

Lithium Iron battery ဆိုရင် ဝန် ပြည့်သုံးက 1.538 hour သုံးလို့ရမယ် ။ ဝန်အားတဝက်သုံးရင် ၃.၀၇ နာရီ သုံးရမယ်

အိမ်သုံးဆိုလာစနစ်တတ်ဆင်လျှင် မိမိစိတ်တိုင်းကျ တခါတည်းရမလား ?

Supplier မှ စနစ်တကျသေခြာတွက်ချက်တတ်ပြီး Electrical Safety , Equipment safety, Systematic Installation Internal wiring Modify, Protection System
ပြည့်စုံစွာတပ်ဆင်ထားသော်လည်း သုံးစွဲသူမှ စနစ်တကျ မသုံးစွဲတတ်လျှင်

Installed capacity = Loads မျှတမှု

မီးလာသည့်အခြေအနေနှင့် မီးပြတ်ချိန်

ရာသီဥတုအခြေအနေ(နေသာ မိုးရွာ တိမ်ထူ အရိပ်ကျ)

ဆိုလာပြားသန့်ရှင်းမှု အခြေအနေ

ဆိုလာစနစ်ဖြင့်လျှပ်စစ်ထုတ်လုပ် သုံးစွဲမှုအခြေအနေ နေအိမ်မှ တဦးဦးက ထိန်းသိမ်းကြည့်ရှုနိုင်မှု

စသည် စသည် အချက်များ စတပ် တပ်ခြင်းစိတ်တိုင်းကျဖြစ်မလာနိုင်ပါ

တဖြည်းဖြည်း သုံးစွဲတတ်လာလျှင်တော့ တပ်ဆင်ရကျိုး ငွေကုန်ရကြိုးနပ်ပါမည်။
After sale service ပေးနိုင်သည့် သူများနှင့်သာ ဝယ်ယူတပ်ဆင်သင့်ပါသည်။

Supplier ၏အကြံကြုံချက်အရ တပ်ဆင်သည့် protection device များတပါတည်းတပ်ဆင်မှု ရှိမရှိစစ်ဆေး သင့်ပါသည်

Supplier မှ စနစ်တကျသေခြာတွက်ချက်မှု မရှိဘဲ တပ်ဆင်ခဲ့လျှင် တော့

သို့မဟုတ် ဈေးကွက်ထဲ မှ ကြော်ငြာကောင်းလို့နားယောင်ပြီးတပ်ဆင်ခဲ့လျှင် တော့

Installed capacity = Loads မမျှတမှု ကြောင့် Inverter ချို့ယွင်းခြင်း သုံးစွဲသူ အပြစ်ကြောင့်ဟု ပုံချကာ warranty မရခြင်း

Warranty ပေးပြန်တော့လဲ စက်ကို အပ်ထားရသဖြင့် မီးမှောင်ထဲတွင်နေရပြန်ခြင်း

ဘက်ထရီ အားဝင်မှန်း/မဝင်မှန်းမသိဘဲ သုံးစွဲမိသဖြင့် ဘက်ထရီ အသစ် တရက်ထဲနှင့် ပျက်စီးသွားခြင်း

ဆိုလာပါဝါ ထွက်ရှိမှု မှာ

ရာသီဥတုအခြေအနေ(နေသာ မိုးရွာ တိမ်ထူ အရိပ်ကျ)

ဆိုလာပြားသန့်ရှင်းမှု အခြေအနေ

ဆိုလာစနစ်ဖြင့်လျှပ်စစ်ဆုတ်လုပ် သုံးစွဲမှုအခြေအနေ နေအိမ်မှ တဦးဦးက ထိန်းသိမ်းကြည့်ရှုနိုင်မှု

စသည် စသည် အချက်များ ကြောင့် စိတ်တိုင်းကျဖြစ်မလာနိုင်ပါ

ငွေကုန်ရကြိုးနပ်အောင်

နားလည်တတ်ကျွမ်းသော အင်ဂျင်နီယာ နှင့်တိုင်ပင်ပြီးဝယ်ယူတပ်တင်ပါ

အရည်အသွေးကောင်းမွန်ပြီး ကာကွယ်မှုစနစ်ပြည့်စုံသည့် Inverter ဖြစ်ပါစေ

တပ်ဆင်သည့် Inverter Capacity နှင့် သုံးစွဲသည့် ဝန်အားကိုက်ညီပါစေ

သုံးစွဲသည့် ဝန်အားပိုမိုသုံးစွဲမှုမရှိစေရန် မူလအိမ်အတွင်းတပ်ဆင်ထားသော ဝါယာ ကြိုးစနစ်ကို ပြုပြင်တပ်ဆင်ပါ

Overload protecter ကိုဖြည့်စွက်တပ်ဆင်ပါ

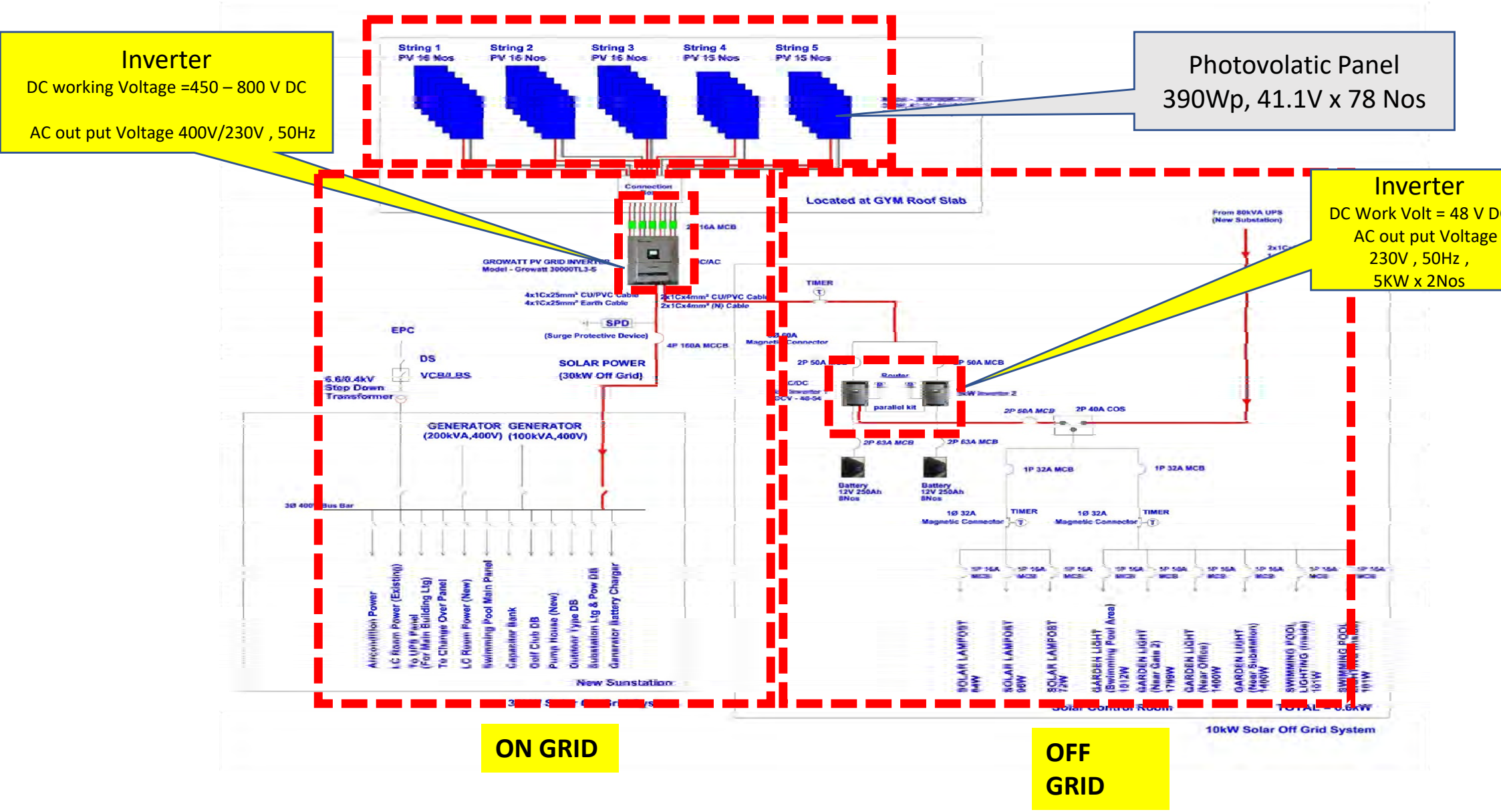
လက်တွေ့တပ်ဆင်မှုမှ
အတွေ့အကြုံများ

SOLAR POWER SYSTEM
(Three Phase)

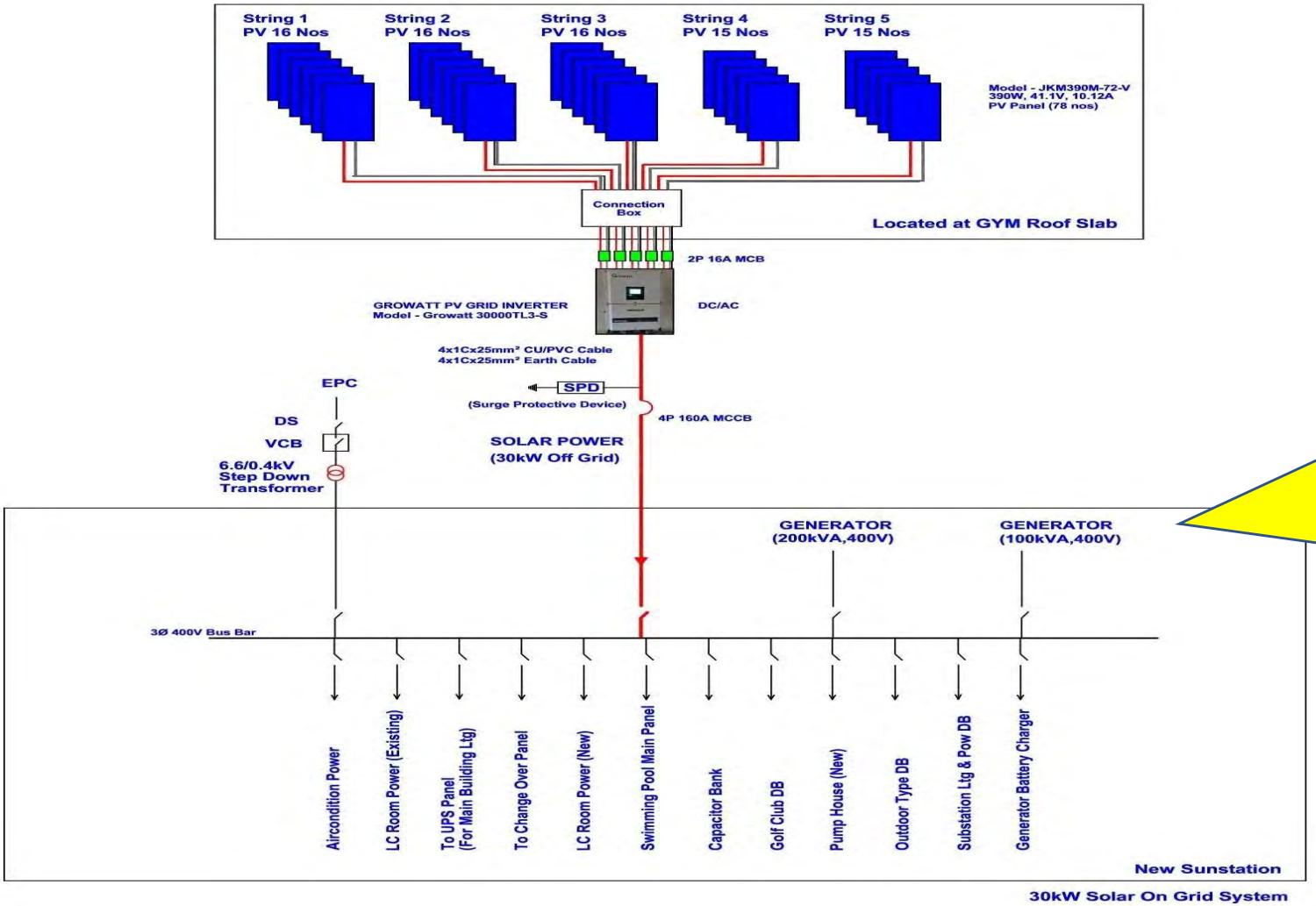
ON GRID (30kW)
&
OFF GRID (10kW)

CONTENTS

(A)Over All SLD of ON Grid (30kW) & OFF Grid (10kW) Solar Power System



(B) 30kW On Grid Solar System



Internal electrical usages ON Grid Lighting Power

30kW On Grid Solar System

Contents

1. Solar PV Panel (390W - 78Nos)
2. DC Cable (1500V)
3. Termination Kit (1200mm Length-2Nos)
4. Connector Box
5. Breaker (2P 16A MCB – 5Nos for 5 String)
6. DC to AC Inverter (30KW)
7. Charger Controller (2Nos)
8. String Inlet (8 Pair) Use Charging controller(A)-3 String , Charging controller(B)- 2 String
9. SPD (Serge Protective Device – 2Nos, DC & AC)
10. AC Power (3 Phase 5 Wire)

SOLAR PANEL SPECIFICATION

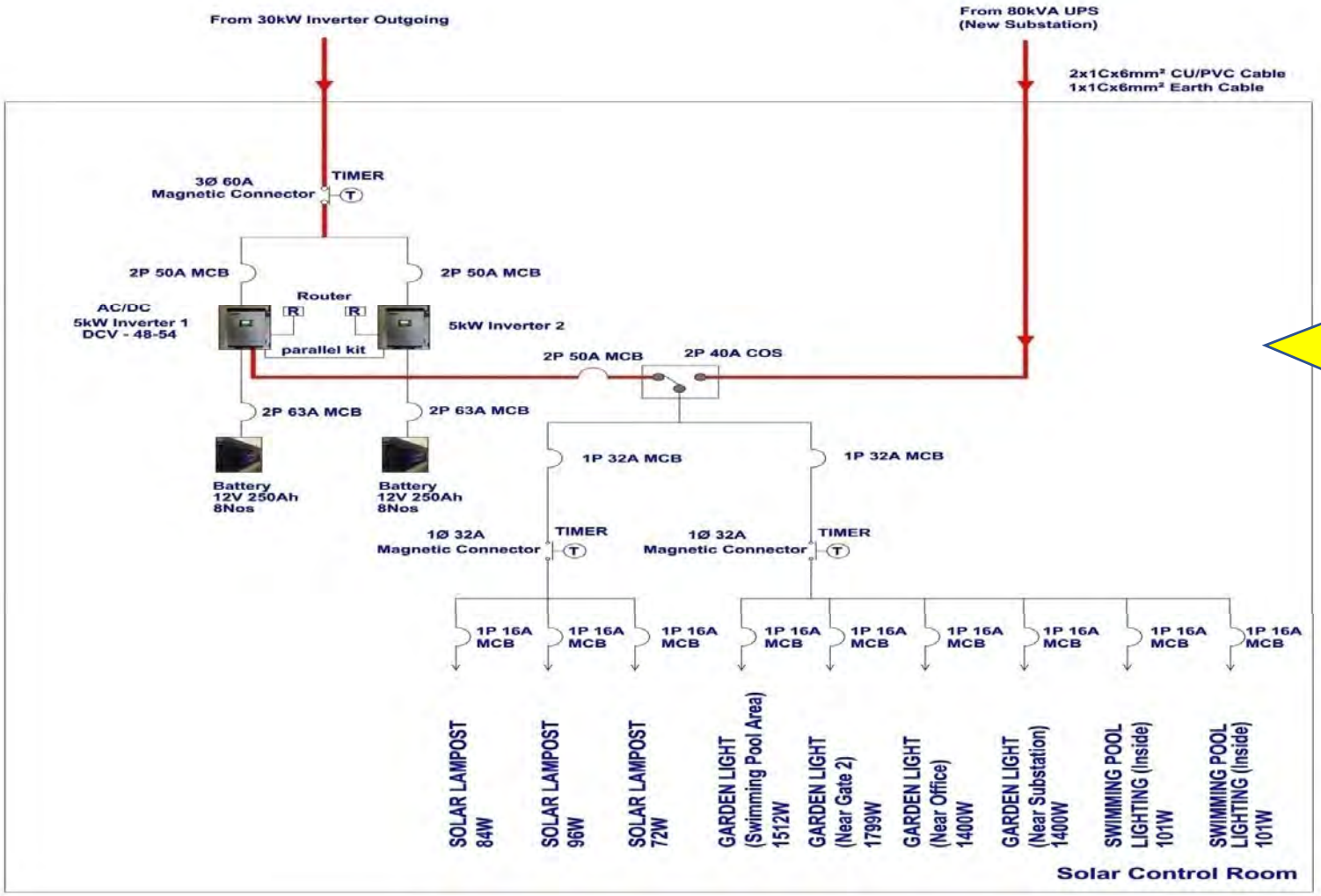
Solar Module Type	- JKM390M-72-V
Maximum Power	- 390W
Power Tolerance	- 0 - + 3%
Maximum Power Voltage(Vmp)	- 41.1V
Maximum Power Current(Imp)	- 9.49A
Open Circuit Voltage(Voc)	- 49.3V
Short Circuit Current(Isc)	- 10.12A
Nominal Operating Cell Temp	- 45± 2°C
Maximum System Voltage	- 1500VDC
Maximum Series Fuse Rating	- 20A
Operating Temperature	- -40° - +85°C

30kW GROWATT

30kW GROWATT PV GRID INVERTER SPECIFICATION

Max. DC Voltage	- 1000 d.c.V
DC Voltage range	- 200-1000 d.c.V
MPPT Voltage range	- 450-800 d.c.V
Max. input current	- 2*34 d.c.A
Max. apparent power	- 33300VA
Nominal output current	- 3*44 a.c.A
Nominal output voltage	- 3W/N/PE , 230/400 a.c.V
AC Frequency	- 50Hz
Power Factor	- 0.9leading-0.9leading
Operation Ambient Temperature	- -25℃ - +60°C

