

Opal Energy Solutions for residential and small commercial & Industrial

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About Opal Energy

- OPAL branding originated from OPAL Solar & OPAL Storage in Australia back in 2018 by our joint venture company Solar Juice Pty Ltd
- With the experiences gain over the years of selling energy storage system, we have put together a new OPAL Energy Storage Solution fit for all applications on-grid and off-grid
- We are committed to deliver the safest technology, competitive, reliable and effective solution to the market.
- Opal Energy offices available to support from Singapore, China, Australia and Germany

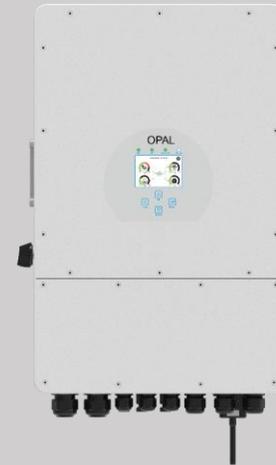
OPAL Energy Solution best suited for:

- Residential and small/mid size commercial/industrial applications
- Each system allows 9 number of 12kW inverter connected in parallel 108kW allowing accepting approximately 135kWp solar array, however we prefer the loads to be separated so that it serve a load of less than 36kW and battery capacity less than 144kWh
- If the requirement is larger, we can multiply similar configuration separating the load output.
- Its idea in places where electricity is not stable i.e. power cut or outages or in places where electricity prices are high or varies depending on supply and demand. It can also be used in off-grid places running on diesel generator.
- It can operate as DC coupling (new system) or AC coupling (retrofit i.e. added to existing grid connect system).

System Description

System comprises 3 key components

- Hybrid inverter
 - Single phase 3kW to 8kW
 - Three phase 5kW to 12kW)
 - For single phase, we are able to expand up to 16 units i.e. single phase up to 128kW (PV 160kWp)
 - For three phase, we are able to expand up to 9 units i.e. three phase up to 108kW (PV 140kWp)
- Energy storage
 - 100AH 48V or 4.8kWh
 - Able to expand up to 31 units i.e. 150kWh
- IP54 Outdoor enclosure
 - 3 sizes; for 1 block, for 2 blocks and for 3 or 4 blocks
 - Can be multiply according to requirement



OPAL Hybrid System features

Max. charging/discharging current/power
and able to take twice the power rating for 10 sec.

Emergency stop button

Colorful touch LCD

DC/AC ratio of 1: 1.3

Transfer switch

Advanced droop control

Remotely O&M

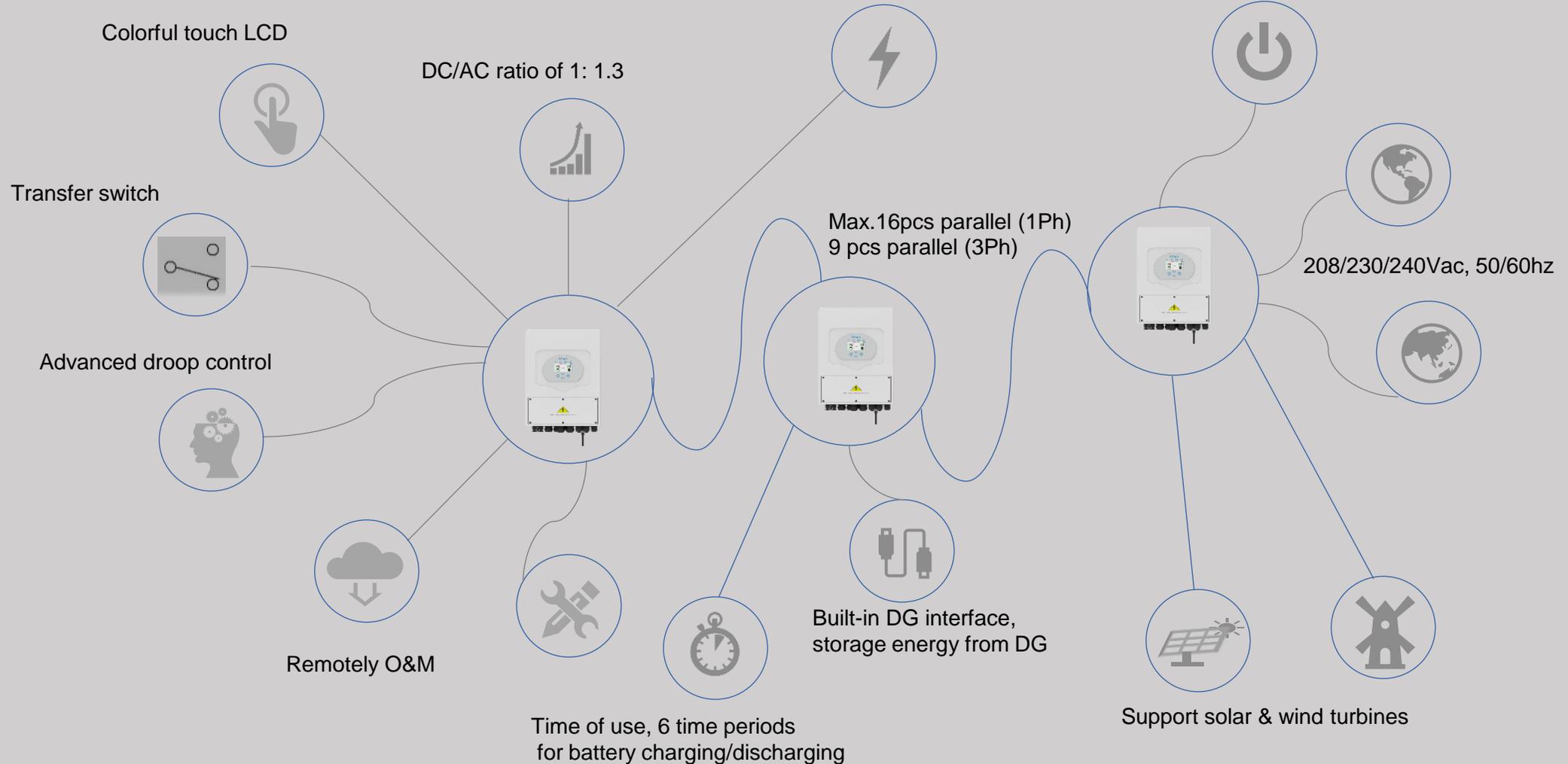
Time of use, 6 time periods
for battery charging/discharging

Max.16pcs parallel (1Ph)
9 pcs parallel (3Ph)

Built-in DG interface,
storage energy from DG

208/230/240Vac, 50/60hz

Support solar & wind turbines

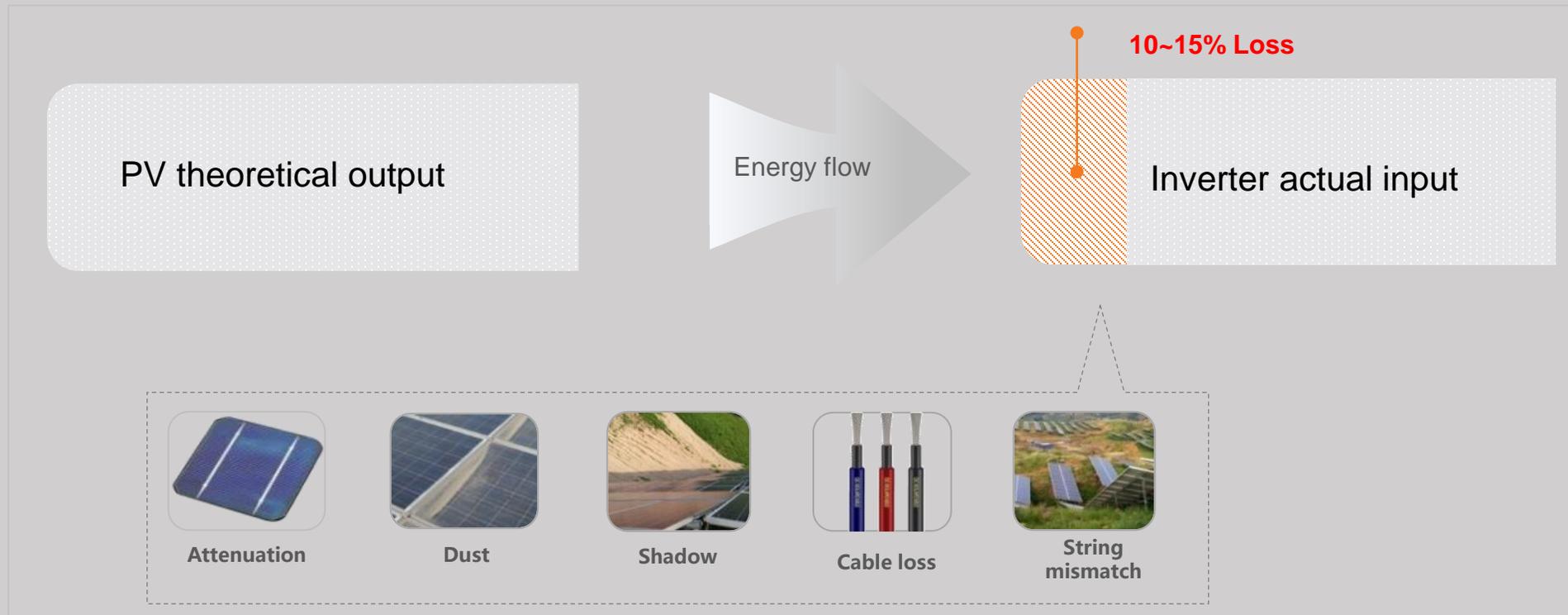


Product Certification

- Hybrid Inverter will have the following certifications
 - Grid Regulation (Australia)
 - AS/NZS 4777.2:2020
 - Grid Regulation (European)
 - IEC 61727, IEC 62116, VDE 4105, UNE217002, VDE 0126-1-1
 - EMC Safety Standard (European/ Australia)
 - IEC62109-1/2, IEC61000-6-1/2/3/4
- Energy Storage will have the following certifications
 - CE
 - IEC 62619
 - IEC 62040
 - UN38.3
- System solutions will have the following certifications
 - CEI 0-21