(C) 10kW Off Grid Solar System



Supply for external usage

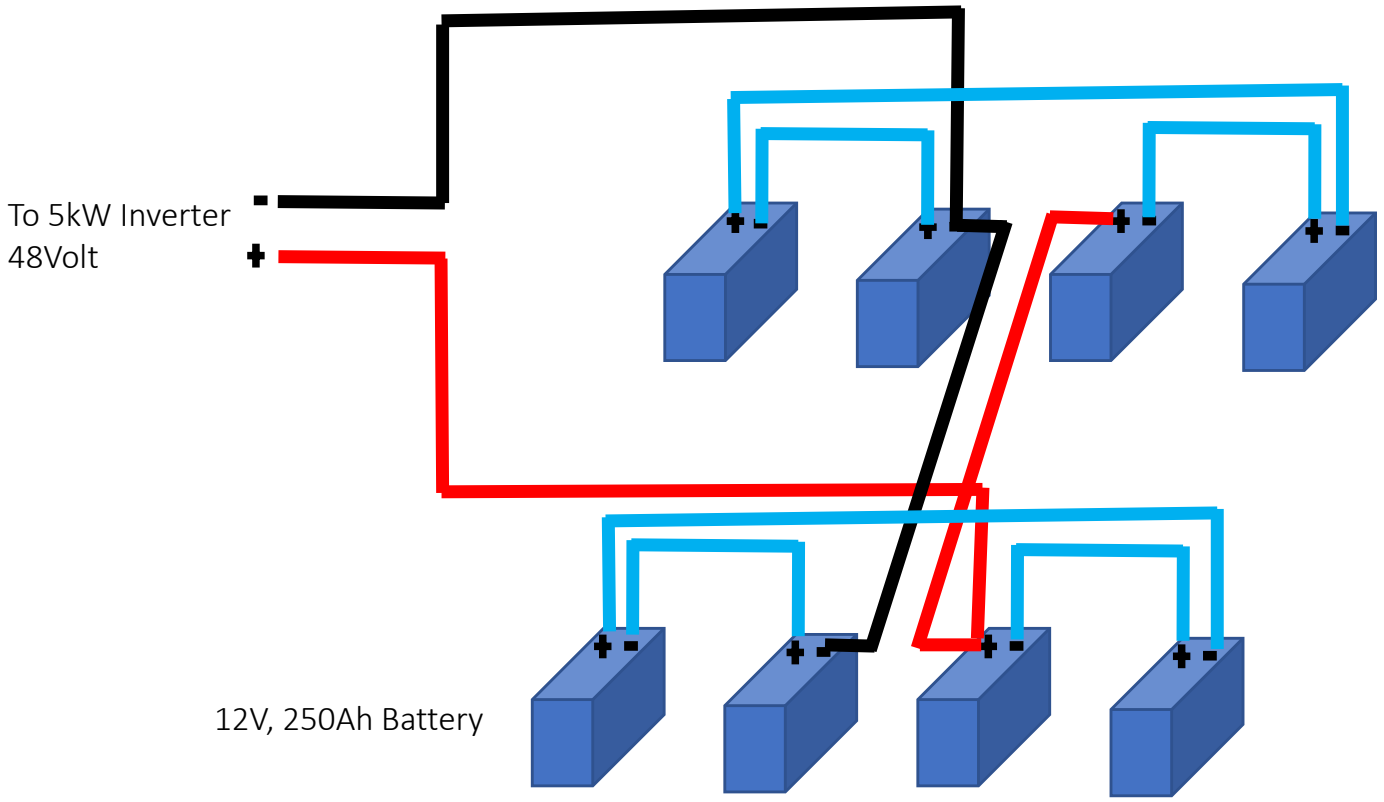
SOLAR CONTROL ROOM | SOLAR LAMPOST = 0.254kW | GARDENLIGHT = 6.11kW | SWIMMIMG POOL = 0.2kW | TOTAL = 6.6kW

10kW Off Grid Solar System

Contents

1. Single Phase KWh Meter
   Timer In - 1Nos
   Solar Power from 30KW System
2. 12V Battery 250Ah -16Nos
3. Router (2Nos)
4. 5KW Inverter 2Nos Contact with parallel kit
5. Timer out - 2Nos

Battery Connection For 5kW Off Grid Solar System



MUST INVERTER

5KW SOLAR INVERTER SPECIFICATION

Model Name	- PV 18-5048 VPM
Inverter Mode:	
Rated Power	- 5000VA/5000W
DC Input	- 48VDC,118A
AC Output	- 230VAC,50Hz,22A,1Ø
Output Power Factor	- 1.0
AC Charger:	
AC Input	- 230VAC,
50Hz,35A,1Ø	
DC Output	- 54VDC,60A (max)
Solar Charger Mode:	
Rated Current	- 80A
System Voltage	- 48VDC
MPPT Voltage Range	- 64 ~ 130VDC
Max. Solar Voltage (VOC)	- 145VDC
Max. Charge Current	- 140A

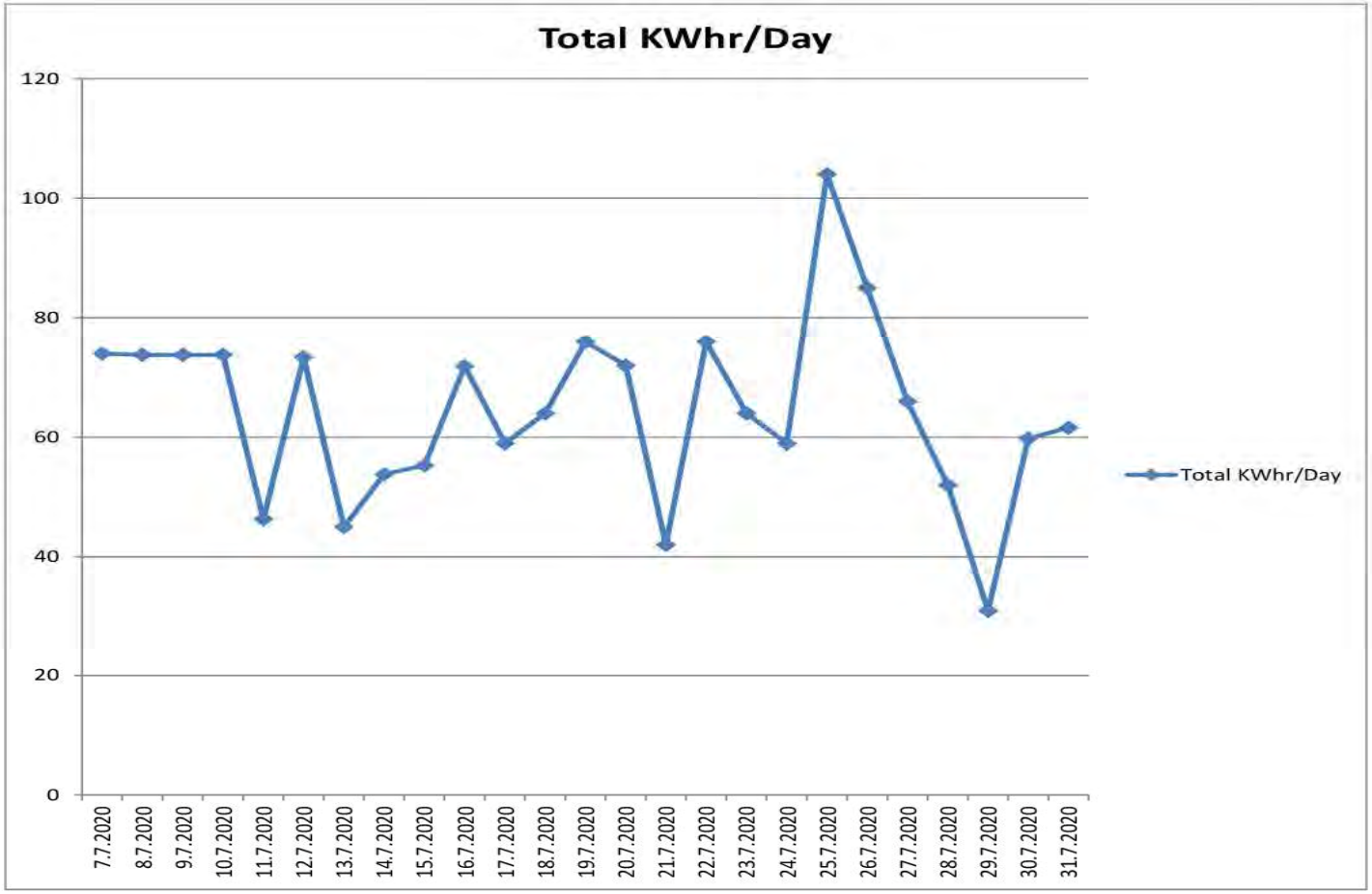
- LOCATION LAYOUT PLAN (PV PANEL INSTALLATION ON ROOF SLAB OF GYM BUILDING)

- 30kW , 10kW INVERTER AND BATTERY @ SOLAR CONTROL ROOM

400V MSB PANEL AT NEW SUBSTATION

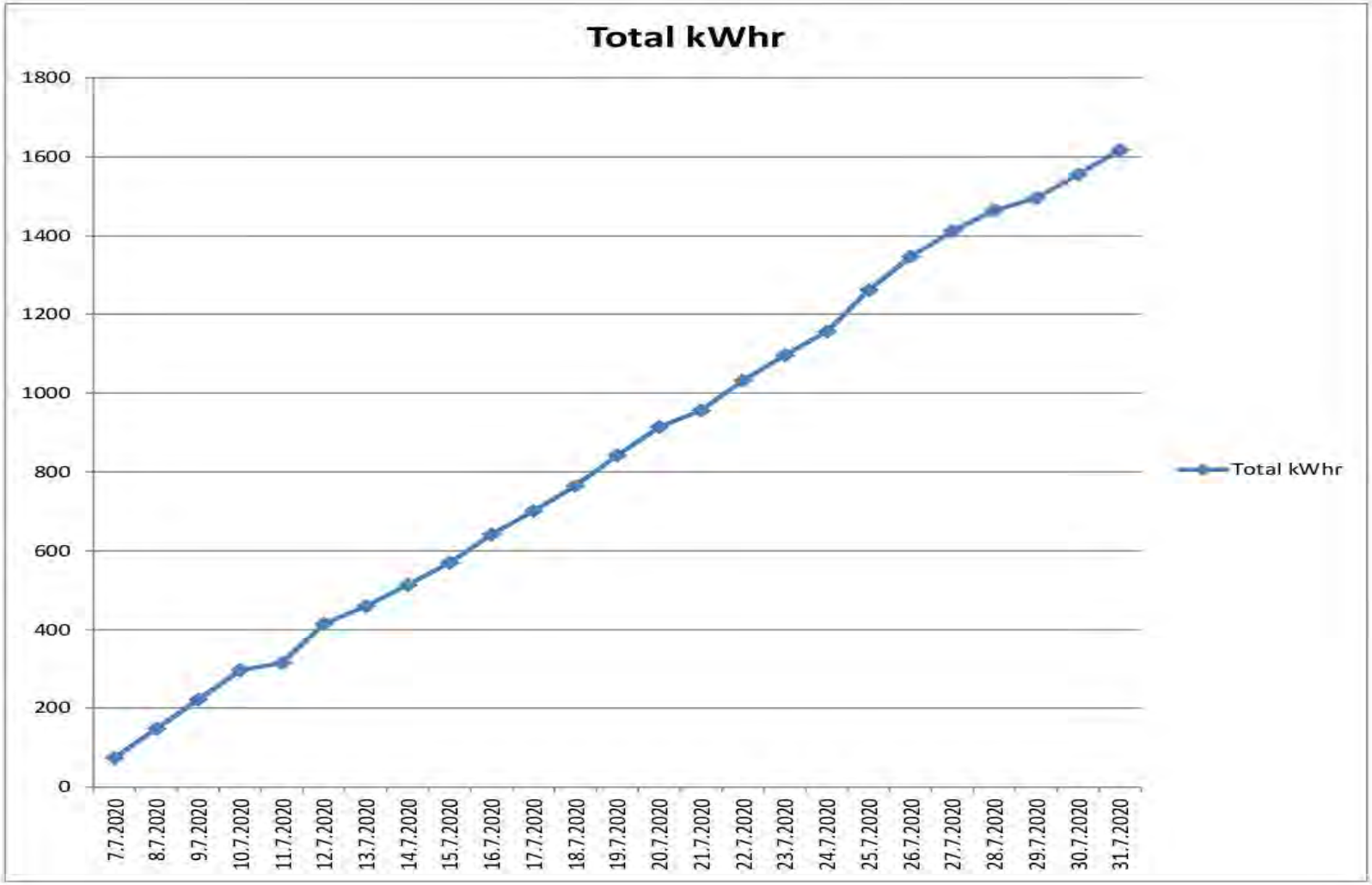
ANALYZE RECORD DATA For 30kWP

Date	Total KWhr/Day
7.7.2020	74
8.7.2020	74
9.7.2020	74
10.7.2020	74
11.7.2020	46
12.7.2020	73
13.7.2020	45
14.7.2020	54
15.7.2020	55
16.7.2020	72
17.7.2020	59
18.7.2020	64
19.7.2020	76
20.7.2020	72
21.7.2020	42
22.7.2020	76
23.7.2020	64
24.7.2020	59
25.7.2020	104
26.7.2020	85
27.7.2020	66
28.7.2020	52
29.7.2020	31
30.7.2020	60
31.7.2020	62



ANALYZE RECORD DATA

Date	Total kWhr
7.7.2020	74
8.7.2020	148
9.7.2020	222
10.7.2020	295
11.7.2020	314
12.7.2020	415
13.7.2020	460
14.7.2020	514
15.7.2020	570
16.7.2020	642
17.7.2020	701
18.7.2020	765
19.7.2020	842
20.7.2020	914
21.7.2020	956
22.7.2020	1032
23.7.2020	1096
24.7.2020	1156
25.7.2020	1261
26.7.2020	1346
27.7.2020	1413
28.7.2020	1465
29.7.2020	1496
30.7.2020	1556
31.7.2020	1618



ANALYZE METER COST
JULY - 2020

For Jun,

EPC Power Consumption = 26,000Unit

EPC Meter Charges/month = 3,935,000/- Kyats

(After Solar System Installation)

For July,

Solar Output kWH (July) = 1618 Unit

EPC Power Consumption = 27,000Unit

Total Power Consumption = 27000+1618 = 28618Unit

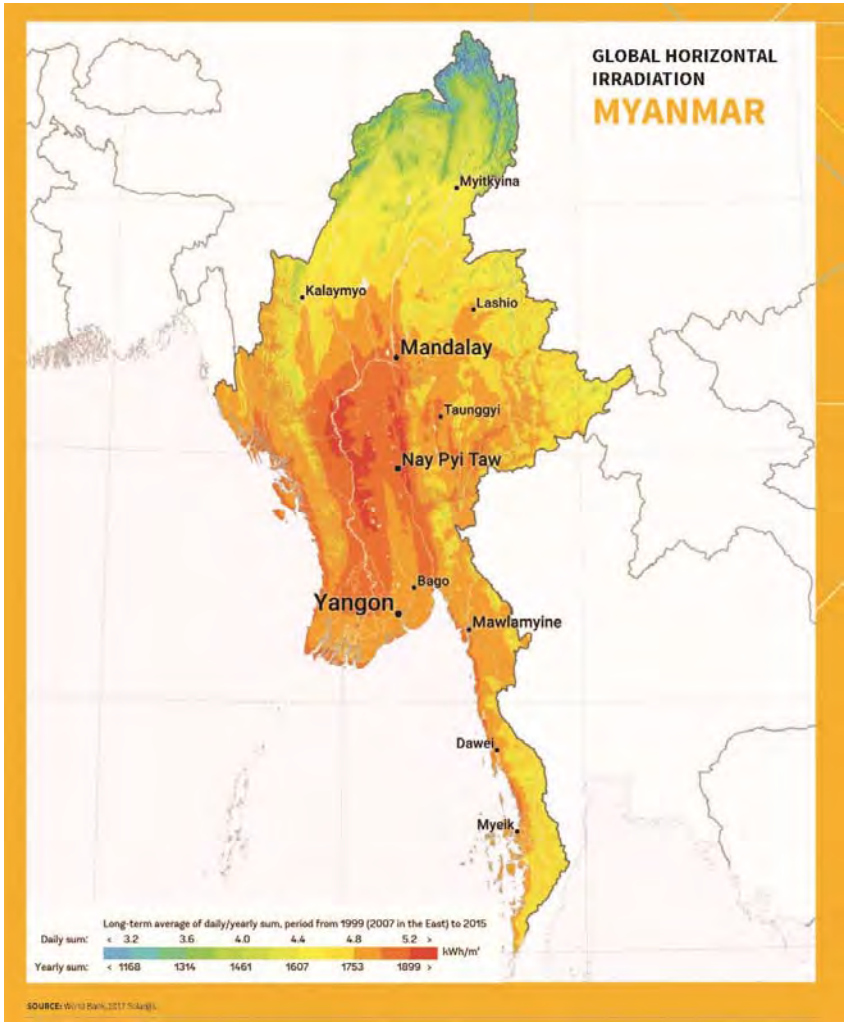
EPC Meter Charges/month = 4,100,000/- Kyats

Estimate Relief Cost = 266,970/- Kyats

PANNITA HOUSING ELECTRICAL CONSUME UNIT FOR 2020

MONTH	YN-19024 300kVA Transformer		SOLAR 30KW On Grid		TOTAL	
	UNIT	AMOUNT(Ks)	UNIT	AMOUNT(Ks)	UNIT	AMOUNT(Ks)
JANAUARY	[illegible]	[illegible]			21000	3,222,400
FEBRUARY	[illegible]	[illegible]			22000	3,387,400
MARCH	[illegible]	[illegible]			33000	5,202,400
APRIL	[illegible]	[illegible]			33000	5,202,400
MAY	[illegible]	[illegible]			37000	5,862,400
JUNE	[illegible]	[illegible]			26000	4,047,400
JULY	[illegible]	[illegible]	1618	266,970	29618	4,644,370
AUGUST	[illegible]	[illegible]	1787	294,855	23787	3,682,255
SEPTEMBER	[illegible]	[illegible]	1922	317,130	23922	3,704,530
OCTOBER	[illegible]	[illegible]	1588	262,020	30588	4,804,420
NOVEMBER						-
DECEMBER						-

Solar Radiation In Myanmar

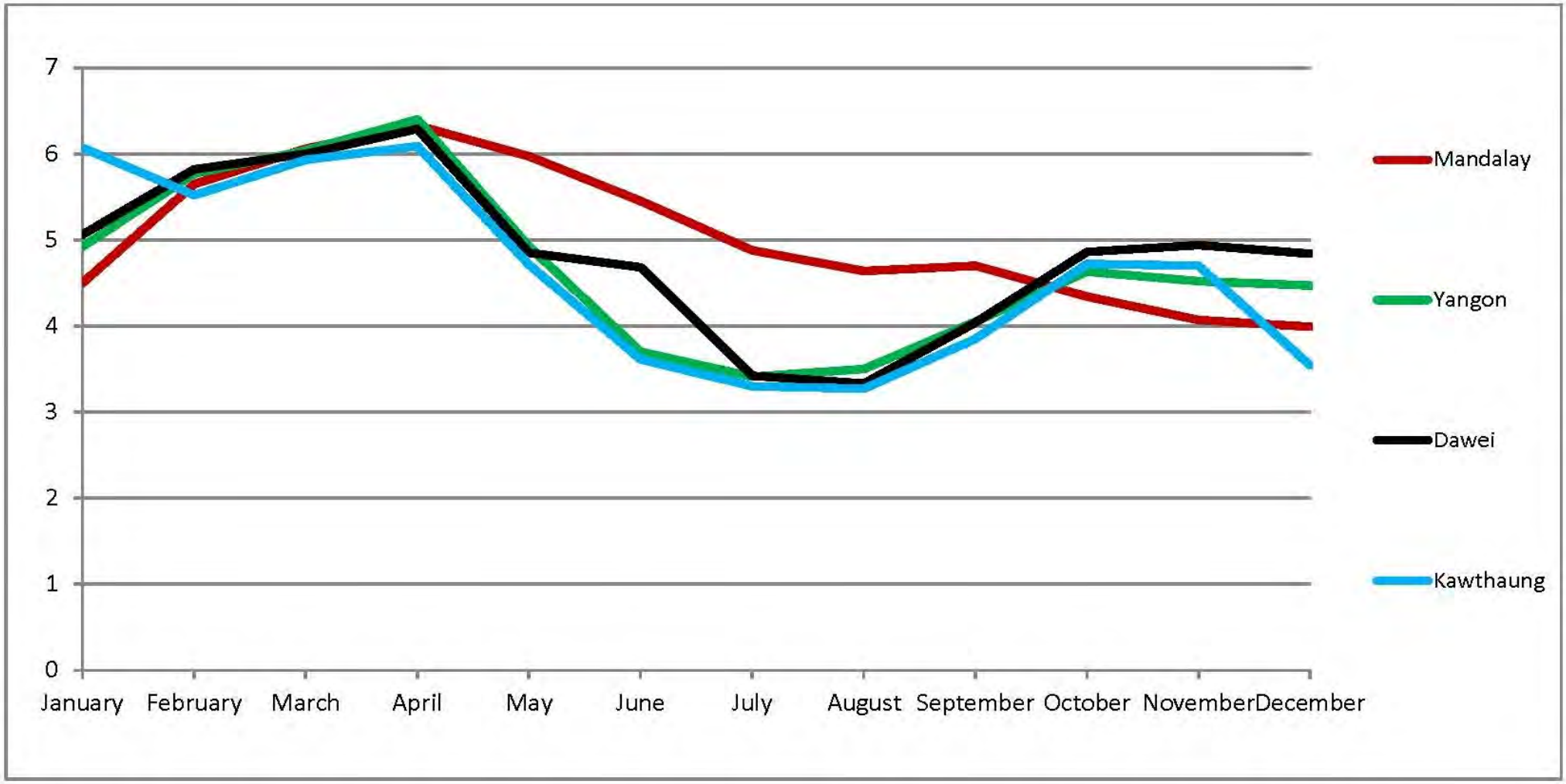


Solar radiation
on horizontal surface:

1650 – 2000 kWh/m2a

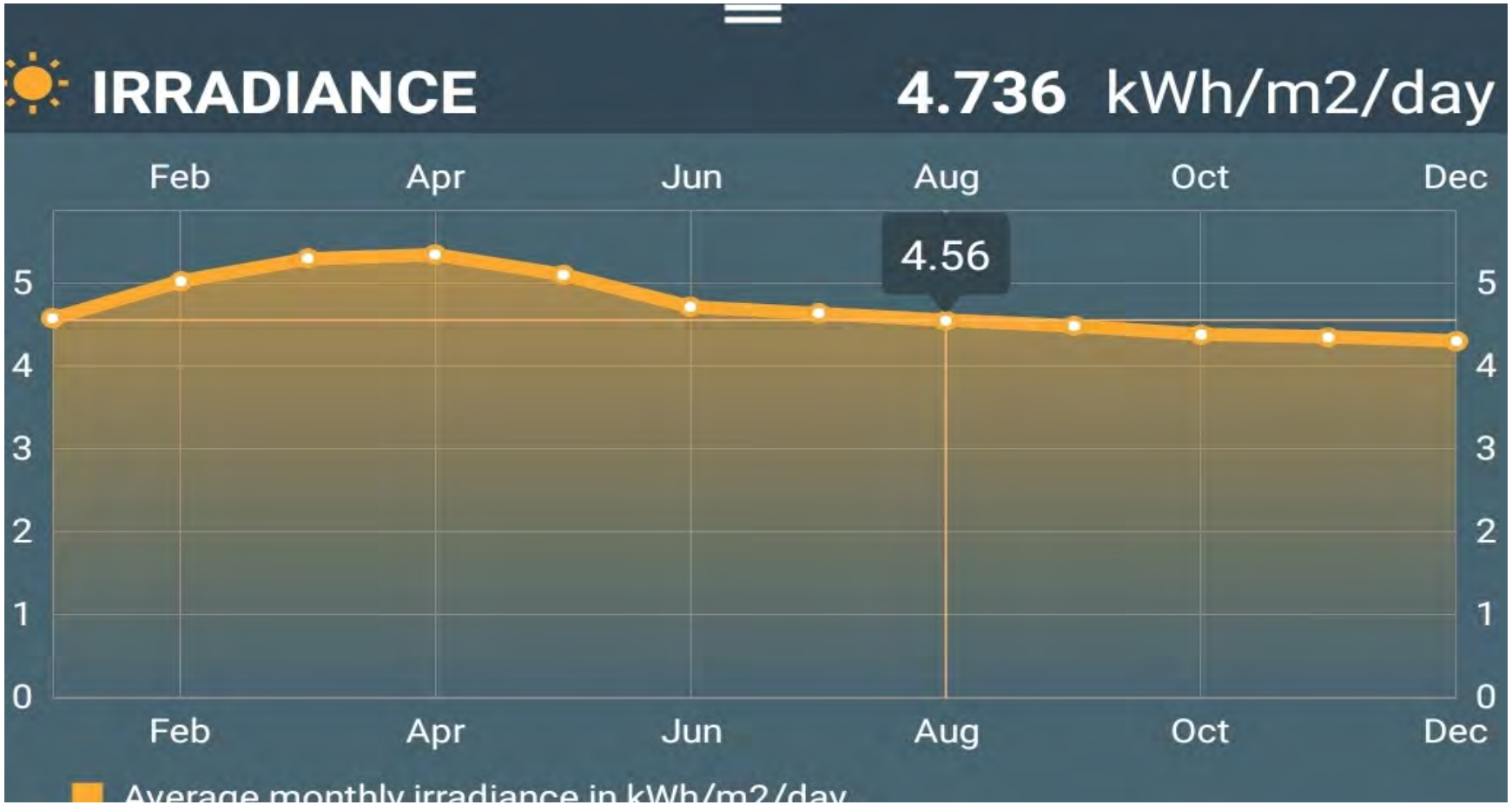
(4.5 – 5.5 kWh/m²d)

SOLAR RADIATION

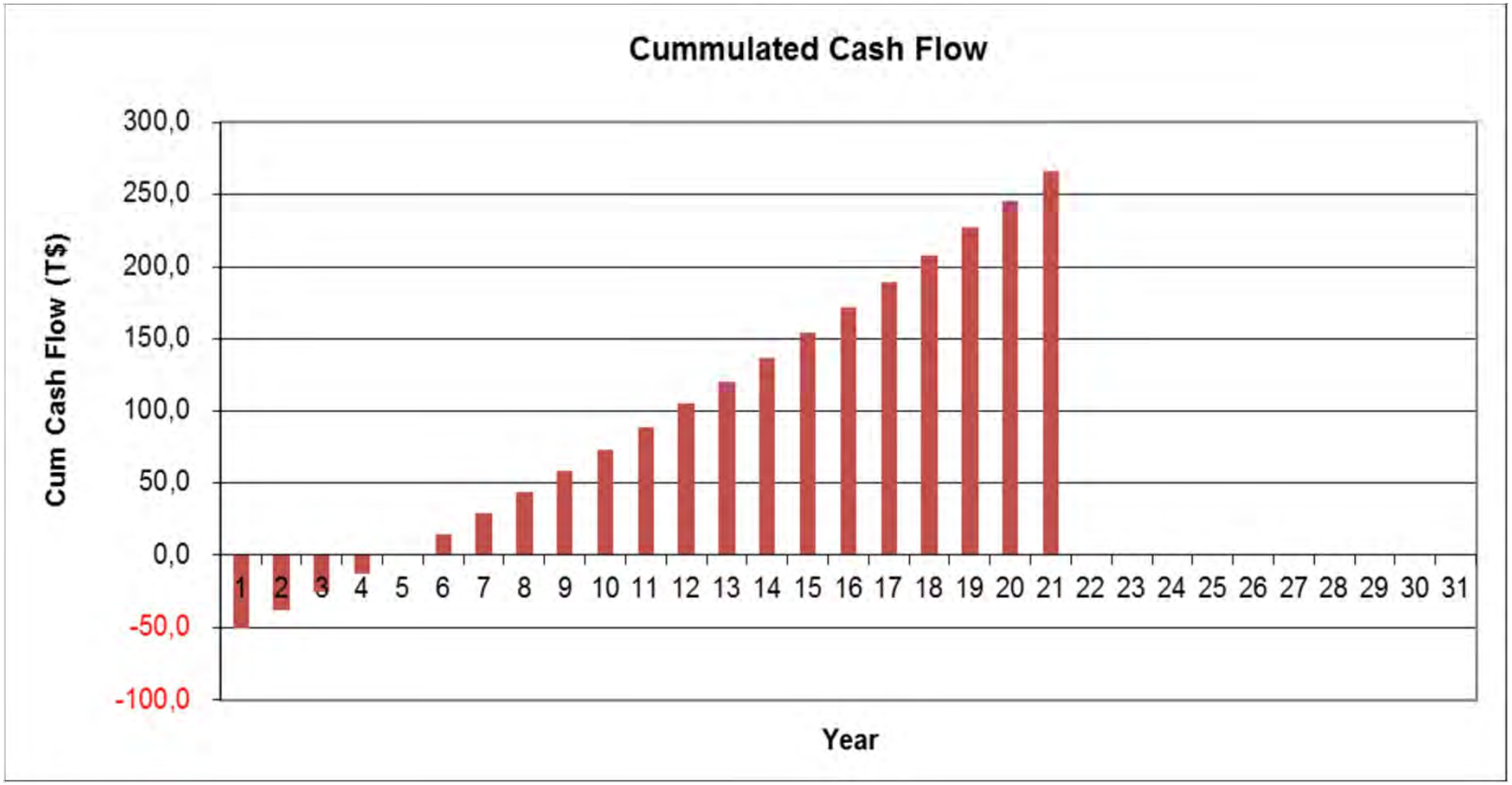


Solar irradiation on horizontal surface in kWh/m2d

OUR PROJECT LOCATION RADIANCE

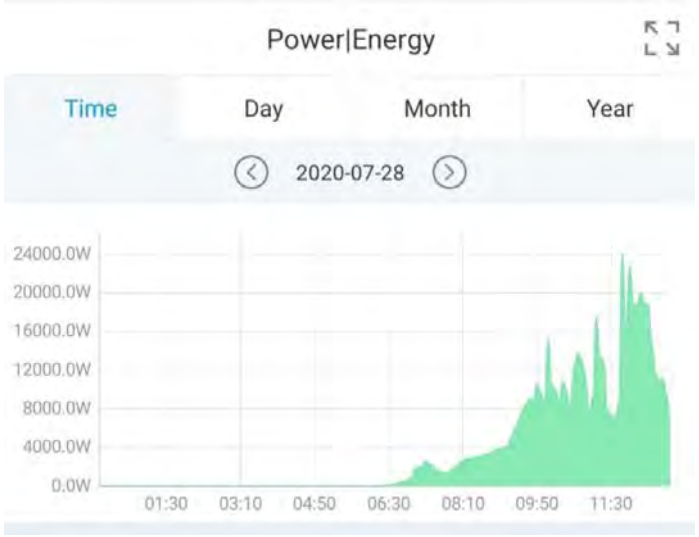


SOLAR INVESTMENT

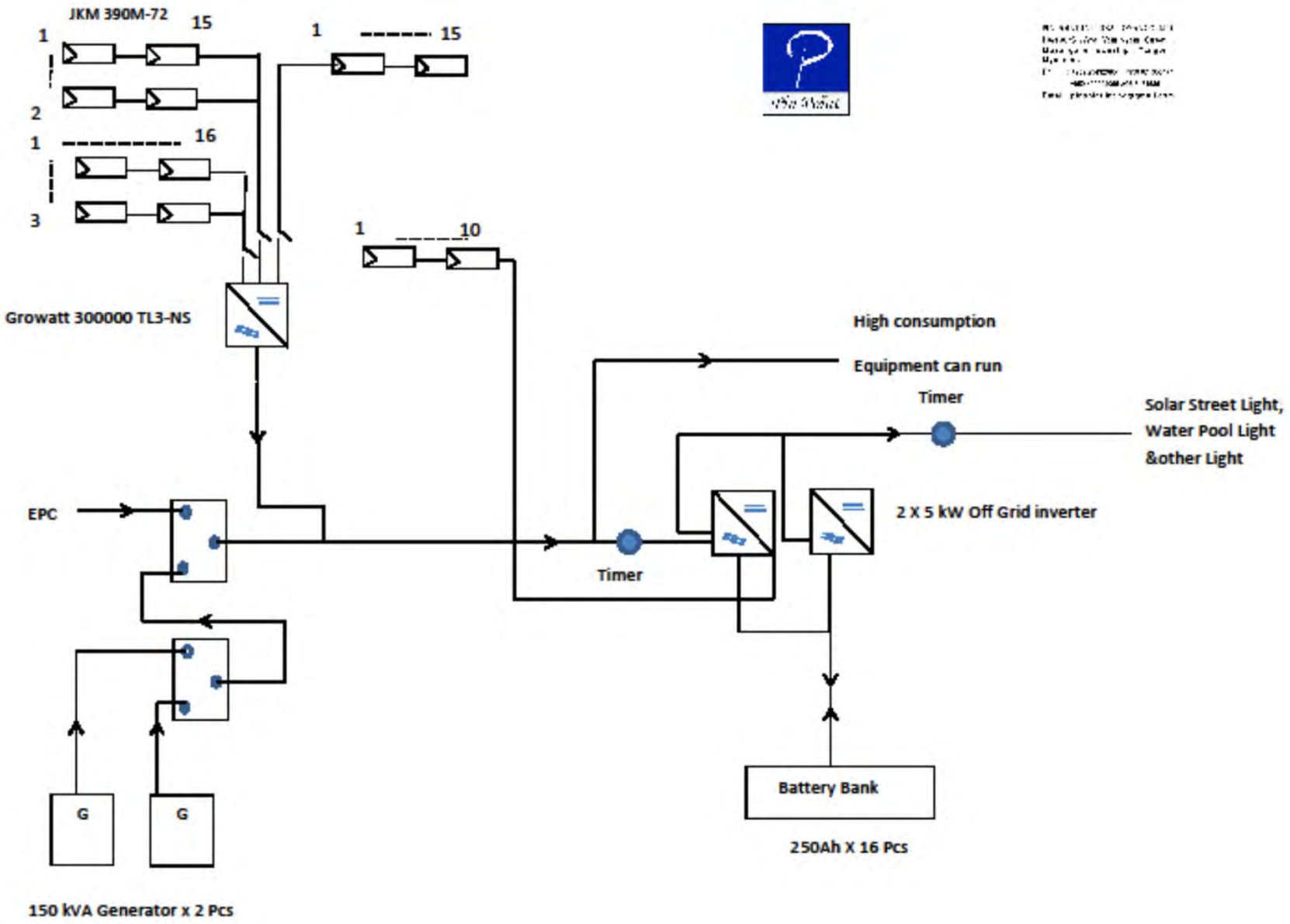


Important for long term high performance: good quality components, good quality design, good quality installation.

- MORNITERING BY PC AND MOBILE APPLICATION



10KW SOLAR EXTENSION PLAN



SOLAR PANEL MAINTENANCE WORK

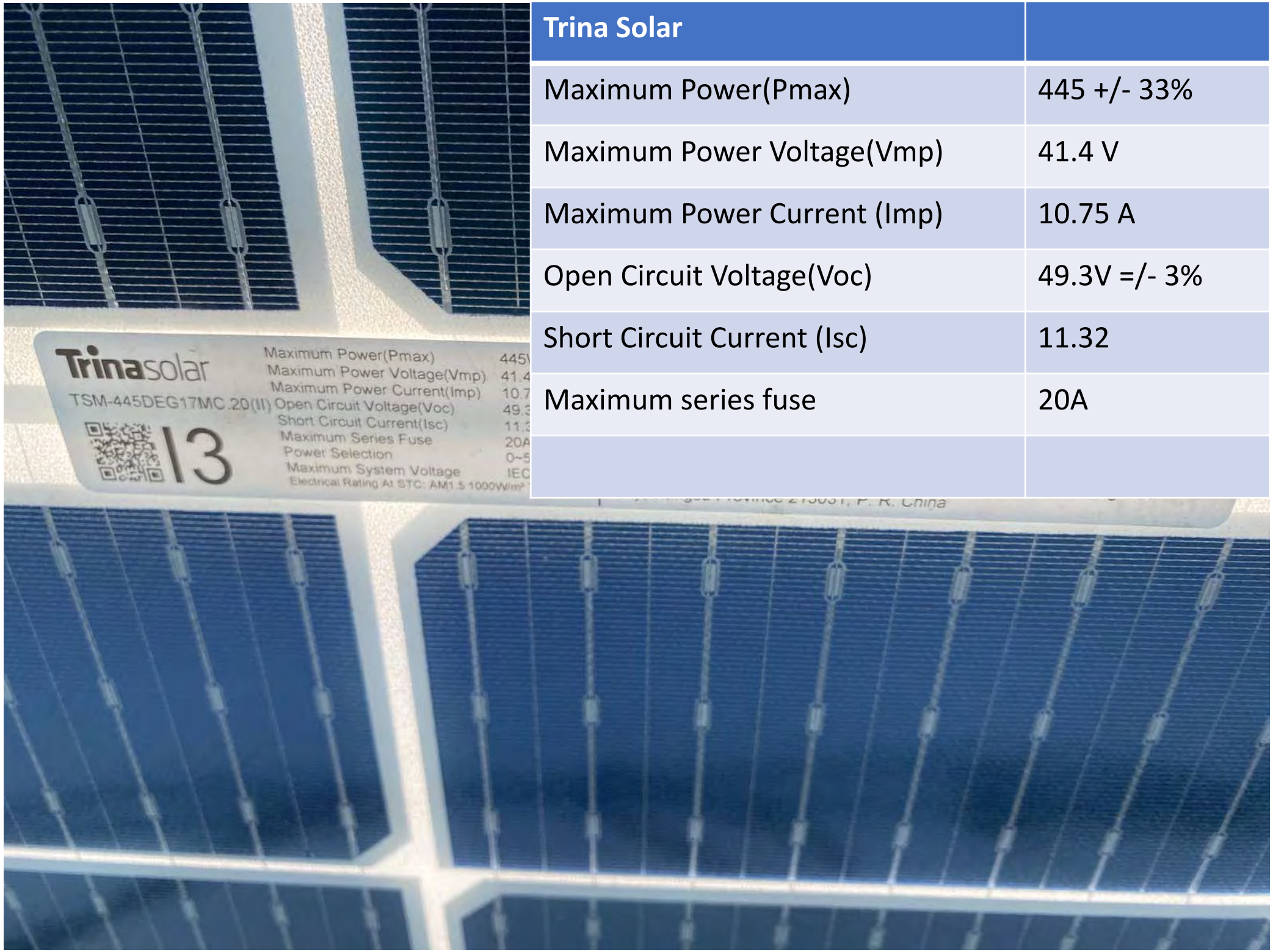
1. Solar Authorized Person should be clean and inspect.
   (Because of Solar PV panel output DC power is minimum – 450V and maximum – 800V)
2. Should be Clean and Inspected as a minimum once every six months or two and four time per year.
3. Must be clean using soft brush and deionized water.
4. Solar panel should be clean in the morning/afternoon or pick a relatively cool day.
5. Solar panel can lose 15-25% of their efficiency if not cleaned properly.