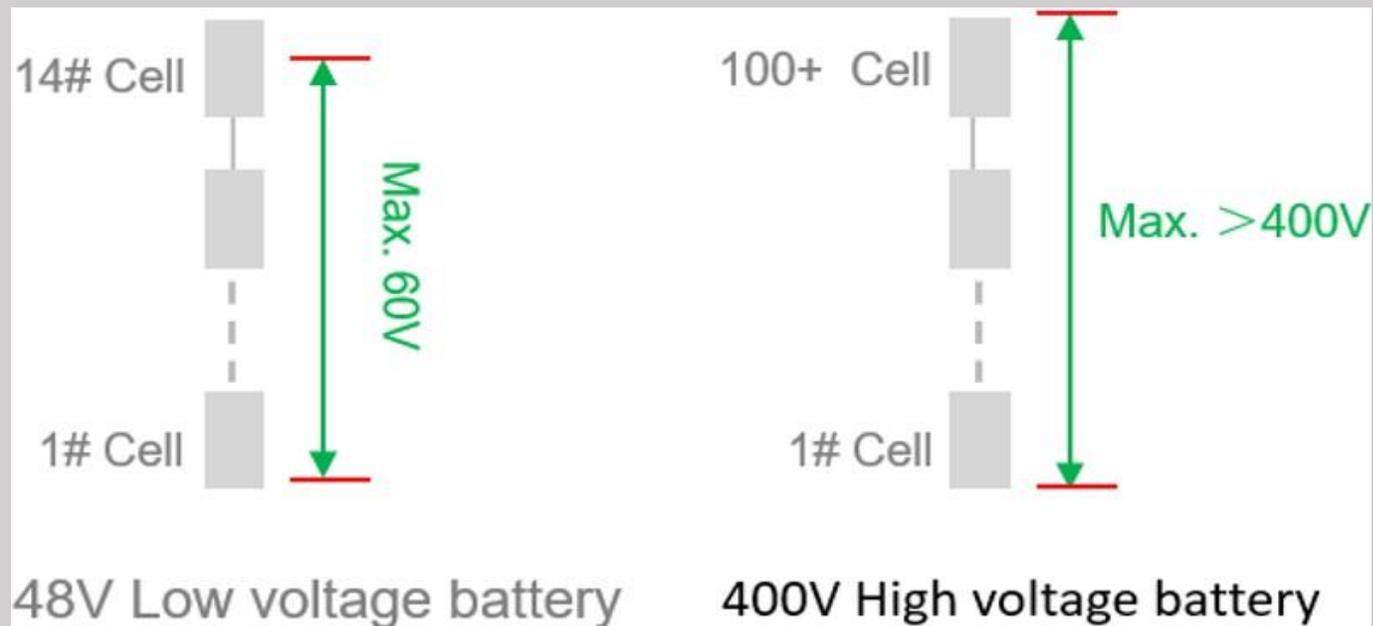
DC/AC ratio up to 1.3, saving equipment investment

- Completely compatible with different brand of solar module including bi-facial solar module
- Power losses due to solar cell inherent LID, dust, possible shading, string mismatch and cable are inevitable.
- With the higher DC/AC ratio, you can fit 30% more solar power lower your investment cost .