Solar panel cleaning using soft brush and deionized water

SOLAR POWER SYSTEM
(Three Phase)

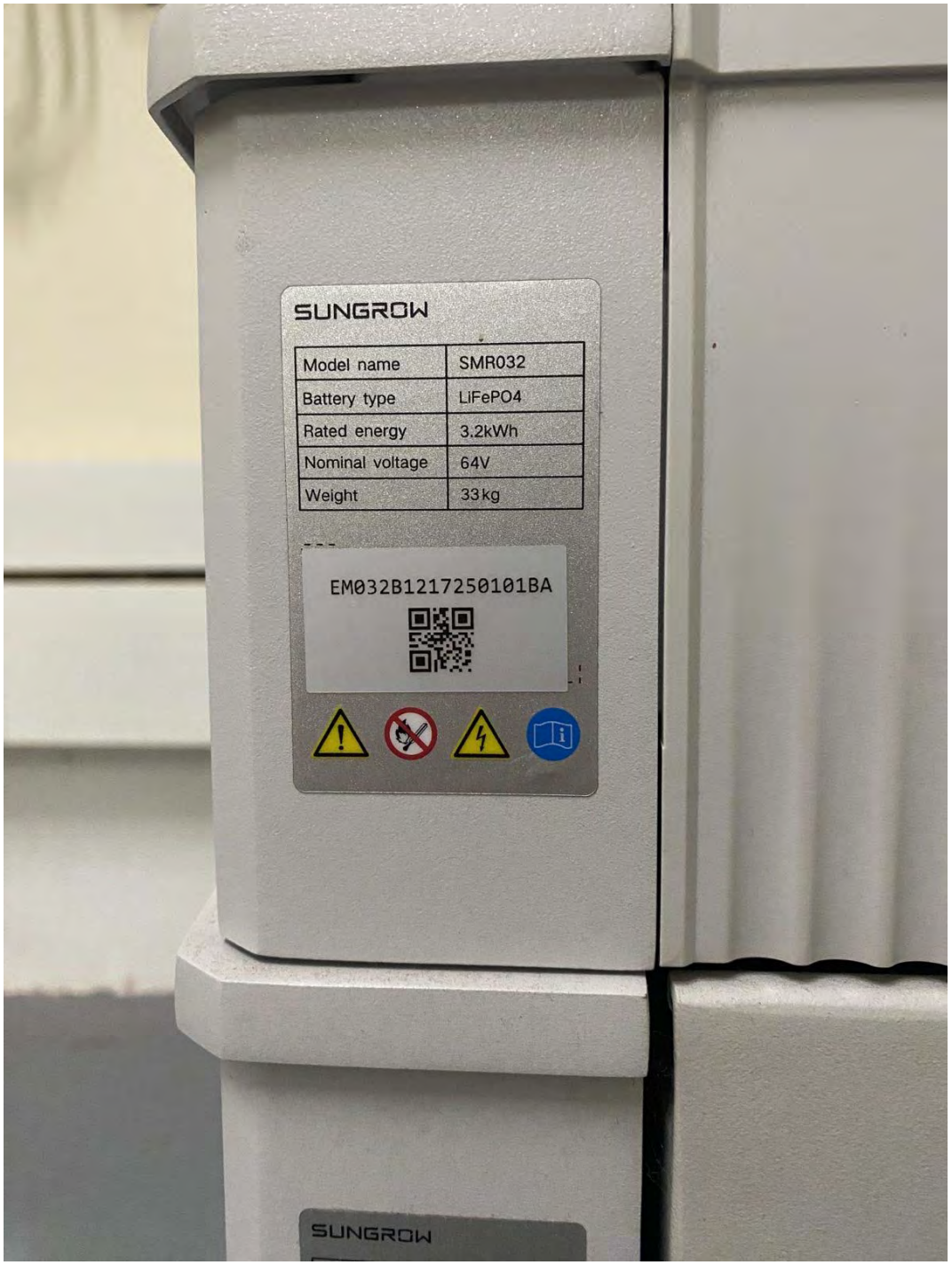
Hybrid Solar Inverter (10 kW x 5 Nos)


Total quantity of Solar = 108
For 5 unit of Inverters

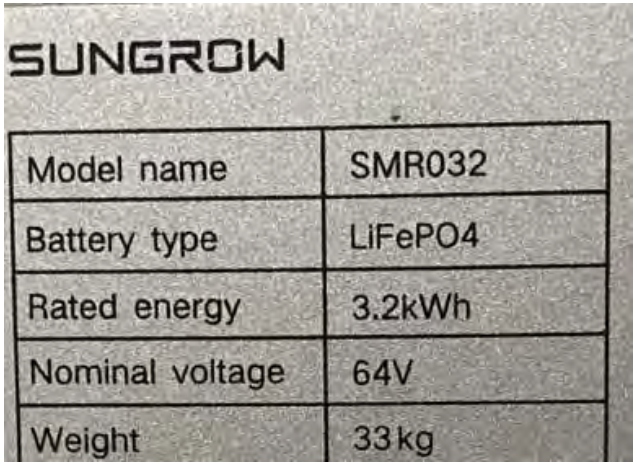


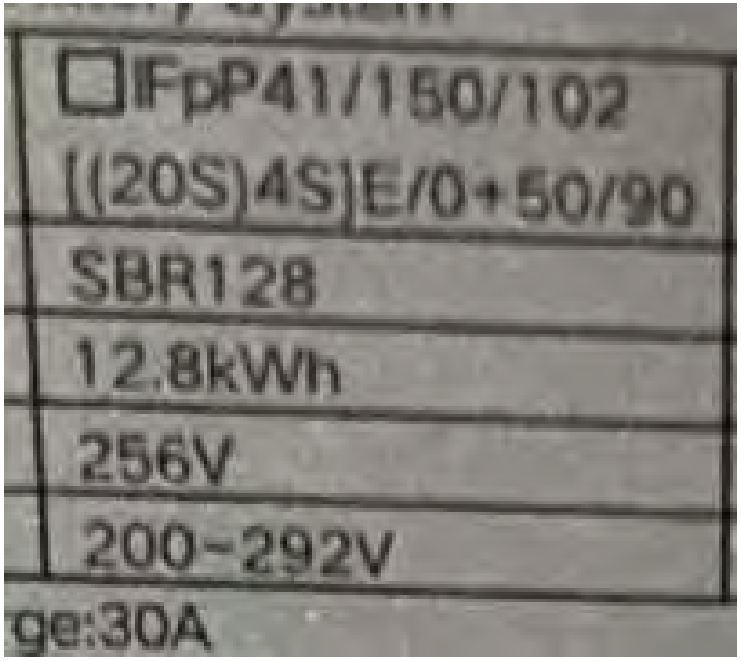
Trina Solar	
Maximum Power(Pmax)	445 +/- 33%
Maximum Power Voltage(Vmp)	41.4 V
Maximum Power Current (Imp)	10.75 A
Open Circuit Voltage(Voc)	49.3V =/- 3%
Short Circuit Current (Isc)	11.32
Maximum series fuse	20A


2
4



Total quantity of Solar = 108
For 5 unit of Inverters





SUNGROW

Product Name	Rechargeable Li-ion Battery System					
	☐FpP41/150/102 [(20S)3S]E/0+50/90	☐FpP41/150/102 [(20S)4S]E/0+50/90	☐FpP41/150/102 [(20S)5S]E/0+50/90	☐FpP41/150/102 [(20S)6S]E/0+50/90	☐FpP41/150/102 [(20S)7S]E/0+50/90	☐FpP41/150/102 [(20S)8S]E/0+50/90
Product Model	SBR096	SBR128	SBR160	SBR192	SBR224	SBR256
Nominal Energy	9.6kWh	12.8kWh	16kWh	19.2kWh	22.4kWh	25.6kWh
Nominal Voltage	192V	256V	320V	384V	448V	512V
Operating Voltage	150~219V	200~292V	250~365V	300~438V	350~511V	400~584V
Max Continuous Current	Charge:30A / Discharge:30A					
Degree of Protection	IP 55					
Protective Class	Class I					
Operating Temperature	Charge: 0℃~50℃ / Discharge: -30℃~50℃					
Manufacturer	Sungrow Power Supply Co.,Ltd					

CAUTION:

Do not disassemble the battery pack. Do not immerse the battery pack in water.
Do not short-circuit the battery. Do not leave the battery near by fire.
The battery should be disposed by qualified recycling agent.

S2106110017

Sequence of Operation

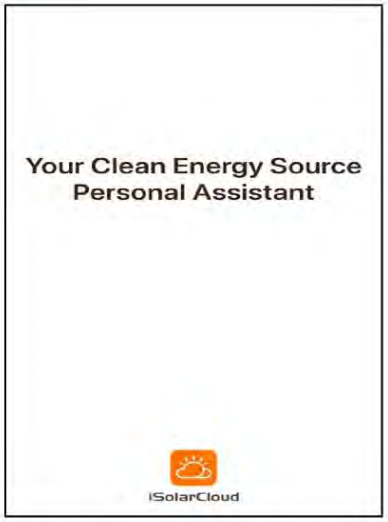
Sungrow Solar

and

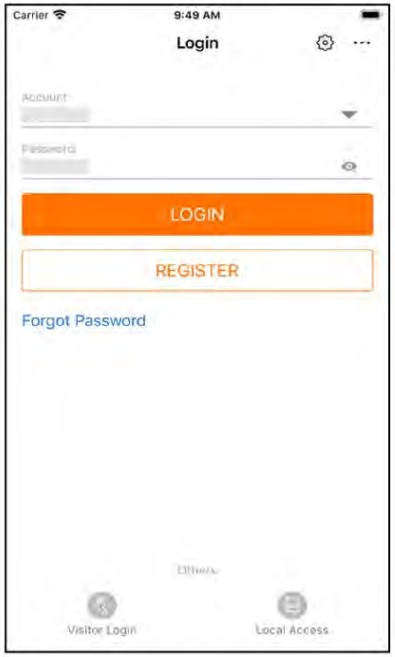
Monitoring System

1. Click “Isolarcloud” icon.

   - This screen appear.

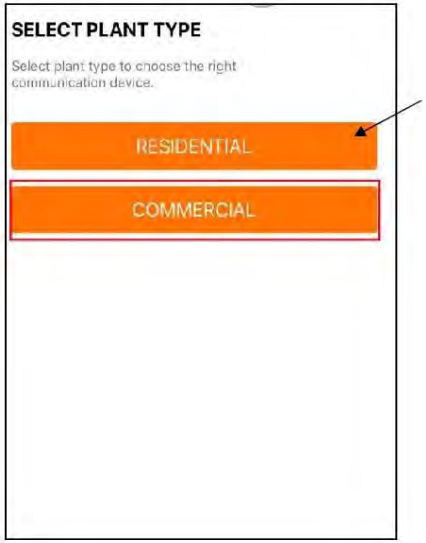


2. Need to log in with email account and password.

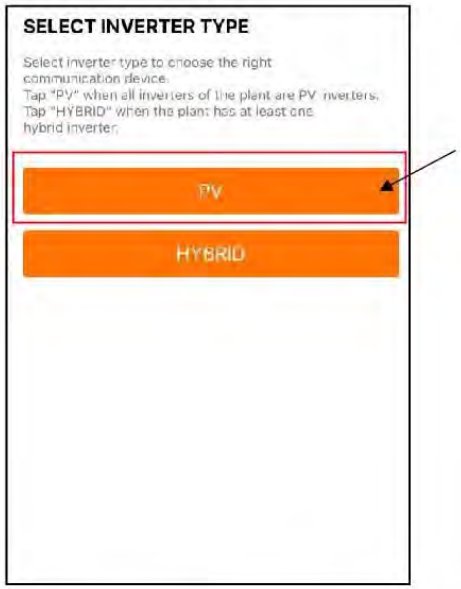


3. Click the icon at the upper right corner.

4. Click the “RESIDENTIAL”.

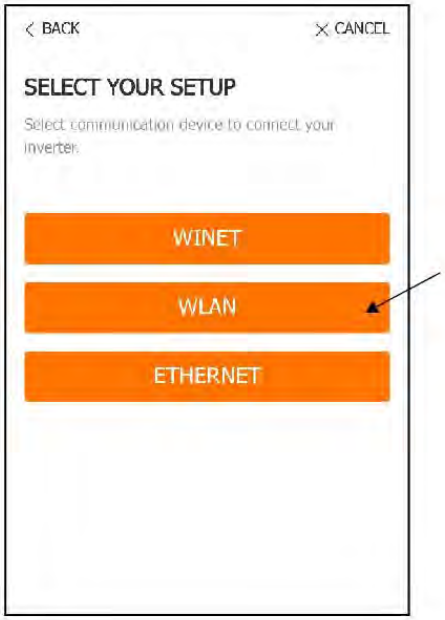


5. Click the “PV”.

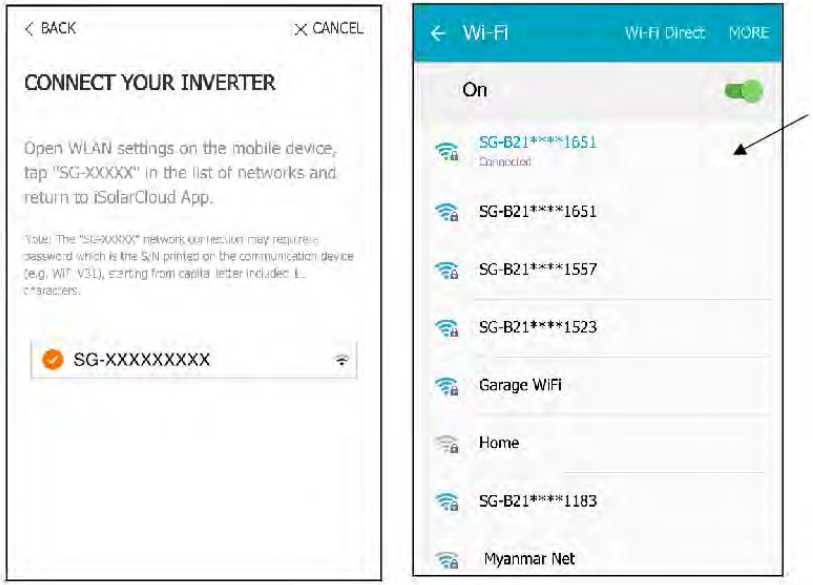


6. Scan the QR Code of Wifi Module (or) Manually write Wifi Module Password.

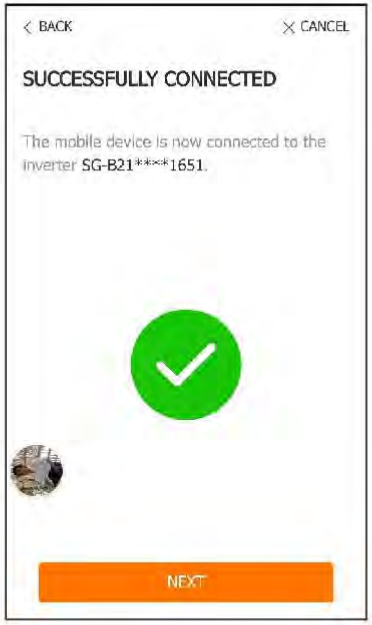
7. This screen appear and Click “ WLAN”.



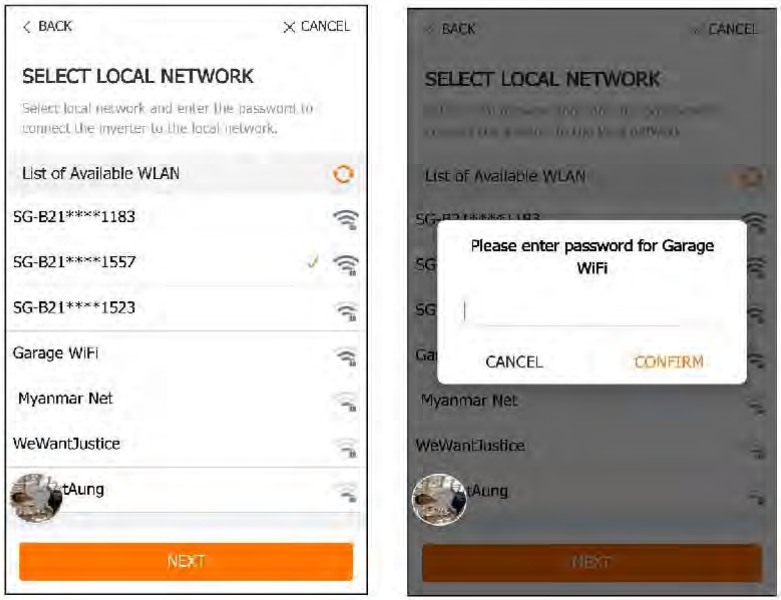
8. This screen appear and Connect the Inverter of Wifi Module Network.



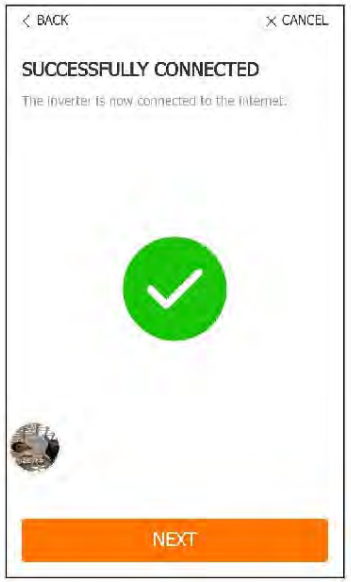
9. This screen appear and Click “NEXT”.



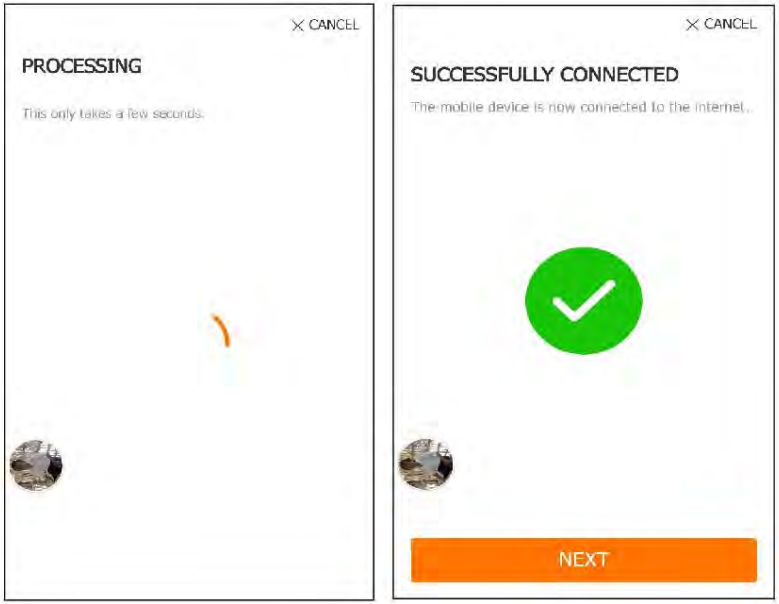
10. This screen appear and Connet the Local Network with Password.



11. This screen appear and Click “NEXT”.

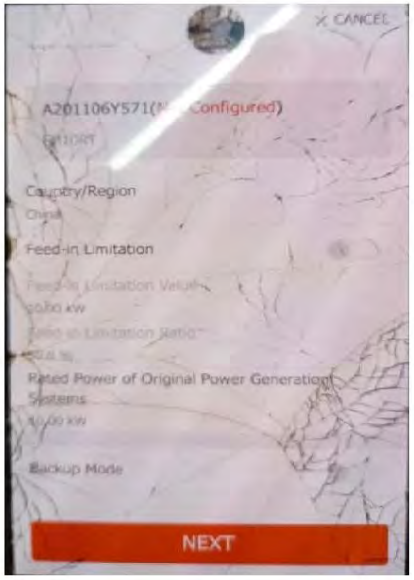


12. This sreen appear, Click “NEXT”.

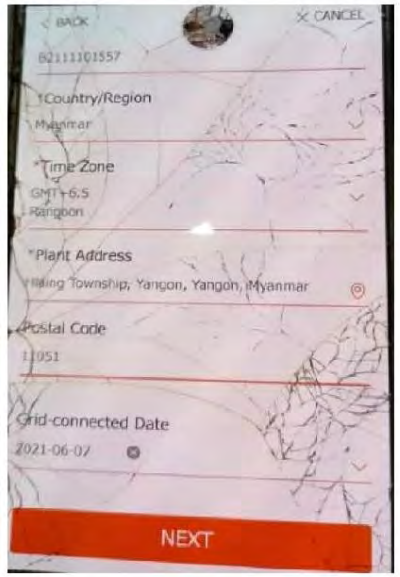


13. This Screen appear and successfully connected with the Inverter. If you want to add all inverter in one, Click “Add More” and connect the another inverter with the following method and Click “NEXT”.

14. This Screen appear and Select “China” at the Country/Region and Click “NEXT”.

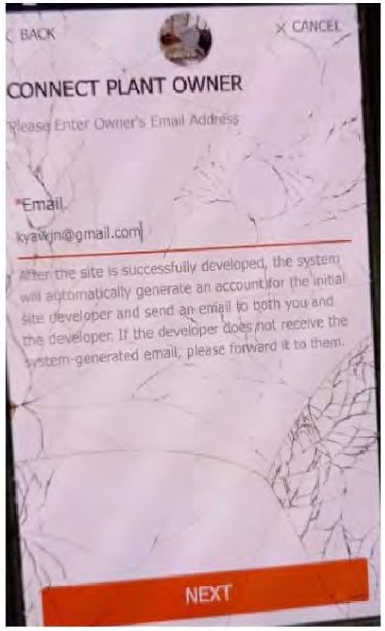


15. This screen appear and fill the Postal Code and Click “NEXT”.

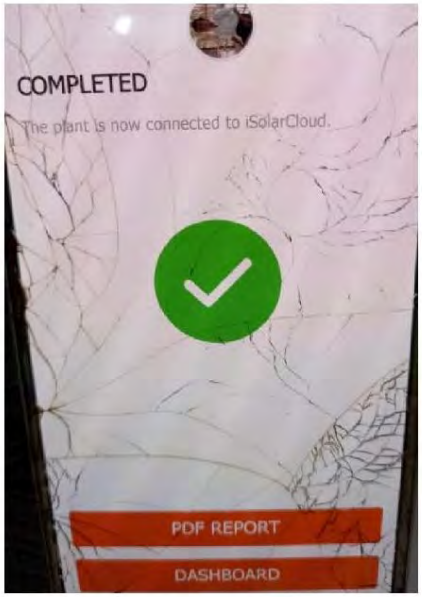


16. This screen appear and Click “Unit” and Choose USD. Fill in the “Feed in Tariff” (0.09375USD) and “Consumption Tariff” (3.47USD) and Click “NEXT”.

17. This screen appear and fill Owner Email address and Click “NEXT”.



18. This Screen appear and Click “PDF REPORT” and Finish.

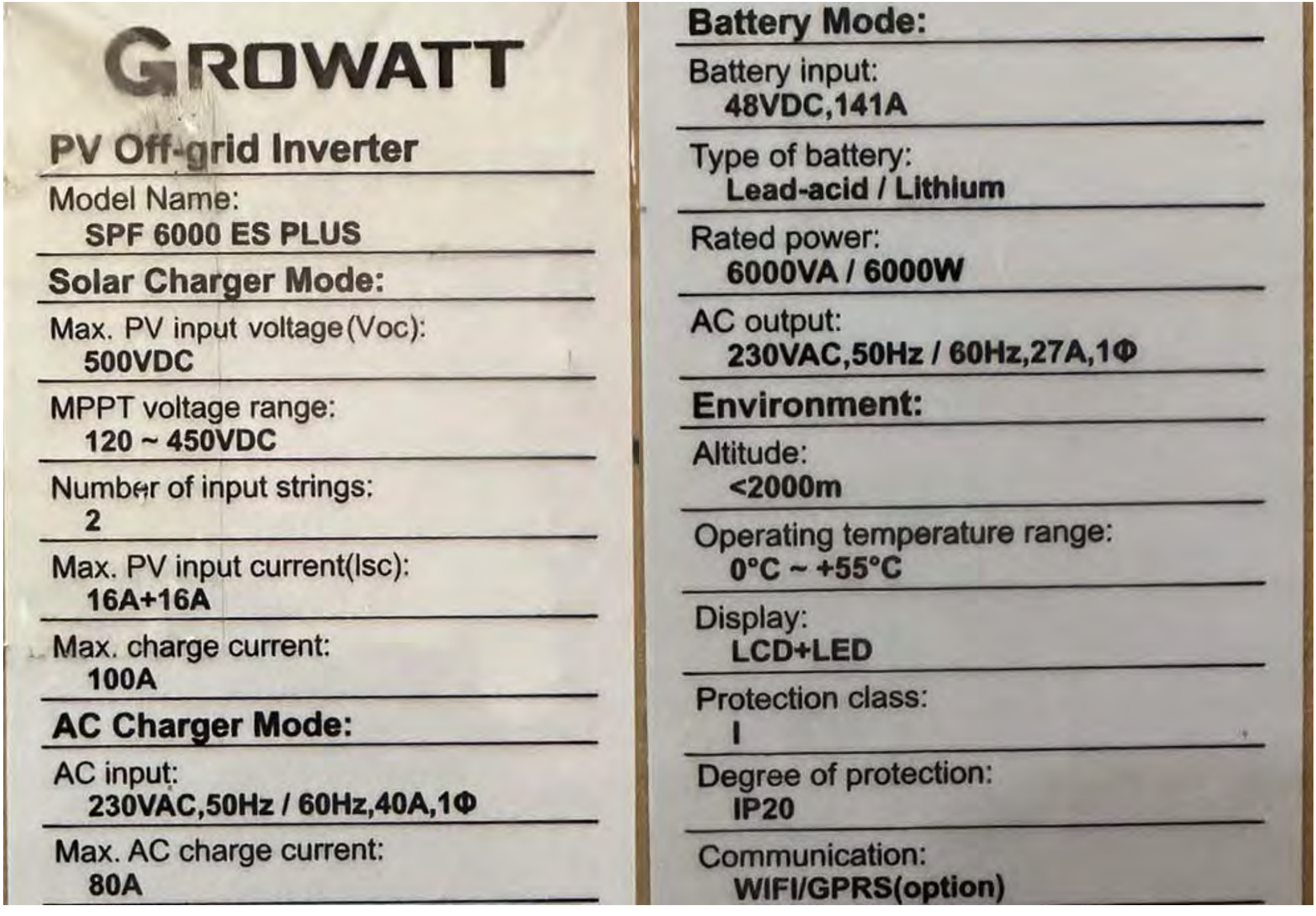


SOLAR POWER SYSTEM
(Single Phase)

Hybrid Solar Inverter (6 kW)

Practical Installation of Solar System

Growatt Inverter



GROWATT

PV Off-grid Inverter

Model Name:
SPF 6000 ES PLUS

Solar Charger Mode:

Max. PV input voltage(Voc):
500VDC

MPPT voltage range:
120 ~ 450VDC

Number of input strings:
2

Max. PV input current(Isc):
16A+16A

Max. charge current:
100A

AC Charger Mode:

AC input:
230VAC,50Hz / 60Hz,40A,1Φ

Max. AC charge current:
80A

Battery Mode:

Battery input:
48VDC,141A

Type of battery:
Lead-acid / Lithium

Rated power:
6000VA / 6000W

AC output:
230VAC,50Hz / 60Hz,27A,1Φ

Environment:

Altitude:
<2000m

Operating temperature range:
0°C ~ +55°C

Display:
LCD+LED

Protection class:
I

Degree of protection:
IP20

Communication:
WIFI/GPRS(option)

CATL Lithium Battery 48V

Power – 14.5KWh
Voltage – 51.8Vdc
Cells - 280Ah NMC Lithium
Manufacture - CATL International Co., Ltd
Max Charging Current - 75A
Max Discharge Current - 100A
Max Peak Current - 300A
Life Cycle - 80% DOD > 4000/ 25'C- 0.5'C
Communication - Smart BMS – Bluetooth Interface
Parallel - Up to 6nos
Weight - 82Kg
Dimension – 615mm x 510mm x 300mm


极空
JIKONG
中 / EN
Vol: 56. 80V
Cur: 0. 7A
99%
Delta Vol: 0. 072V
MOS: 33C
Temp: 29C
Alarm: Normal
Ave. Vol: 4. 057V
Balance: ON
Charge: ON
Discharge: ON
STATUS
CELLS VOLTAGE
ALARM


AC/INV
CHG
FAULT
2.02
435
16
0
52.1
ESC
UP
DOWN
ENTER

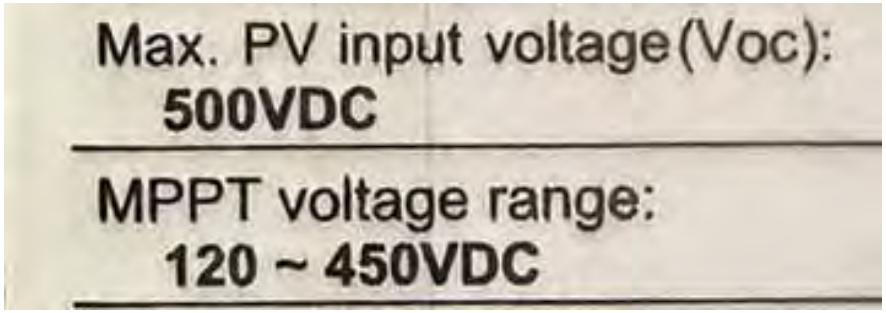
Installation

Checking of Solar Panel Technical Specification

Wattage	*250 Wp*
Open circuit voltage (Voc)	*44.1 V*
Close circuit voltage (Voc)	*36.0 V*
Maximum current (I max)	*6.0A*
12 Nos of Solar panel in series connection	*445V(measuring)*

Checking on MPPT specification

On Inverter



Checking and Inspection of Solar Connection plug.

Make sure no lose connection

Make sure adequate cable size (AC & DC)

Solar DC wires, battery cables

Check the DC voltage and correct polarity.

(By measuring voltage with multimeter)

Solar Input Voltage from solar

Battery connection (+ tive) (- tive)

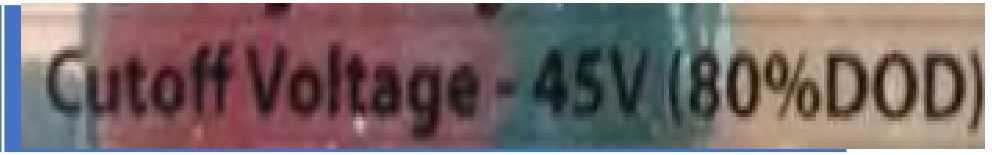
AC input (L, N), AC output (L, N)

Setting of Inverter

Program	description	Setting option
01	(Solar First) (Utility First) (Solar priority, not sufficient battery power same time) (Solar priority, not sufficient utility power same time)	SOL UTI SbU SUb
02	Maximum charging current	60

03	AC Input Range	Acceptable AC input Voltage range 90 ~ 280V (APL) 170 ~ 280 (UPS) 90 ~ 280V (GEN) Generator capacity not <20kVA
04	Power saving Mode Enable/disable	**If disabled**, no matter connected load is low or high, the on/off status of inverter output will not be effected**.(Dis)**√√ If enabled, the output of inverter will be off when connected load is pretty low or not detected. (ENA)

03	AC Input Range	Acceptable AC input Voltage range 90 ~ 280V (APL) 170 ~ 280 (UPS) 90 ~ 280V (GEN) Generator capacity not <20kVA
05	Battery Type	AGM Flooded Lithium(USE,US2)
19	Charging Voltage	Bulk Charging Voltage - 58.2V
20	Float Charging Voltage	Floating Voltage - 58V
21	Low DC Cut off Voltage	Cutoff Voltage - 45V (80%DOD)

21	Low DC Cut off Voltage	

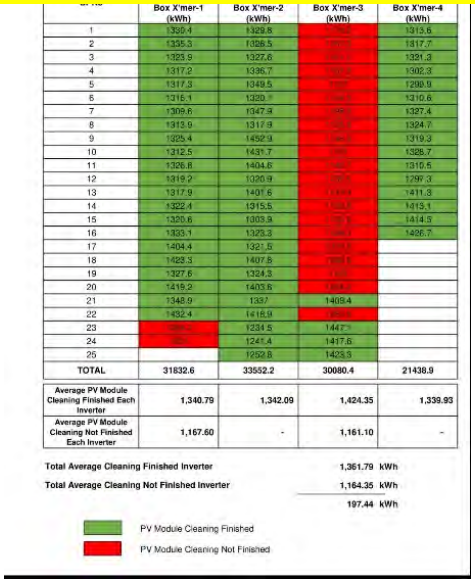
When reach low DC cut off voltage

1) ***If battery power is only power source available, inverter will shut- down***
2) ***If PV energy and battery power are available, inverter will charge battery without AC output.***
3) ***If PV energy, battery power and utility are all available, inverter will transfer to line mode and provide output power to loads, and charge the battery at the same time***

Solar panel Cleaning

Study of Solar Panel Cleaning work

TAUNG TAW GWIN



Sr No	Box X'mer-1 (kWh)	Box X'mer-2 (kWh)	Box X'mer-3 (kWh)	Box X'mer-4 (kWh)
1	1330.4	1329.8		1313.6
2	1335.3	1328.5		1317.7
3	1325.9	1327.6		1321.3
4	1317.2	1336.7		1302.3
5	1317.3	1349.5		1299.9
6	1316.1	1329.1		1310.6
7	1309.6	1347.9		1327.4
8	1313.9	1317.9		1324.7
9	1325.4	1452.9		1319.3
10	1312.5	1431.7		1328.7
11	1326.8	1404.6		1310.5
12	1319.2	1326.9		1297.3
13	1317.9	1401.6		1411.3
14	1322.4	1315.5		1413.1
15	1320.6	1303.9		1414.5
16	1333.1	1323.3		1406.7
17	1404.4	1321.5		
18	1428.3	1407.5		
19	1327.6	1324.3		
20	1419.2	1403.6		
21	1348.9	1337	1409.4	
22	1432.4	1418.9		
23		1234.5	1447.5	
24		1241.4	1417.6	
25		1252.8	1425.3	
TOTAL	31832.6	33552.2	30080.4	21438.9
Average PV Module Cleaning Finished Each Inverter	1,340.79	1,342.09	1,424.35	1,339.93
Average PV Module Cleaning Not Finished Each Inverter	1,167.60	-	1,161.10	-

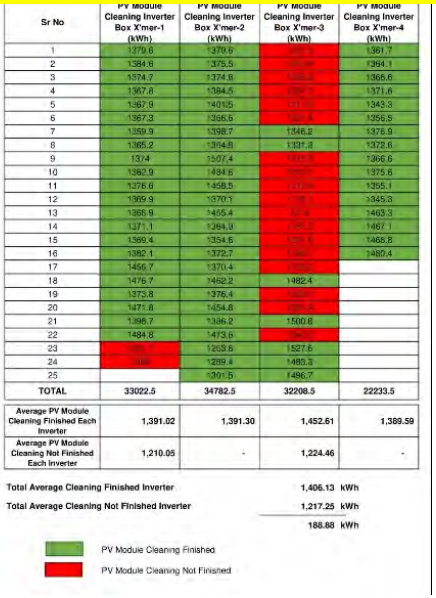
Total Average Cleaning Finished Inverter 1,361.79 kWh

Total Average Cleaning Not Finished Inverter 1,164.35 kWh

197.44 kWh

PV Module Cleaning Finished

PV Module Cleaning Not Finished



Sr No	PV Module Cleaning Inverter Box X'mer-1 (kWh)	PV Module Cleaning Inverter Box X'mer-2 (kWh)	PV Module Cleaning Inverter Box X'mer-3 (kWh)	PV Module Cleaning Inverter Box X'mer-4 (kWh)
1	1370.6	1376.6		1361.7
2	1384.6	1375.5		1384.1
3	1374.7	1374.8		1365.6
4	1367.6	1384.5		1371.6
5	1367.9	1401.5		1343.3
6	1367.3	1366.5		1356.5
7	1359.9	1398.7	1346.2	1376.9
8	1365.2	1354.8	1331.3	1372.6
9	1374	1407.4		1366.6
10	1382.9	1434.6		1375.6
11	1376.6	1458.5		1355.1
12	1369.9	1370.1		1345.3
13	1366.9	1455.4		1403.3
14	1371.1	1364.9		1467.1
15	1389.4	1354.5		1468.8
16	1382.1	1372.7		1480.4
17	1456.7	1370.4		
18	1476.7	1462.2	1482.4	
19	1373.8	1376.4		
20	1471.6	1454.8		
21	1398.7	1386.2	1500.6	
22	1484.8	1473.6		
23		1263.6	1527.6	
24		1289.4	1483.3	
25		1301.5	1496.7	
TOTAL	33022.5	34782.5	32208.5	22233.5
Average PV Module Cleaning Finished Each Inverter	1,391.02	1,391.30	1,452.61	1,389.59
Average PV Module Cleaning Not Finished Each Inverter	1,210.05	-	1,224.46	-

Total Average Cleaning Finished Inverter 1,406.13 kWh

Total Average Cleaning Not Finished Inverter 1,217.25 kWh

188.88 kWh

PV Module Cleaning Finished

PV Module Cleaning Not Finished

Green Power Energy Co.,Ltd

Solar Power Plant Project (Taung Taw Gwin)

arsion of Inverter Data (PV Module Cleaning)

15.2.2023

Sr No	PV Module Cleaning Inverter Box X'mer-1 (kWh)	PV Module Cleaning Inverter Box X'mer-2 (kWh)	PV Module Cleaning Inverter Box X'mer-3 (kWh)	PV Module Cleaning Inverter Box X'mer-4 (kWh)
1	1594	1594.5		1563.8
2	1580	1577.2		1563.1
3	1574.7	1575.6		1585
4	1567.8	1588.7		1572.1
5	1567.2	1604.7		1538.3
6	1566.1	1567.4		1555.4
7	1556.7	1565.4	1577.1	1578.4
8	1568.6	1567.1	1587.9	1574
9	1578	1705.9		1568.2
10	1560.1	1702.5	1539.6	1577
11	1579.3	1674.4		1554.7
12	1571.7	1566.3	1511.7	1543.1
13	1569	1569		1677.8
14	1577.3	1582.6	1498.4	1682.3
15	1573.2	1554.1		1682.1
16	1587.5	1572.6		1696.4
17	1574	1570.1		
18	1692	1679.1	1730.3	
19	1568.9	1570.7	1592.8	
20	1585.7	1585.4	1441.2	
21	1599.8	1592	1716.3	
22	1700.6	1690.3	1509.8	
23		1432.4	1751.2	
24		1480	1708.7	
25		1492.3	1721.9	
TOTAL	37866.5	39874.2	37596.7	25493.7
Average PV Module Cleaning Finished Each Inverter	1,594.99	1,594.97	1,604.43	1,593.36
Average PV Module Cleaning Not Finished Each Inverter	1,388.35	-	1,387.43	-

Total Average Cleaning Finished Inverter 1,596.94 kWh

Total Average Cleaning Not Finished Inverter 1,387.89 kWh

209.05 kWh

PV Module Cleaning Finished

PV Module Cleaning Not Finished

Sr No				
1				
2				
3				
4	1459.2	1497.6		1572.1
5	1459.2	1495.6		1536.3
6	1457.6	1473.6		1555.4
7	1448.7	1494	1476.9	1578.4
8	1454.6	1489.7	1494.1	1574
9	1472.3	1510.9		1568.2
10	1462.3	1588.3	1489	1577
11	1472.5	1585.9		1554.7
12	1461.8	1468.1	1496.2	1543.1
13	1463.5	1561		1677.8
14	1466.8	1451.2	1507.4	1682.3
15	1467.6	1452.6		1682.1
16	1481	1469.5		1696.4
17	1560.2	1467.4		
18	1578.2	1569.8	1822.7	
19	1467.7	1472.3	1484.6	
20	1571.5	1582.8	1559	
21	1494.5	1485.3	1612.6	
22	1586.9	1575.9	1546.2	
23		1045	1635.2	
24		1384.7	1597.9	
25		1395.8	1609	
TOTAL	35293.3	37297.4	35737.9	25493.7
Average PV Module Cleaning Finished Each Inverter	1,486.30	1,491.90	1,548.48	1,593.36
Average PV Module Cleaning Not Finished Each Inverter	1,297.30	-	1,300.63	-