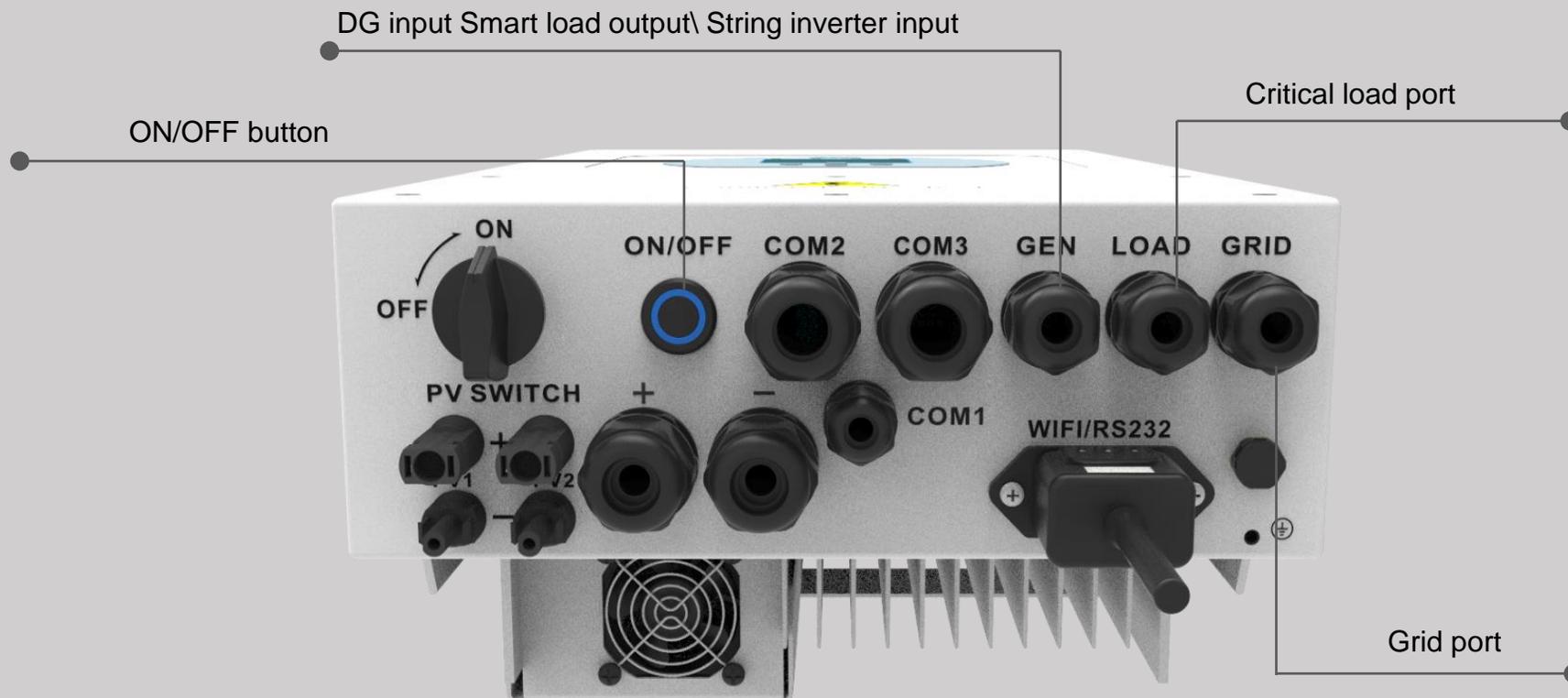
Safer low voltage 48V

- Compared with high voltage of 300V/400V battery system, 48V battery is safer and more reliable. E.g., for 48V battery, normally it adopts 15 or 16pcs cells in series (LFP) only. With the built-in transformer, OPAL hybrid inverter isolates the battery from the grid, which improve the battery safety.
- For rated voltage of 400V battery, it needs more than 100pcs cells in series. The cell voltage balance is huge challenge for the battery system. Also, the battery capacity can't be expanded easily since the cell balance issue.



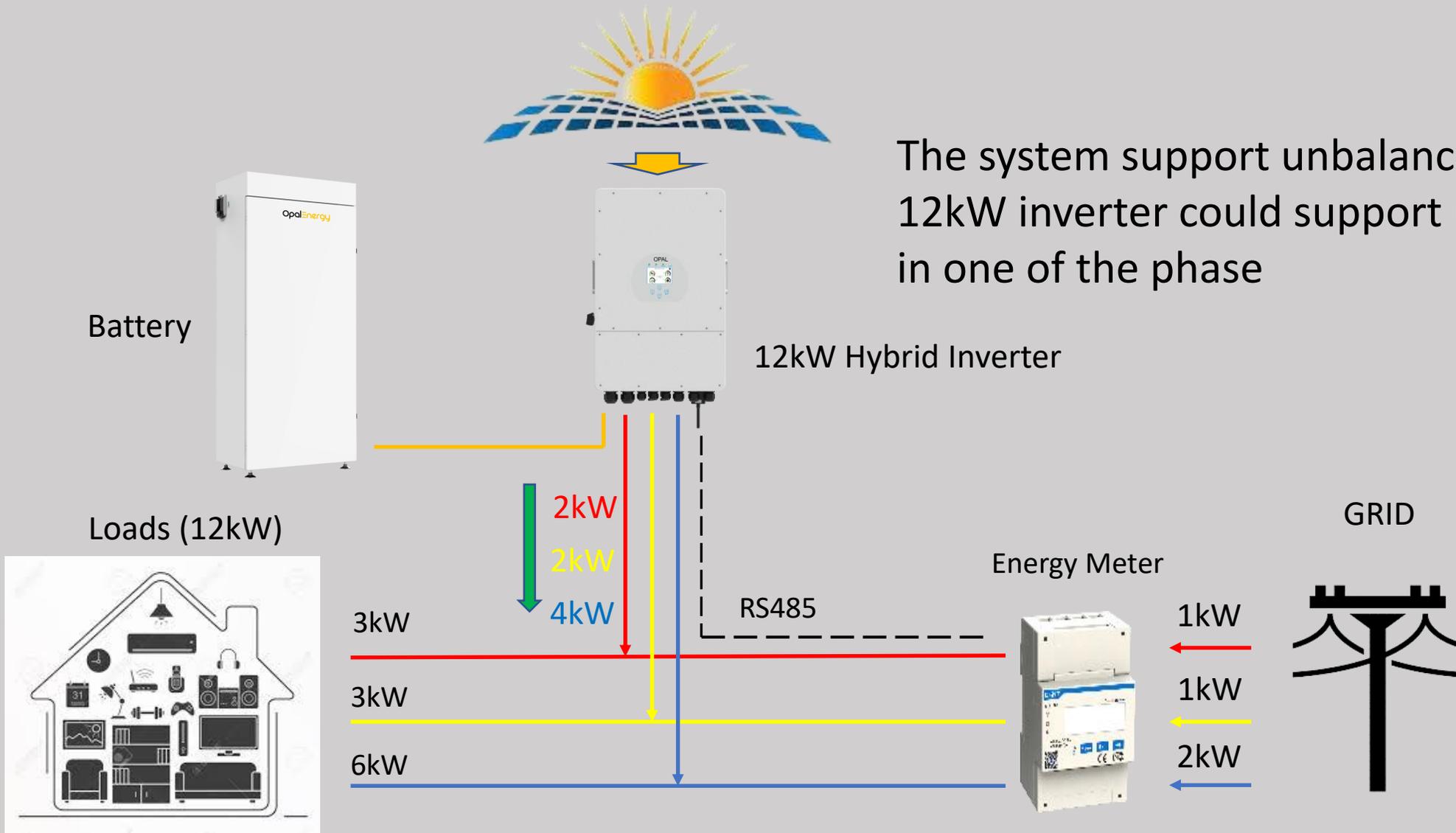
Independent backup Load Port

- Integrating independent backup load port i.e. you don't need a separate additional ATS device for users, increase reliability and lower cost.
- Built-in ON/OFF switch, allow rapid safe shut down in the case of an emergency situation.



Able to handle unbalance loads

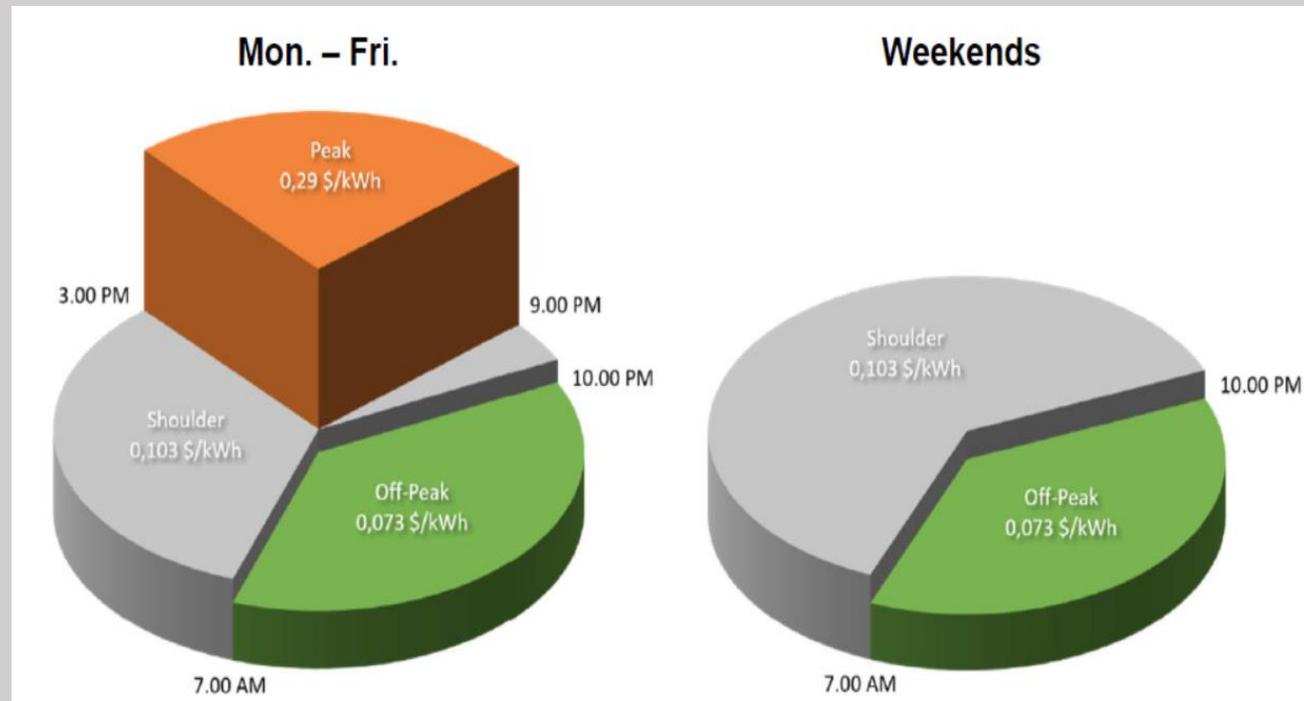
The system support unbalance loads i.e. a 12kW inverter could support up to 6kW load in one of the phase



Independent backup Load Port

- “Time of use”, time-dependent electricity tariffs, customers pay different prices for their energy consumption at different times of the day. Below figure shows typical time-of-use tariffs applied in Australia.
- For this situation, OPAL hybrid inverter allows users to set time windows for charging and discharging the energy storage system. In this way, the behavior of the hybrid inverter can be adjusted in line with the time-dependent electricity tariffs, reducing electricity bills.