Total Average Cleaning Finished Inverter 1,530.01 kWh

Total Average Cleaning Not Finished Inverter 1,298.97 kWh

231.04 kWh

PV Module Cleaning Finished

PV Module Cleaning Not Finished

After Cleaning

Before Cleaning

Total Average Cleaning Finished Inverter 1,361.79 kWh

Total Average Cleaning Not Finished Inverter 1,164.35 kWh

197.44 kWh

Total Average Cleaning Finished Inverter 1,406.13 kWh

Total Average Cleaning Not Finished Inverter 1,217.25 kWh

188.88 kWh

Total Average Cleaning Finished Inverter 1,596.94 kWh

Total Average Cleaning Not Finished Inverter 1,387.89 kWh

209.05 kWh

Total Average Cleaning Finished Inverter 1,530.01 kWh

Total Average Cleaning Not Finished Inverter 1,298.97 kWh

231.04 kWh

THAPYAYWA

Thapyawa Solar Power Station
Inverters Data Record

8.3.2023

Sr No	Inverter No	Box X'mer-1	Box X'mer-2	Box X'mer-3	Box X'mer-4	Box X'mer-5	Total Inv: 126 nos (kWh)	Remark
		kWh	kWh	kWh	kWh	kWh		
1	1	1579.0	1517.9	1460.3	1452.3	1425.2		
2	2	1524.4	1509.1	1464.1	1444	1450.1		
3	3	1497.8	1513.2	1467.8	1437.5	1443.3		
4	4	1542.9	1513	1461.6	1451.6	1450.9		
5	5	1531.1	1513.3	1467.4	1449.9	1442.2		
6	6	1531.7	1516.4	1454.9	1437	1461.8		
7	7	1518.9	1504.5	1454.8	1448.9	1454.9		
8	8	1505	1503.5	1443.6	1440.9	1457.4		
9	9	1464.4	1496.1	1433.6	1429.8	1459.7		
10	10	1456.9	1496.3	1528.5	1486.6	1400.9		
11	11	1464.1	1476.1	1528.9	1433.3	1446.7		
12	12	1463.6	1502.3	1473.8	1512.7	1449.7		
13	13	1399.7	1510.8	1464.5	1520.2	1454.2		
14	14	1460.7	1514.6	1454	1525.7	1448		
15	15	1451.8	1519.6	1445.4	1515.5	1441.9		
16	16	1449.3	1492.8	1431.4	1524.4	1446		
17	17	1455.1	1503.9	1434.1	1522.2	1421.3		
18	18	1451.9	1502.3	1462	1469.6	1435.6		
19	19	1450.6	1507	1447.1	1404.5	1430.7		
20	20	1462.7	1505.4	1466.2	1414.8	1418.6		
21	21	1418.8	1507.2	1522.4	1414.6	1417.8		
22	22	1416.2	1388.7	1522.6	1425.1	1431.4		
23	23	1445.6	1402.6	1541.8	1439.9	1438.5		
24	24	1413.4	1404.2	1474	1445	1454.8		
25	25	1443.4	1400.8	1556.3	1449.3	1464.3		
26	26					1433.4		
Total (kWh)		36831.8	37221.7	36861.1	36494.9	37479.3	184888.8	184.89
Average PV Module Cleaning Finished Each Inverter		1,528.95	1,505.97	-	1,507.66	-		
Average PV Module Cleaning Not Finished Each Inverter		1,447.07	1,399.08	1,474.44	1,441.18	1,441.51		

Total Average Cleaning Finished Inverter 1,514.19 kWh

Total Average Cleaning Not Finished Inverter 1,440.66 kWh

Thapyawa Solar Power Station
Inverters Data Record

14.3.2023

Sr No	Inverter No	Box X'mer-1	Box X'mer-2	Box X'mer-3	Box X'mer-4	Box X'mer-5	Total Inv: 126 nos (kWh)	Remark
		kWh	kWh	kWh	kWh	kWh		
1	1	1549.7	1501.8	1545.8	1545.2	1433.3		
2	2	1492.8	1493.9	1548.9	1526.3	1422.3		
3	3	1467.5	1494.9	1555.6	1527.5	1417.8		
4	4	1510.4	1495.1	1548.8	1548.7	1422.8		
5	5	1498.4	1494.4	1557.6	1544.4	1419.2		
6	6	1498.3	1411.1	1546	1499.2	1425		
7	7	1485.3	1405.6	1551.4	1531.5	1413		
8	8	1466.3	1487	1545.6	1523.2	1407		
9	9	1523.4	1476.9	1540.2	1525	1404.5		
10	10	1520.8	1480.9	1618.9	1503.4	1466.4		
11	11	1511.5	1472.4	1614.1	1523.6	1524.6		
12	12	1437.4	1480.2	1549.9	1481.4	1530.7		
13	13	1376.4	1486.6	1545.5	1497.2	1531.6		
14	14	1439.2	1401.4	1539.6	1503.9	1523.8		
15	15	1429.2	1406.8	1535.7	1490.7	1520.1		
16	16	1425	1413.1	1529.9	1499.4	1511.8		
17	17	1551.8	1483.7	1535.2	1496.4	1488.6		
18	18	1517.4	1400.2	1550.9	1489.8	1499.9		
19	19	1522	1398.9	1542.7	1484.6	1419.7		
20	20	1525.5	1483.2	1561.4	1497.4	1387.3		
21	21	1492.9	1396.8	1612.1	1491.7	1377.5		
22	22	1494.4	1495.4	1610.8	1505.2	1370.9		
23	23	1514.4	1401.6	1628.9	1512.1	1409.3		
24	24	1414.9	1404.4	1568	1514	1422		
25	25	1412.9	1484.1	1639.8	1512.8	1420.7		
26	26					1378.6		
Total (kWh)		37077.8	36350.4	39121.5	37771.6	37539.4	187860.7	187.86
Average PV Module Cleaning Finished Each Inverter		1,507.93	1,454.02	1,564.86	1,510.86	1,464.08		
Average PV Module Cleaning Not Finished Each Inverter		1,419.29	-	-	-	1,398.25		

Total Average Cleaning Finished Inverter 1,500.35 kWh

Total Average Cleaning Not Finished Inverter 1,408.77 kWh

91.58 kWh

Remark : After Solar Cleaning

Sr No	Inverter No	Box X'mer-1	Box X'mer-2	Box X'mer-3	Box X'mer-4	Box X'mer-5	Inv: 126 nos (kWh)	Remark
		kWh	kWh	kWh	kWh	kWh		
1	1	1714.7	1655.6	1710.9	1721.4	1604.5		
2	2	1676.6	1645.7	1710.1	1702.3	1593.2		
3	3	1700.8	1648	1725.5	1703.3	1588.7		
4	4	1701.1	1649.6	1715.9	1718.4	1594.1		
5	5	1692.2	1649.1	1728.9	1717	1580.3		
6	6	1691.4	1651.9	1716.4	1688.9	1597.6		
7	7	1684.6	1644	1721.4	1703.6	1583.9		
8	8	1684.3	1646.2	1715	1702.3	1577		
9	9	1685.4	1639.9	1713.6	1706.3	1574.1		
10	10	1681.8	1650.5	1795	1674.7	1643.9		
11	11	1682.2	1639.6	1790	1704.4	1707.9		
12	12	1686.3	1647.5	1725.2	1654.4	1714.4		
13	13	1620.7	1652.4	1727	1665.9	1715.5		
14	14	1694.2	1655.9	1722.4	1674.4	1696.4		
15	15	1678.6	1660.3	1715.5	1662.9	1702.1		
16	16	1675.3	1670	1710.7	1673.7	1690.6		
17	17	1716.7	1638	1718.9	1672.7	1661.8		
18	18	1682.8	1638.2	1717.4	1657.9	1677.2		
19	19	1682.7	1638.9	1706.1	1653.6	1594.4		
20	20	1689.6	1636.8	1734.6	1669.8	1558.5		
21	21	1654.1	1641.1	1780.9	1664.8	1548.4		
22	22	1656.8	1662.4	1788.5	1682.6	1540.8		
23	23	1679.9	1657.2	1802.6	1691.1	1588.3		
24	24	1636.2	1659.3	1744.3	1694.2	1602.9		
25	25	1676.9	1654	1818.8	1693.6	1598.2		
26	26					1553.9		
Total (kWh)		42025.9	41231.3	43455.6	42154.2	42088.6	210955.6	210.96
Average PV Module Cleaning Finished Each Inverter		1,681.04	1,649.25	1,738.22	1,686.17	1,639.07		
Average PV Module Cleaning Not Finished Each Inverter		-	-	-	-	1,573.18		

Total Average Cleaning Finished Inverter 1,678.75 kWh

Total Average Cleaning Not Finished Inverter 1,573.18 kWh

105.57 kWh

Total Average Cleaning Finished Inverter 1,514.19 kWh

Total Average Cleaning Not Finished Inverter 1,440.66 kWh

73.54 kWh

Total Average Cleaning Finished Inverter 1,500.35 kWh

Total Average Cleaning Not Finished Inverter 1,408.77 kWh

91.58 kWh

Total Average Cleaning Finished Inverter 1,678.75 kWh

Total Average Cleaning Not Finished Inverter 1,573.18 kWh

105.57 kWh

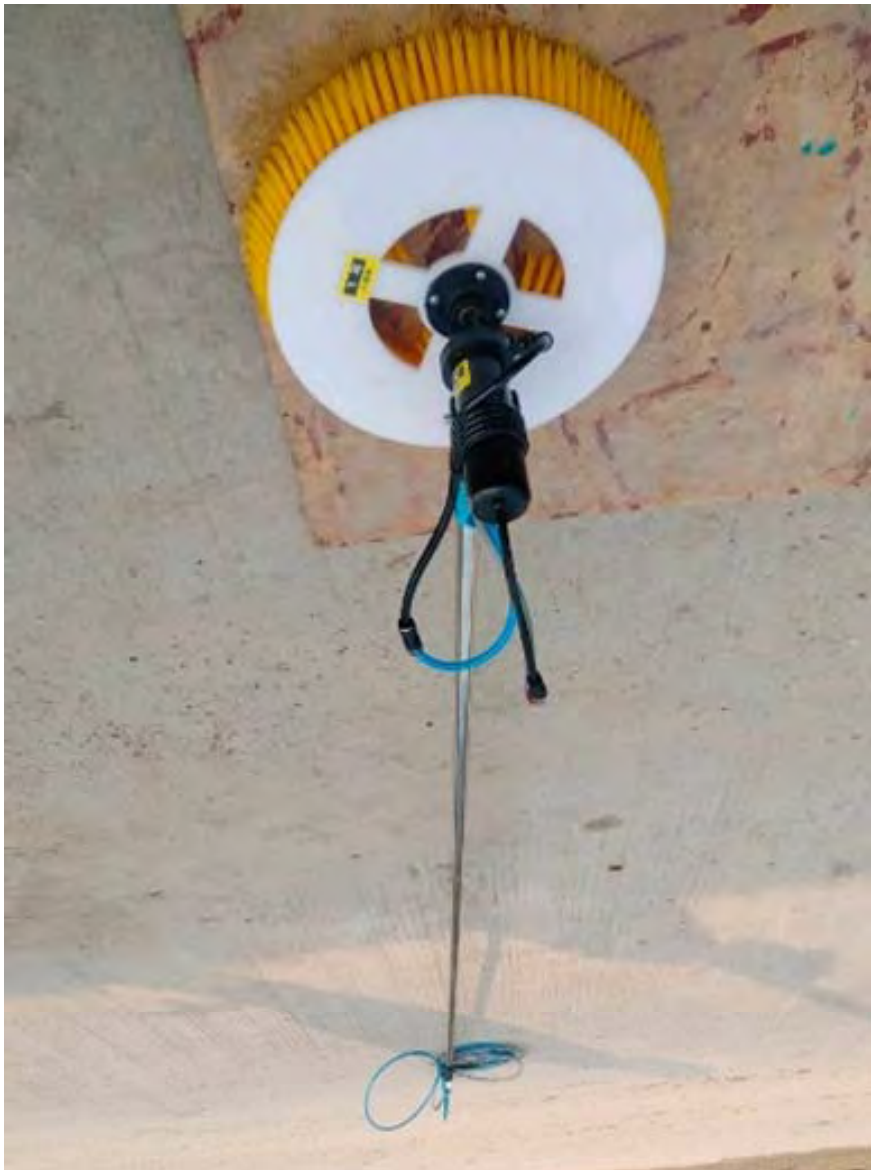
Heavy

Can not cleaning Long Time

Motor is 24V DC , Supply is 230V AC

By using AC to DC adaptor

Water Bowser are followed behind



Modify to Single Brush

Provided DC power from Batteries.

Created Water bucket and water spray pump instead of water bowser.

Creating of Thread brush with compressed air for day time cleaning

Creating of Thread brush with blower air for day time cleaning

Other Roof top Solar Installation

ROOF TOP SOLAR SYSTEM

Electrical Plant & Pump House 400 kW Roof-Top Solar System

ROOF TOP SOLAR SYSTEM

Office building 200 kW Roof-Top Solar System

ROOF TOP SOLAR SYSTEM

Car Parking 250 kW Roof-Top Solar System

Effective Hour of Rooftop solar production in Yangon area

	Project 1	Project 2	Project 3	Project 4	Total
Date	400 KW	200 KW	250 KW	800 KW	1600 KW
11/1/2023	2030	936	1200	4480	8646
11/2/2023	1870	838	1090	3450	7248
11/3/2023	2050	959	1240	4320	8579
11/4/2023	1710	773	1040	3710	7233
11/5/2023	1620	756	976	3500	6852
11/6/2023					8450
11/7/2023					8404
11/8/2023					7495
11/9/2023	1230	585	763	2650	5228
11/10/2023	1330	591	795	2800	5516
11/11/2023	1350	653	829	3250	6082
11/12/2023	1940	912	1150	4240	8242
11/13/2023	1860	851	1110	3780	7611
11/14/2023	1700	804	1010	3630	7144
11/15/2023	1600	770	967	3620	6957
11/16/2023	1840	852	1100	3870	7662
11/17/2023	1830	848	1090	3940	7708
11/18/2023	2040	925	1150	4280	8435
11/19/2023	1700	732	1010	3630	7132
11/20/2023	1650	775	965	3870	7210
11/21/2023	1510	705	921	3160	6296
11/22/2023	1650	757	1000	3600	7017
11/23/2023	1640	740	982	3320	6682
11/24/2023	1810	821	1060	3700	7391
11/25/2023	1830	832	1080	3980	7722
11/26/2023	1780	805	1,050	3,710	7345
11/27/2023	1890	850	1,090	3,740	7570
11/28/2023	1770	806	1,050	3,800	7426
11/29/2023	1760	815	1,050	3,730	7355
11/30/2023	1230	595	760	2,680	5265
Total	*52,090*	*24,085*	*31,048*	*110,680*	*217,903*
Average	*1736.33*	*802.83*	*1034.93*	*3689.33*	*7263.43*
Divided by installed Capacity	**4.34**	**4.01**	**5.17**	**4.61**	**4.40**

ROOF TOP SOLAR SYSTEM

Donation of 110 kW RoofTop Solar system to Waibargi Infectious Hospital

Study of ON Grid solar System
(Comsume / Solar Production/ Flow into Grid)

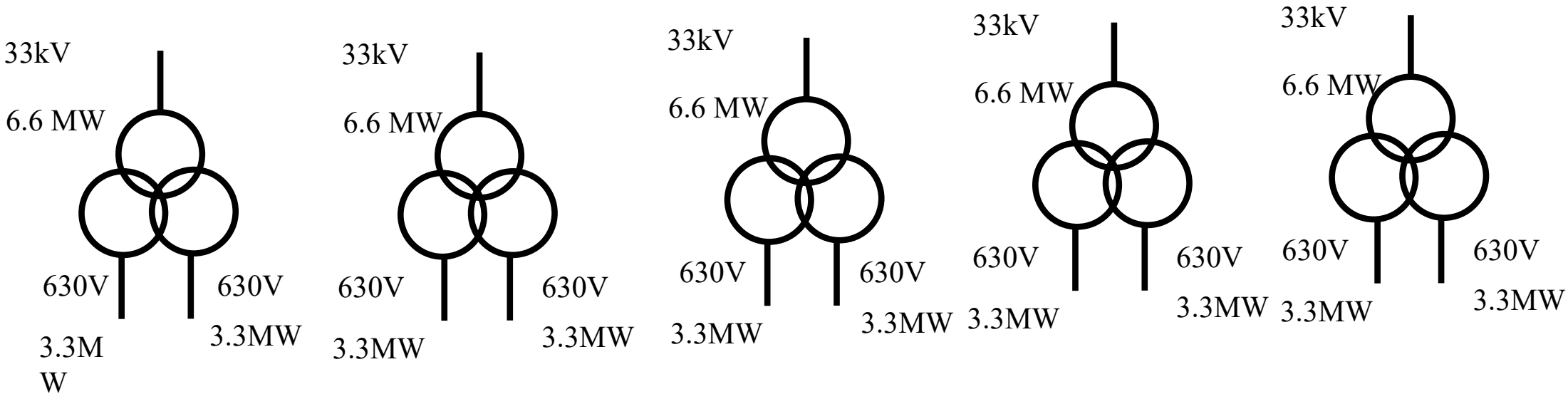
Column (A)	Column (B)	Column (C)	Column (D) (D=B+C)	Column (E)	Column (F)	Column (G) (G=E-F)	Column (H) (H=D+G)	
Date	YESC HT Unit (kWhr)			Software Solar Meter (kWhr)			Total Use	Remark
	Day	Night	Total	Product	Export	Solar Use		
26.8.2022	650	180	830	291.00	40	251.00	1,081.00	
27.8.2022	340	210	550	340.80	-	340.80	890.80	
28.8.2022	110	170	280	376.40	150	226.40	506.40	Sunday
29.8.2022	450	270	720	471.30	90	381.30	1,101.30	
30.8.2022	170	120	290	415.20	210	205.20	495.20	
31.8.2022	-	240	240	256.90	200	56.90	296.90	
1.9.2022	60	230	290	464.10	70	394.10	684.10	
2.9.2022	60	210	270	592.30	220	372.30	642.30	
3.9.2022	1,360	380	1,740	264.20	-	264.20	2,004.20	
4.9.2022	940	530	1,470	344.70	10	334.70	1,804.70	Sunday