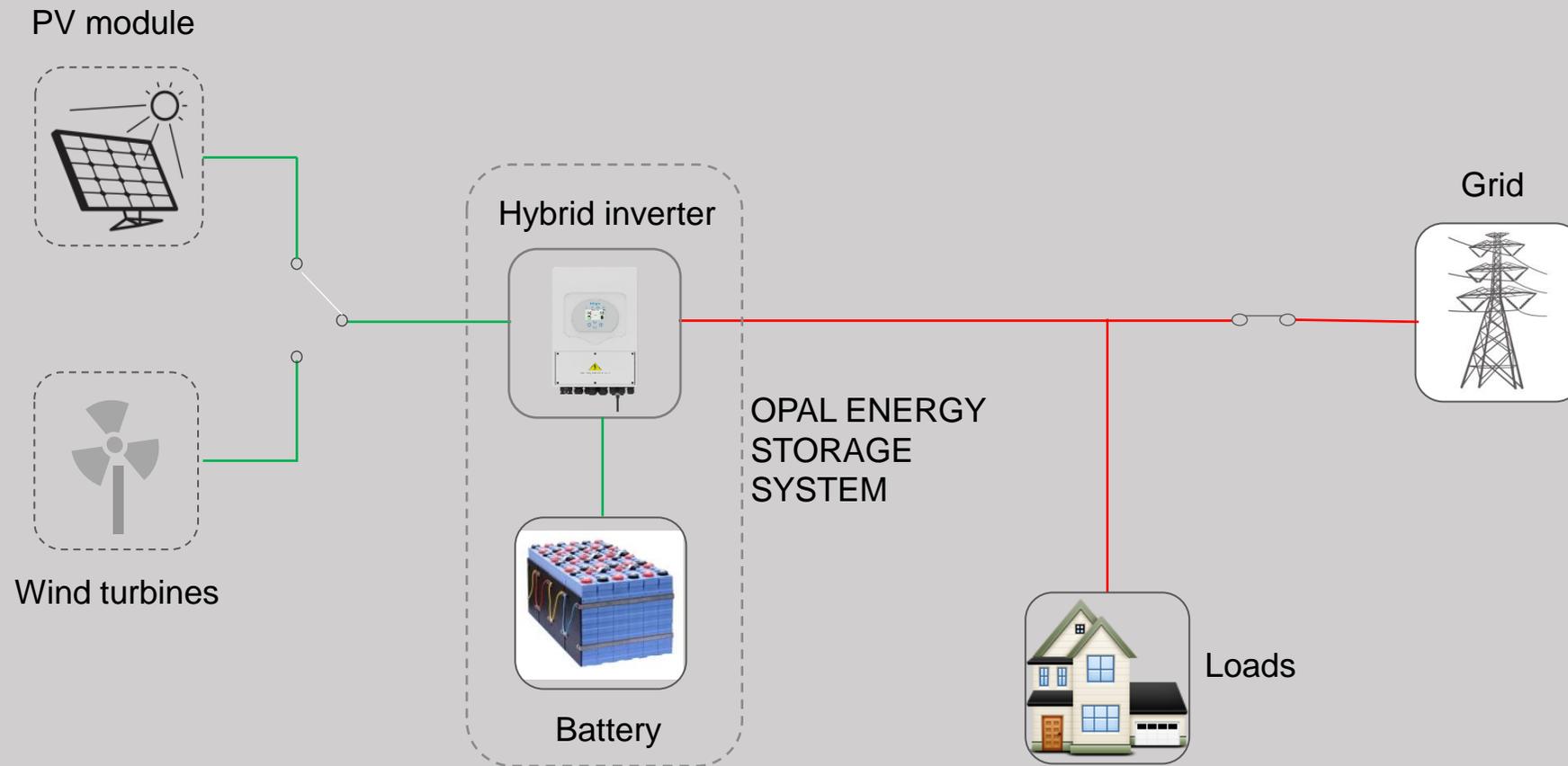
Time of use interface



System Work Mode					
Grid Charge	Gen	Time		Batt	
<input type="checkbox"/>	<input type="checkbox"/>	01:00	~ 5:00	80%	<input type="button" value="↑"/> Work Mode2 <input type="button" value="↓"/> <input type="button" value="✕"/> <input type="button" value="✓"/>
<input type="checkbox"/>	<input type="checkbox"/>	05:00	~ 9:00	80%	
<input type="checkbox"/>	<input type="checkbox"/>	09:00	~ 13:00	80%	
<input type="checkbox"/>	<input type="checkbox"/>	13:00	~ 17:00	80%	
<input type="checkbox"/>	<input type="checkbox"/>	17:00	~ 21:00	80%	
<input type="checkbox"/>	<input type="checkbox"/>	21:00	~ 01:00	80%	

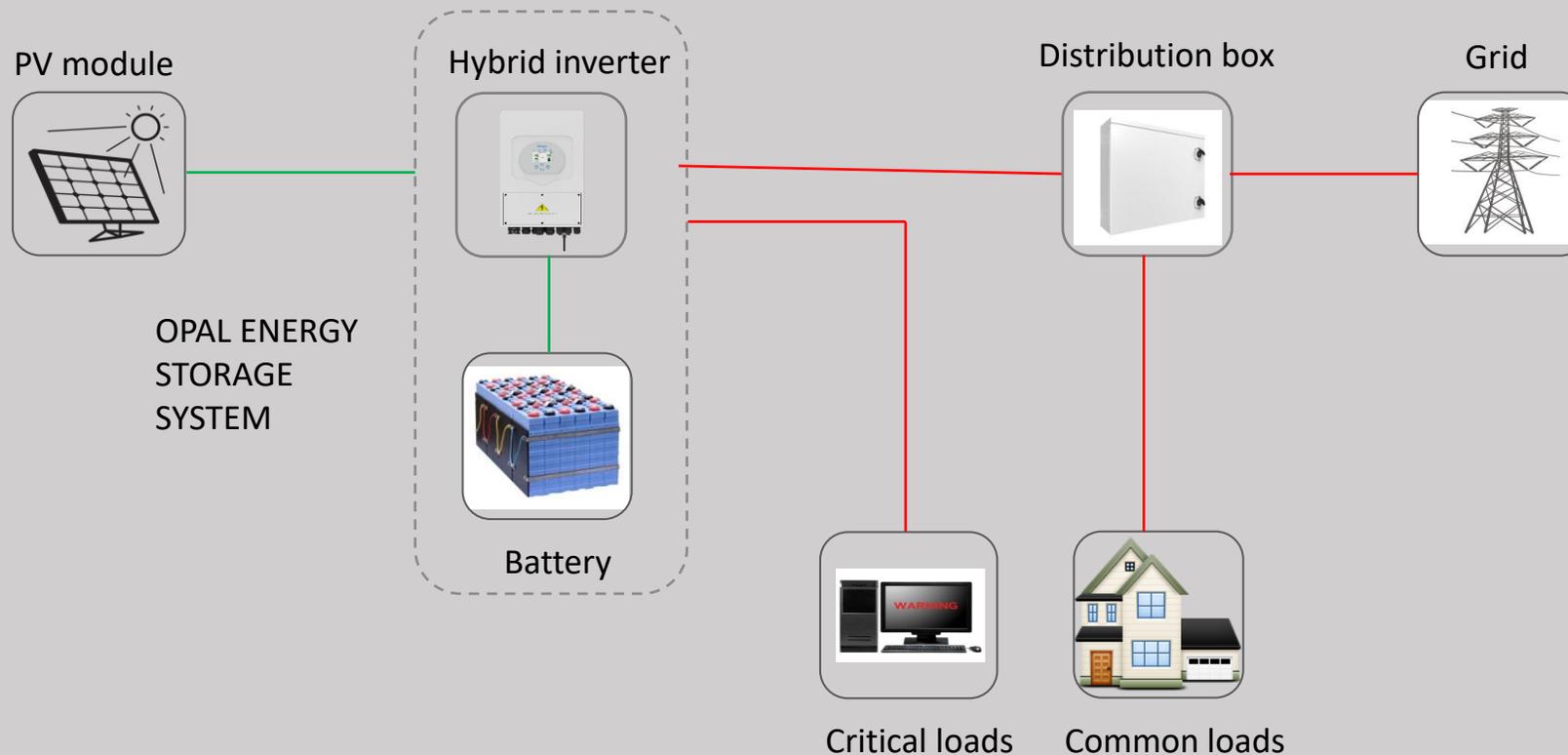
Support Wind Turbines

- Compatible with wind turbine as well. Also, it supports 1st MPPT connects PV module and 2nd MPPT connects wind turbines. For others, they can only use solar panel as DC input energy.
- In the off-grid mode, the peak output power is up to 10000W@10S