30MW Solar Power Generation Plant

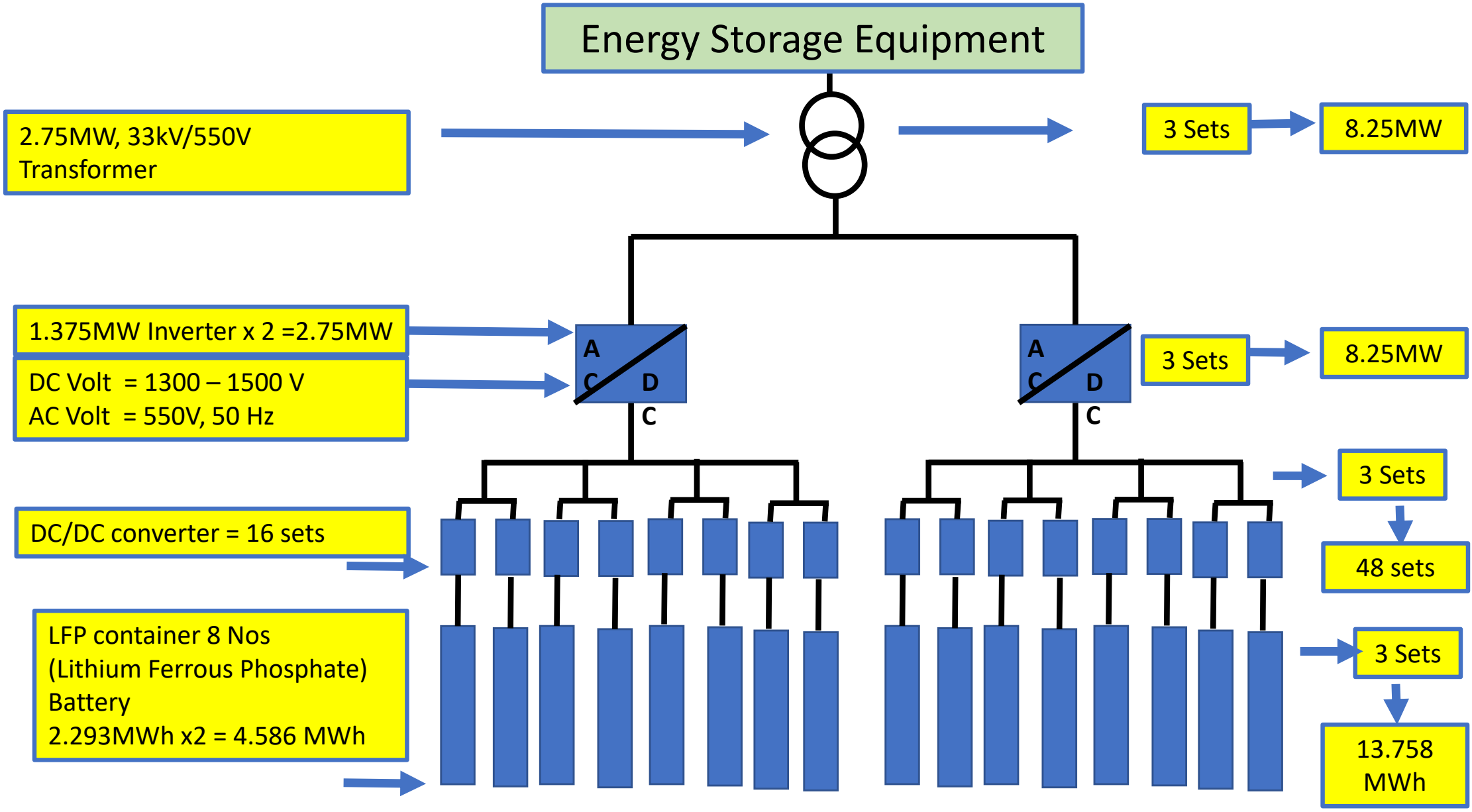
With B.E.S.S

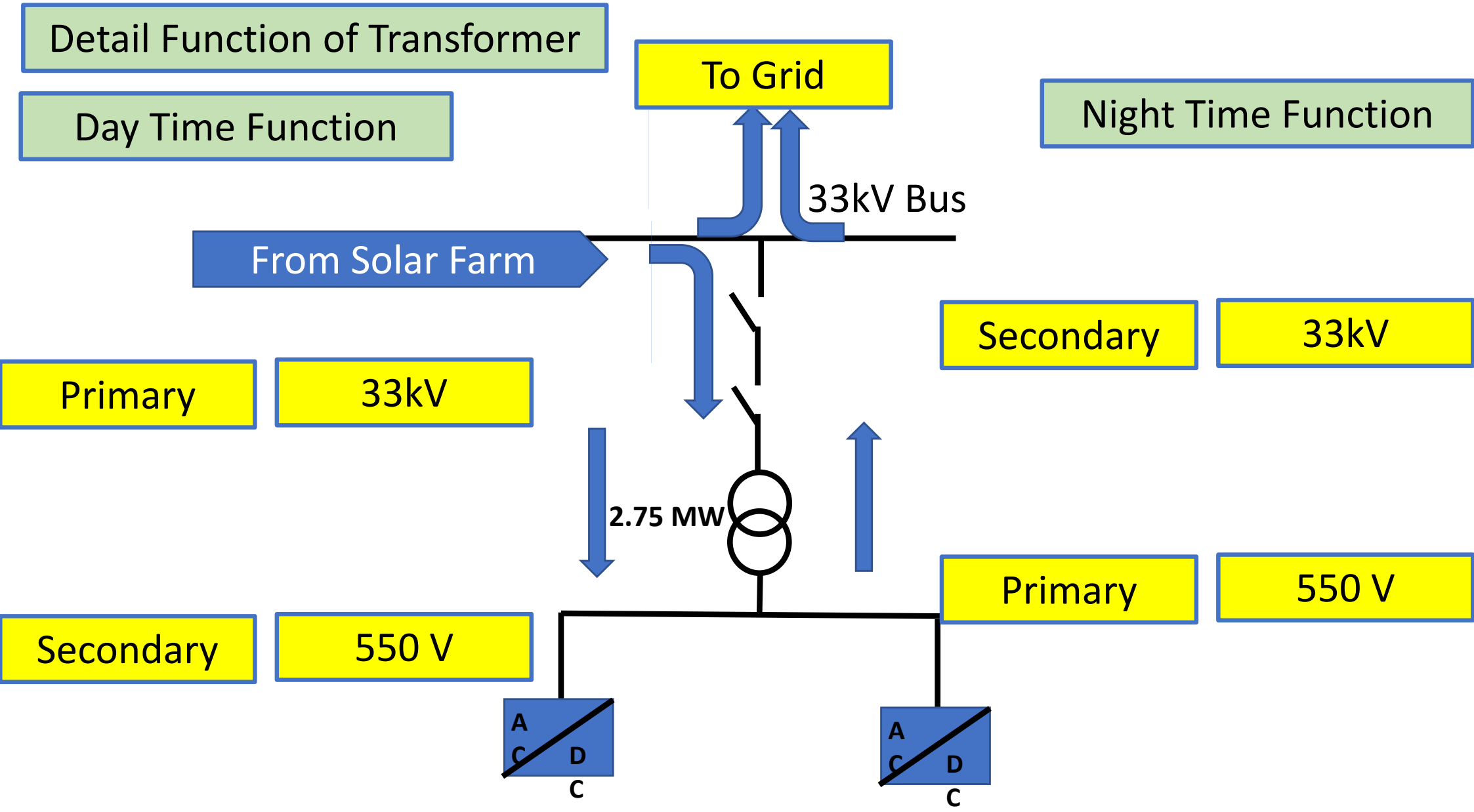
Battery Energy Storage System

Total Install Capacity of Transformers

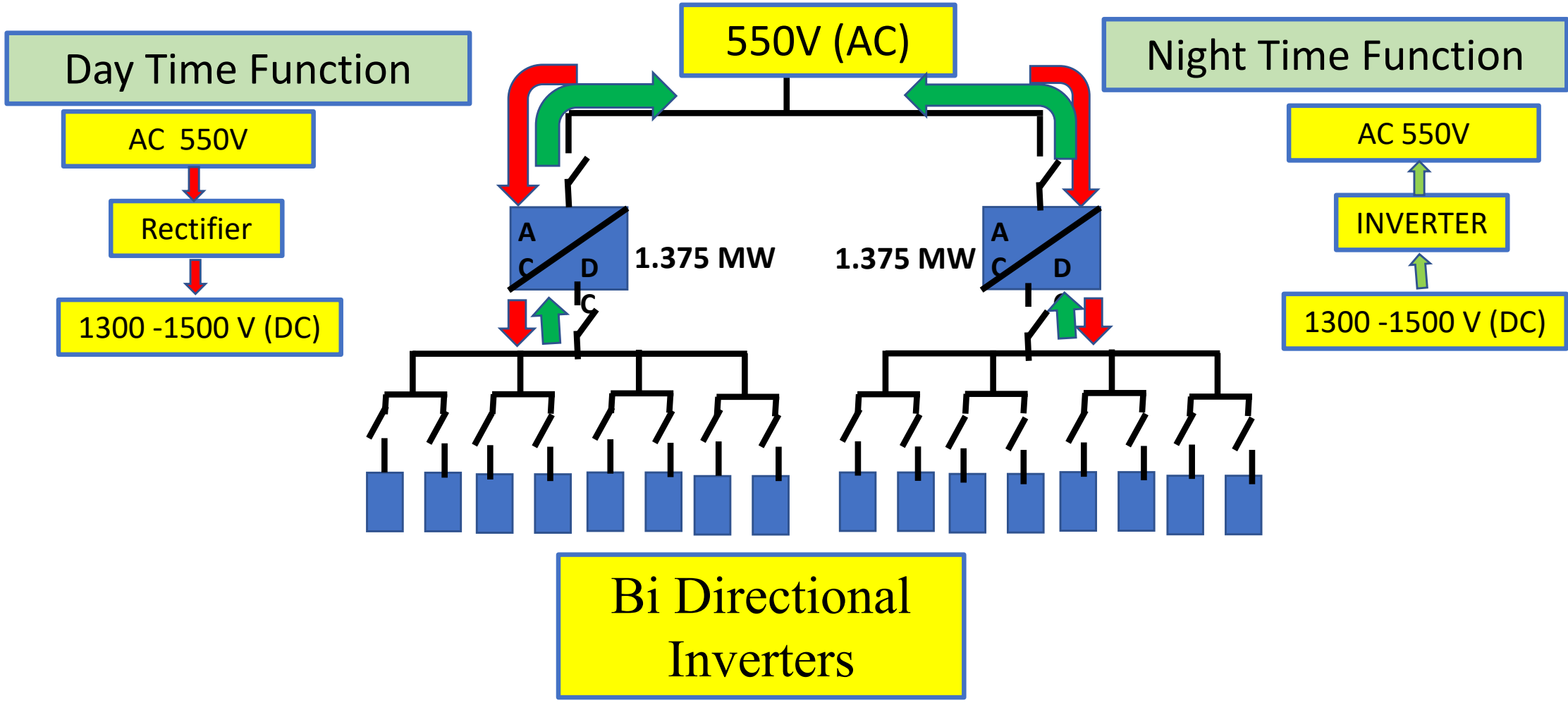


6600KW , 33/630 -630V Transformer x 5 Sets = 33,000kW= **33 MW**


Energy Storage Equipment
2.75MW, 33kV/550V
Transformer
3 Sets
8.25MW
1.375MW Inverter x 2 =2.75MW
DC Volt = 1300 – 1500 V
AC Volt = 550V, 50 Hz
A
C
D
C
A
C
D
C
3 Sets
8.25MW
DC/DC converter = 16 sets
3 Sets
48 sets
LFP container 8 Nos
(Lithium Ferrous Phosphate)
Battery
2.293MWh x2 = 4.586 MWh
3 Sets
13.758
MWh


Detail Function of Transformer
Day Time Function
To Grid
Night Time Function
33kV Bus
From Solar Farm
Secondary
33kV
Primary
33kV
2.75 MW
Primary
550 V
Secondary
550 V
A
C
D
C
A
C
D
C

Function of AC/DC Equipment



Function of DC/DC Converter and LFP Batteries Container

LBS (Load Break Switch)

DC-DC converter

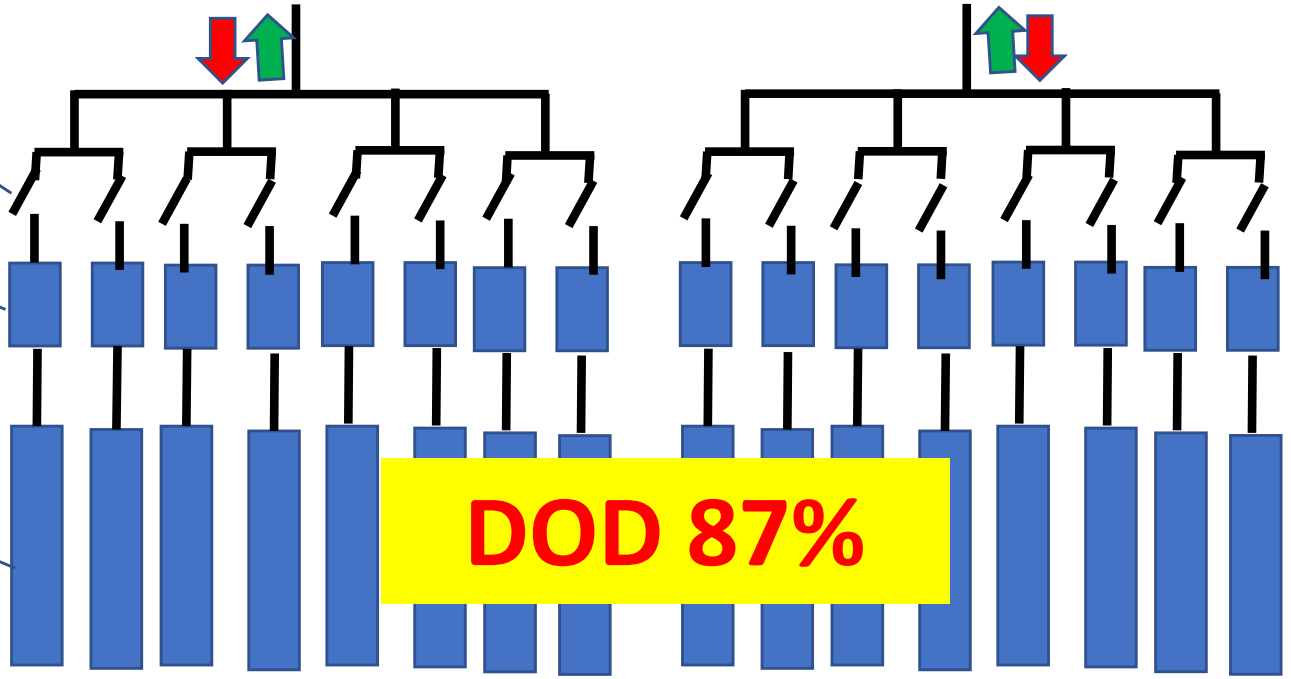
DC Voltage Range = 500 ~ 1500 V

Step Up

Batteries Containers

Battery Cell = 280Ah, 3.2V

Battery **1 Cell** Power = 280 x 3.2 = 896 Wh= **0.896 kWh**



Series of Batteries for **1 Pack**=0. 896kWh x 64 = **57.344 kWh** (3.2 V x 64 = 204.8 V)

Energy Storage for **1 Rack** =(57.344 kWh x 5 = **286.72 kWh** (204.8 x 5 = 1024 V) **(One Container)**

Single container **8 rack** Energy storage = 286.72 x 8 =2293.76 kWh = **2.293 MWh**

Energy Storage System of 1 Transformer = 2293.76 x 2= 4587.53 kWh = **4.587 MWh** → 3 transformer System → **13.761MWh**

BOX TYPE Transformer Single line diagram

33kV Switchgear

Transformer

AC SPD

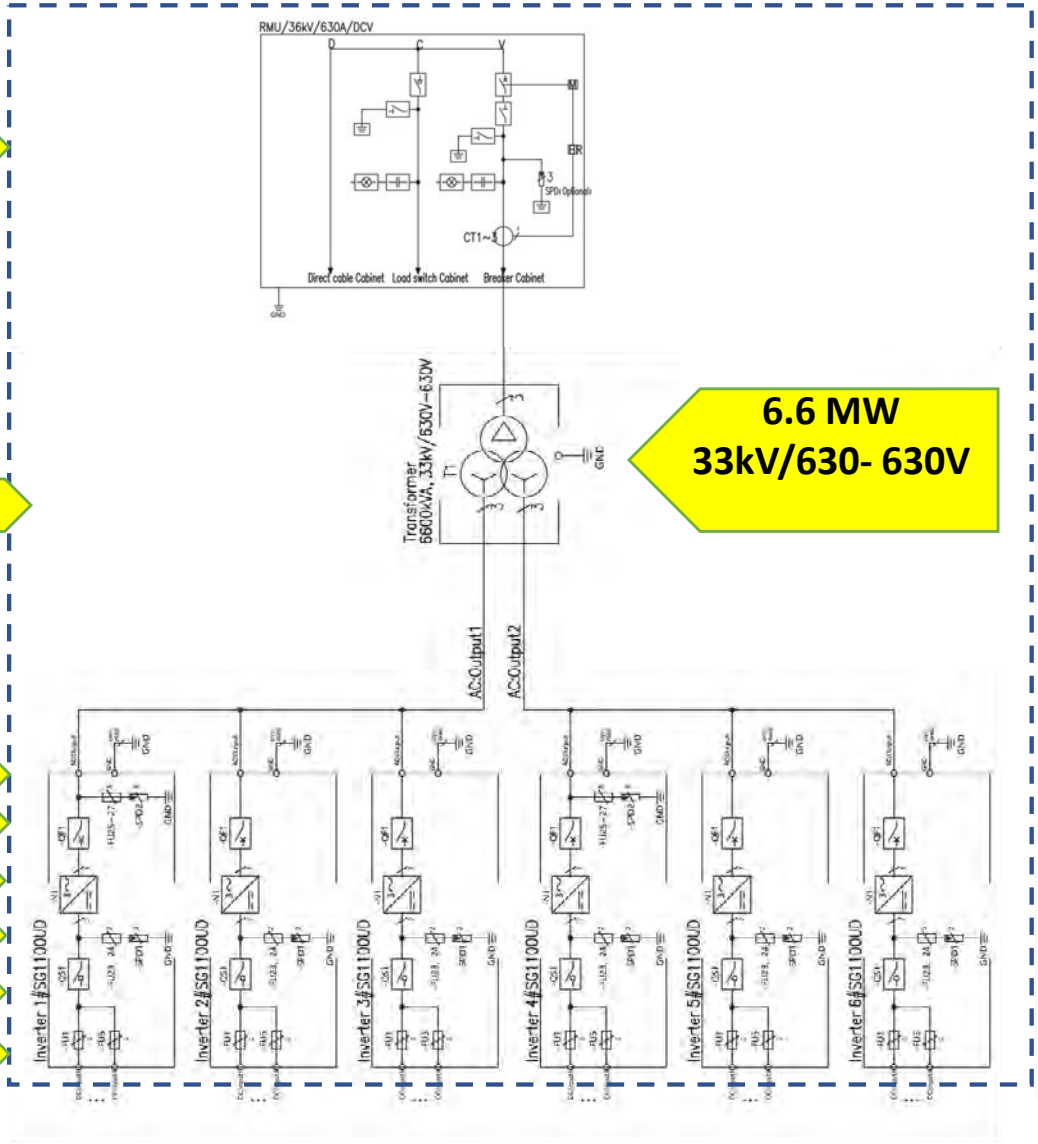
AC Breakers

Inverters(1.1MW)

DC Surge Protect Device

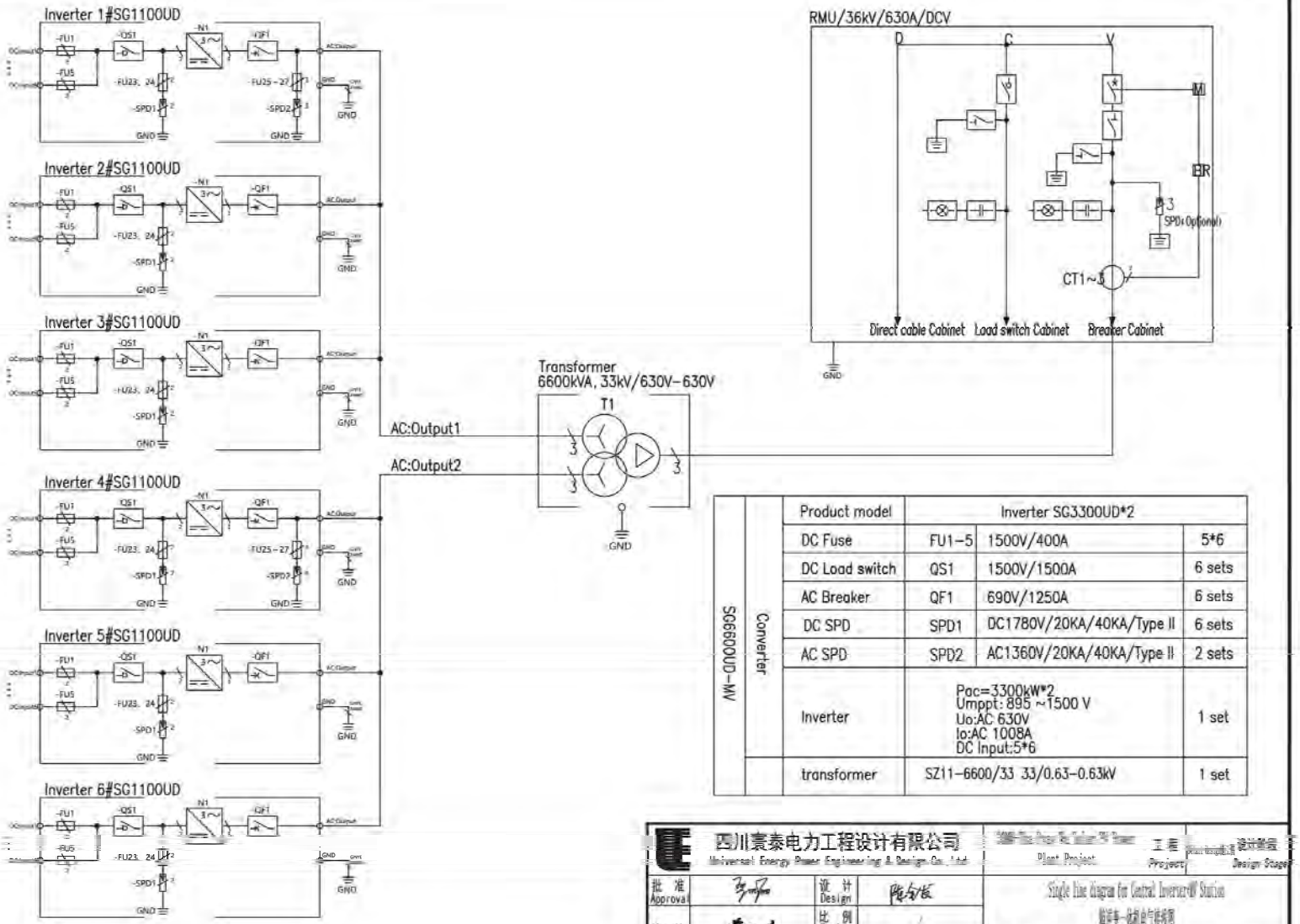
DC Load Switchs(6)

DC Fuses(30 Nos)



6.6 MW
33kV/630- 630V

SG6600UD-MV	Converter	Product model	Inverter SG3300UD*2	
		DC Fuse	FU1-5	1500V/400A	5*6
		DC Load switch	QS1	1500V/1500A	6 sets
		AC Breaker	QF1	690V/1250A	6 sets
		DC SPD	SPD1	DC1780V/20KA/40KA/Type II	6 sets
		AC SPD	SPD2	AC1360V/20KA/40KA/Type II	2 sets
		Inverter	Pac=3300kW*2 Umppt: 895 ~1500 V Uo:AC 630V Io:AC 1008A DC Input:5*6		1 set
		transformer	SZ11-6600/33 33/0.63-0.63kV		1 set



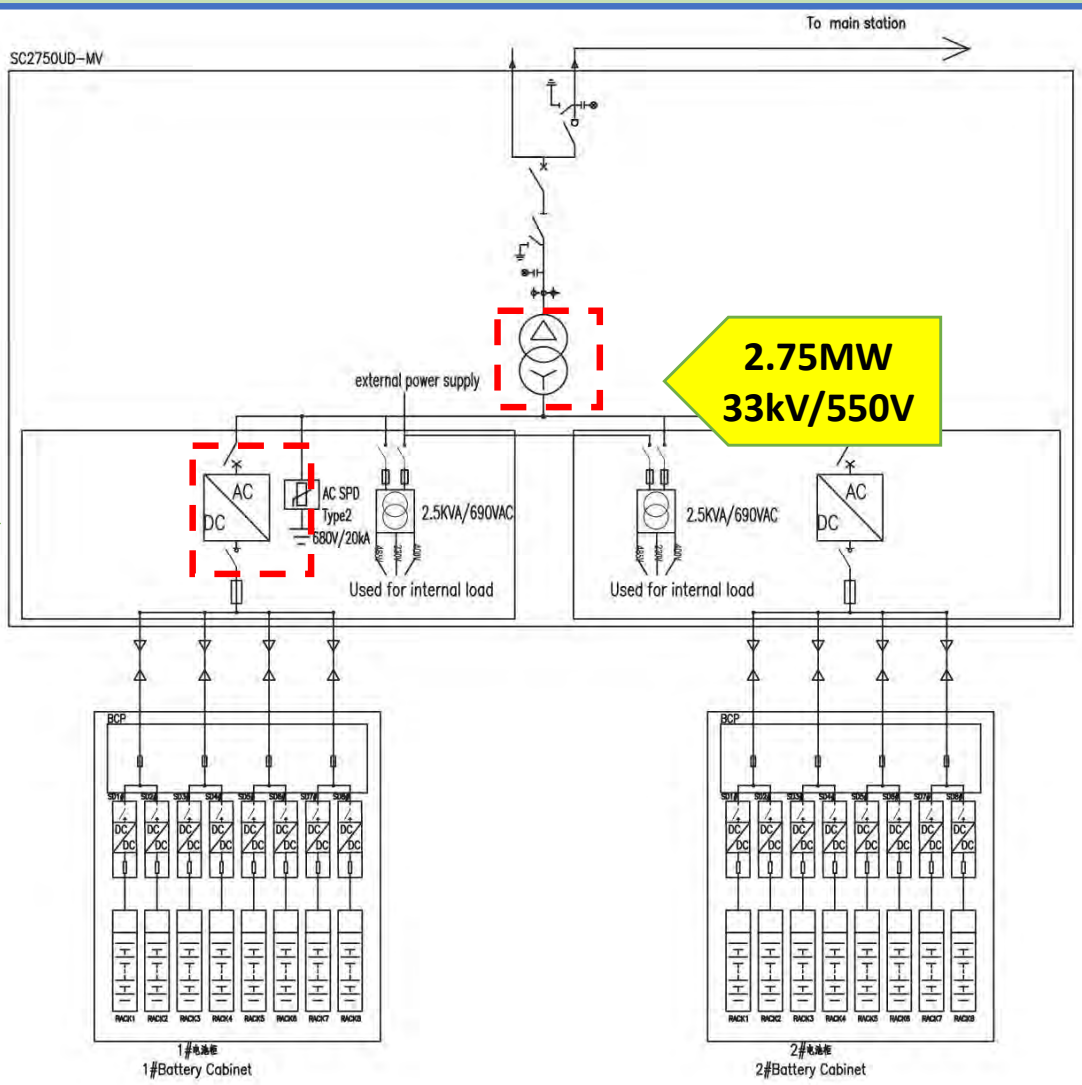
SG6600UD-MV	Converter	Product model	Inverter SG3300UD*2	
		DC Fuse	FU1-5	1500V/400A	5*6
		DC Load switch	QS1	1500V/1500A	6 sets
		AC Breaker	QF1	690V/1250A	6 sets
		DC SPD	SPD1	DC1780V/20KA/40KA/Type II	6 sets
		AC SPD	SPD2	AC1360V/20KA/40KA/Type II	2 sets
		Inverter	Pac=3300kW*2 Umppt: 895 ~1500 V Uo:AC 630V Io:AC 1008A DC Input:5*6		1 set
		transformer	SZ11-6600/33 33/0.63-0.63kV		1 set

西川蜀泰电力工程设计有限公司 Universal Energy Power Engineering & Design Co., Ltd			Plant Project	工程 Project	设计阶段 Design Stage
批准 Approval		设计 Design		Single line diagram for Central Inverter+MV Station	
校核 Check		比例 Scale	/	集中式+一体机电气接线图	
		日期 Date	2023.05	图号 Dwg. No	版本号 Rev. 01

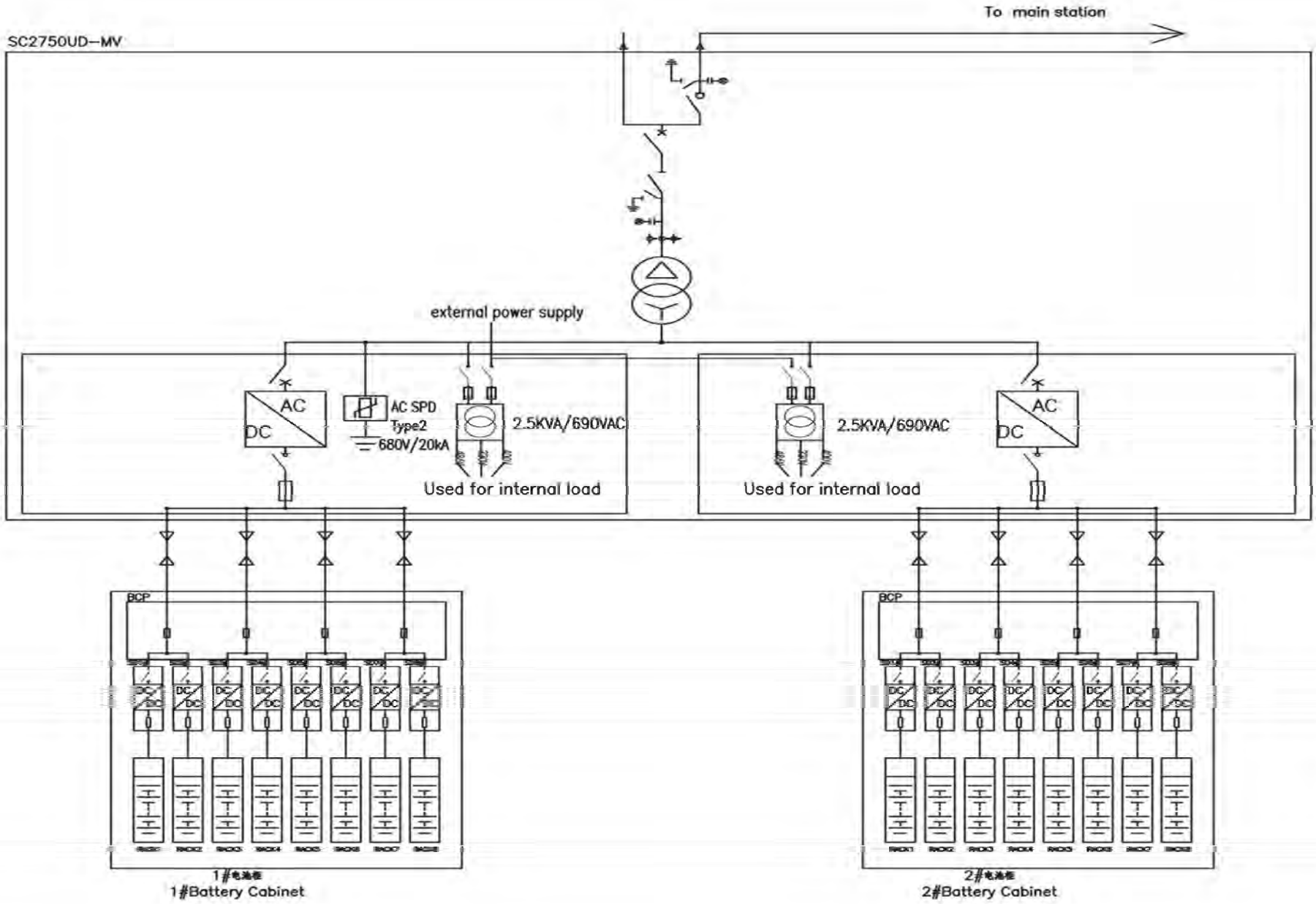
Energy Storage System Single Line diagram

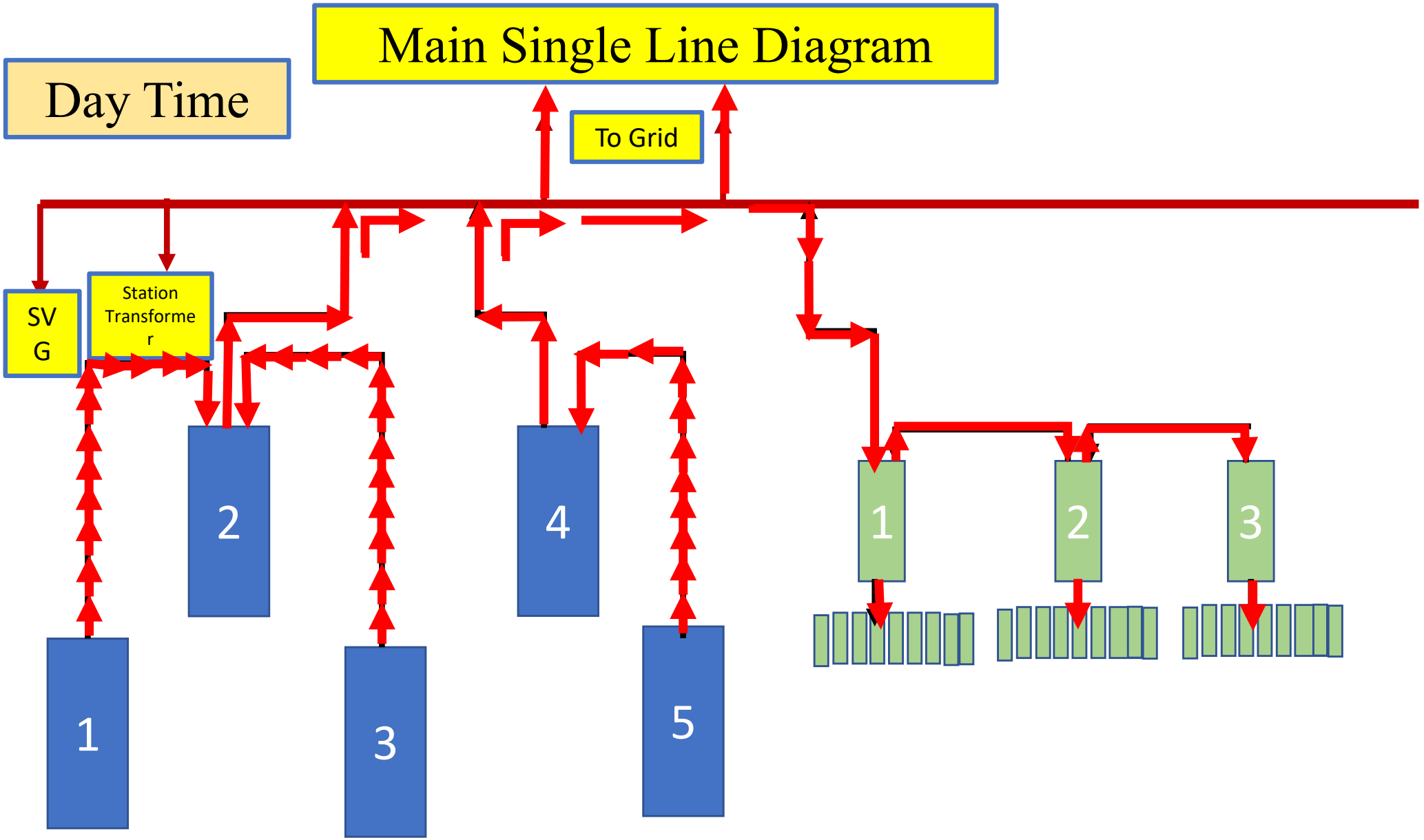
Transformer

Bi-Directional Inverters AC to DC & DC to AC



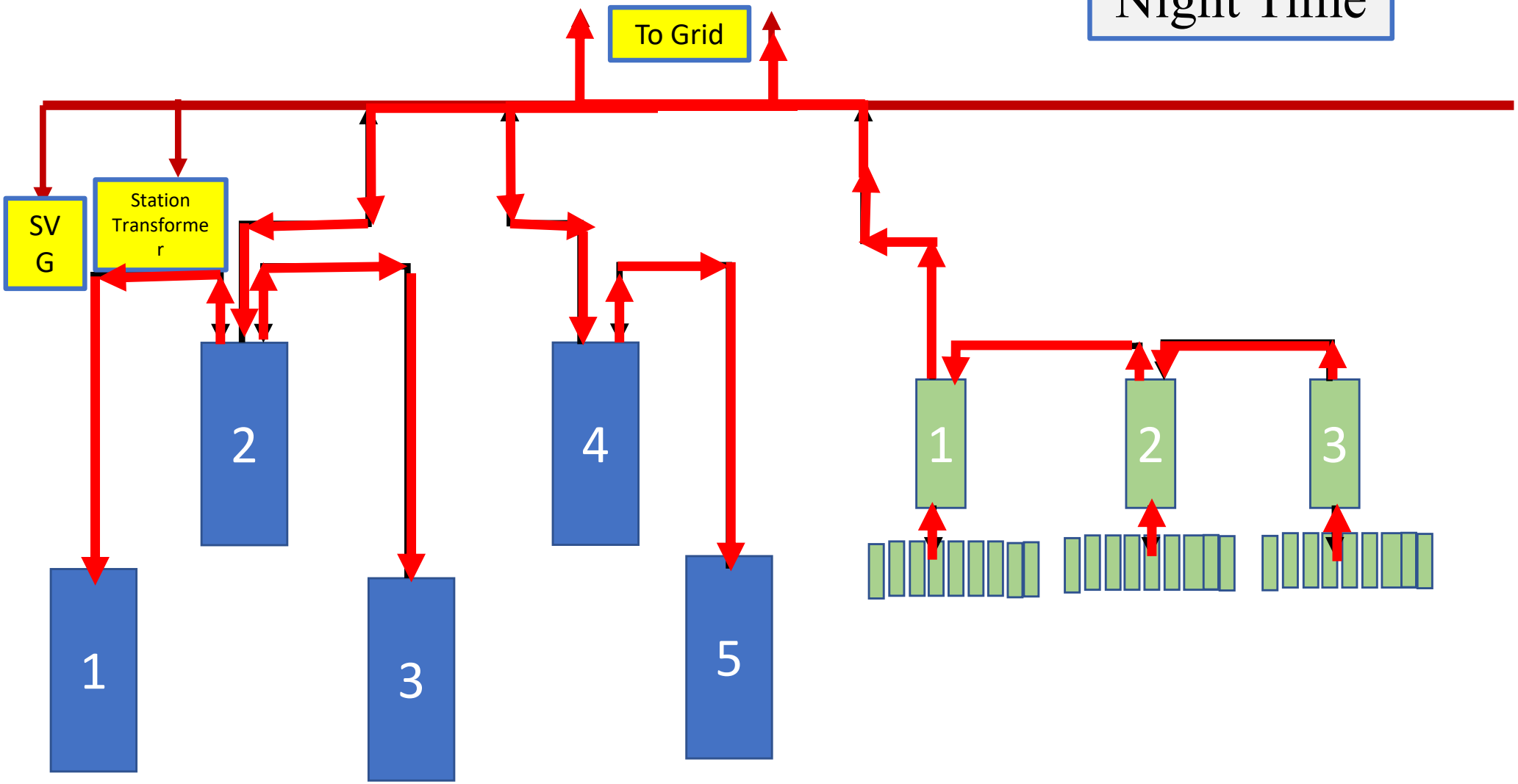
储能变流升压一体机(PCS-MV)	高压环网柜(WXDZ)	高压断路器(High voltage breaker): VG10/630A/20kA/20kA(3s) 高压负荷开关(High voltage load switch): SAFE-LBS/630A/20kA(3s) 高压隔离开关(High voltage Disconnector): SAFE-GL36/630A/20kA(3s) 高压接地开关(High voltage earthing switch): SAFE-E36/630A/20kA(3s) 带电显示(VPIS): DXN5-T
	变压器(Transformer)	SL-2750/33 33/0.55kV Dy11, Ud=6%
	储能变流器(PCS)	Pac=1375kW 直流电压(DC Voltage): 1300-1500V 交流电压(AC Voltage): 550V 频率(Frequency): 50Hz 功率因数调整范围(PF adjustment range): 1超前-1滞后 断路器(Breaker): 690V/2000A 负荷开关(Load Switch): 1500V/2500A 熔断器(Fuse): 1500V/3000A
电缆 Cable		2X(ZC-YJV63-1.5kV-1X185mm2)
电池舱(Battery Container)	DC/DC	磷酸铁锂电池舱(LFP Container): 2.293MWh*2 汇流柜(BCP): (1500V系统) 8进4出(8 in 4 out) 熔断器(Fuse): 1500V/420A DC/DC: 工作电压 500~1500V 负荷开关: INOSYS LBS 1500V/250A 熔断器: 2XLaR250U15C 1500V/250A
	储能电池(Battery)	单舱(Single Container): 8簇(8 Rack) 单簇(Single Rack): 286.72kWh, 320S1P 电池包数(PACK No.): 5 电池包(PACK): 57.344kWh, 64S1P 电芯(Cell): 280Ah, 3.2V


To main station
SC2750UD-MV
external power supply
AC
DC
AC SPD
Type2
680V/20kA
2.5KVA/690VAC
Used for internal load
2.5KVA/690VAC
AC
DC
Used for internal load
BCP
BCP
1#电池柜
1#Battery Cabinet
2#电池柜
2#Battery Cabinet


Main Single Line Diagram
Day Time
To Grid
SV G
Station Transforme r
1
2
3
4
5
1
2
3

Main Single Line Diagram

Night Time



Q&A

Thank You