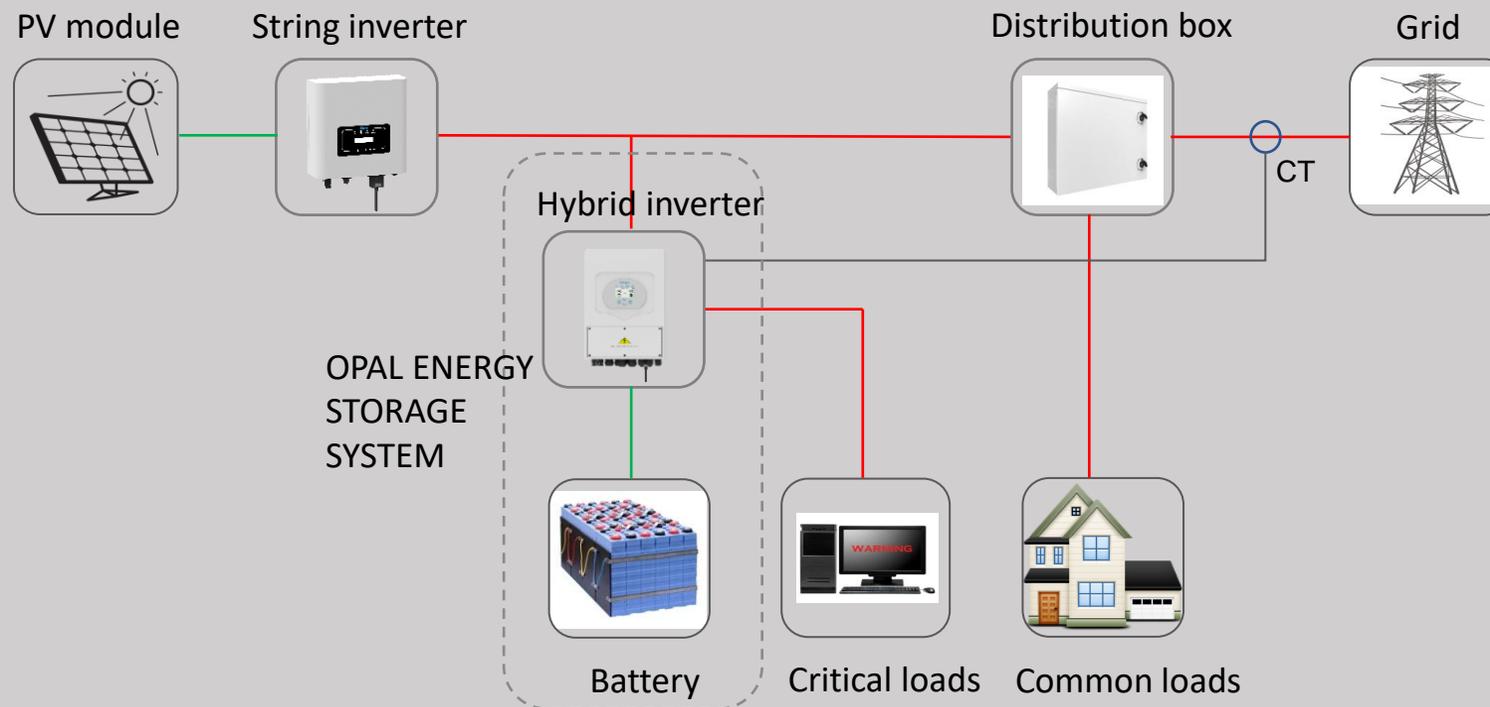
DC Coupling System

- Ideal for a new system as it is more economical and efficient as there is only one inverter needed
- In an event where there is a power failure for a prolong period and the battery is fully discharge, an AC coupled system may not be able to charge the battery and have to wait till the grid comes back. DC coupled system do not have this problem



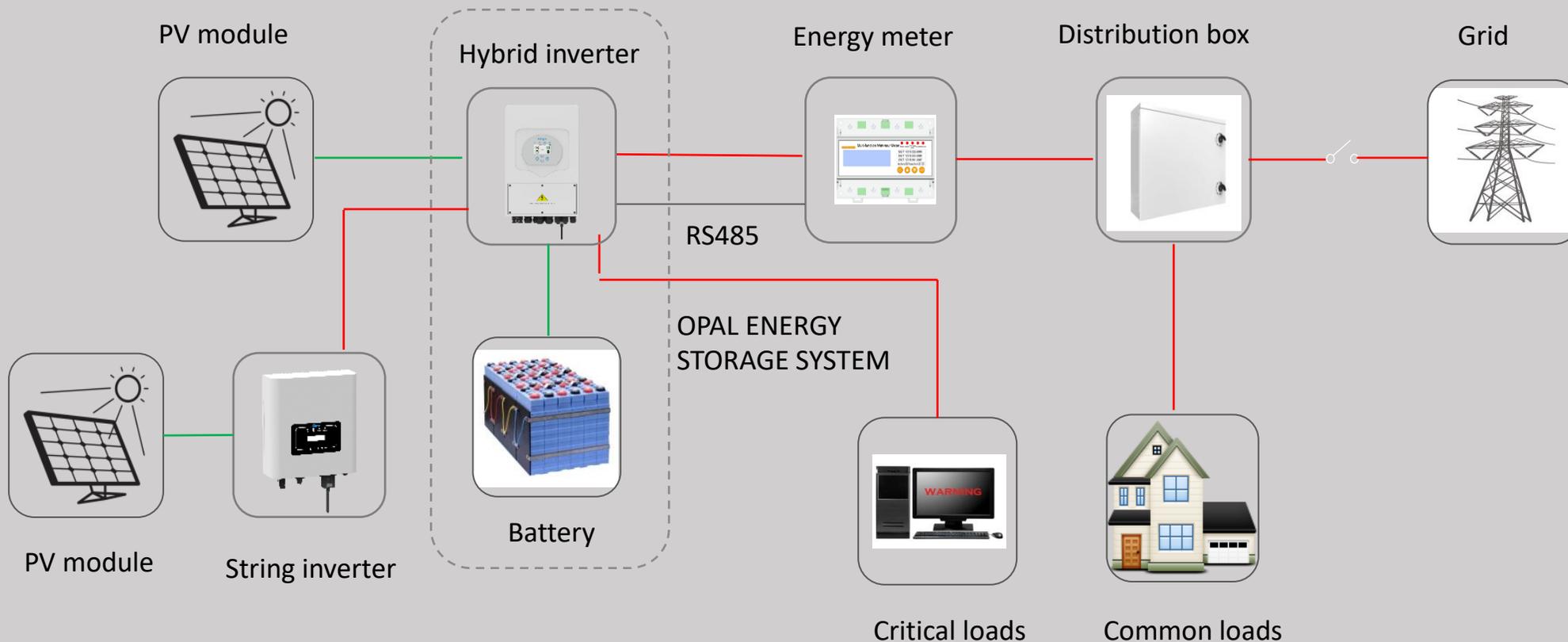
AC Coupled Type 1

- OPAL Energy Storage System can be integrated into the existing solar system allowing home owners to have full control on the use of the solar energy generated (to sell or to store for self-consumption)
- Should the existing grid inverter is not performing or working, it can be removed and the PV can be connected to the OPAL Hybrid inverter converting AC coupled to DC coupled system.
- An external CT need to be added to detect energy flow direction

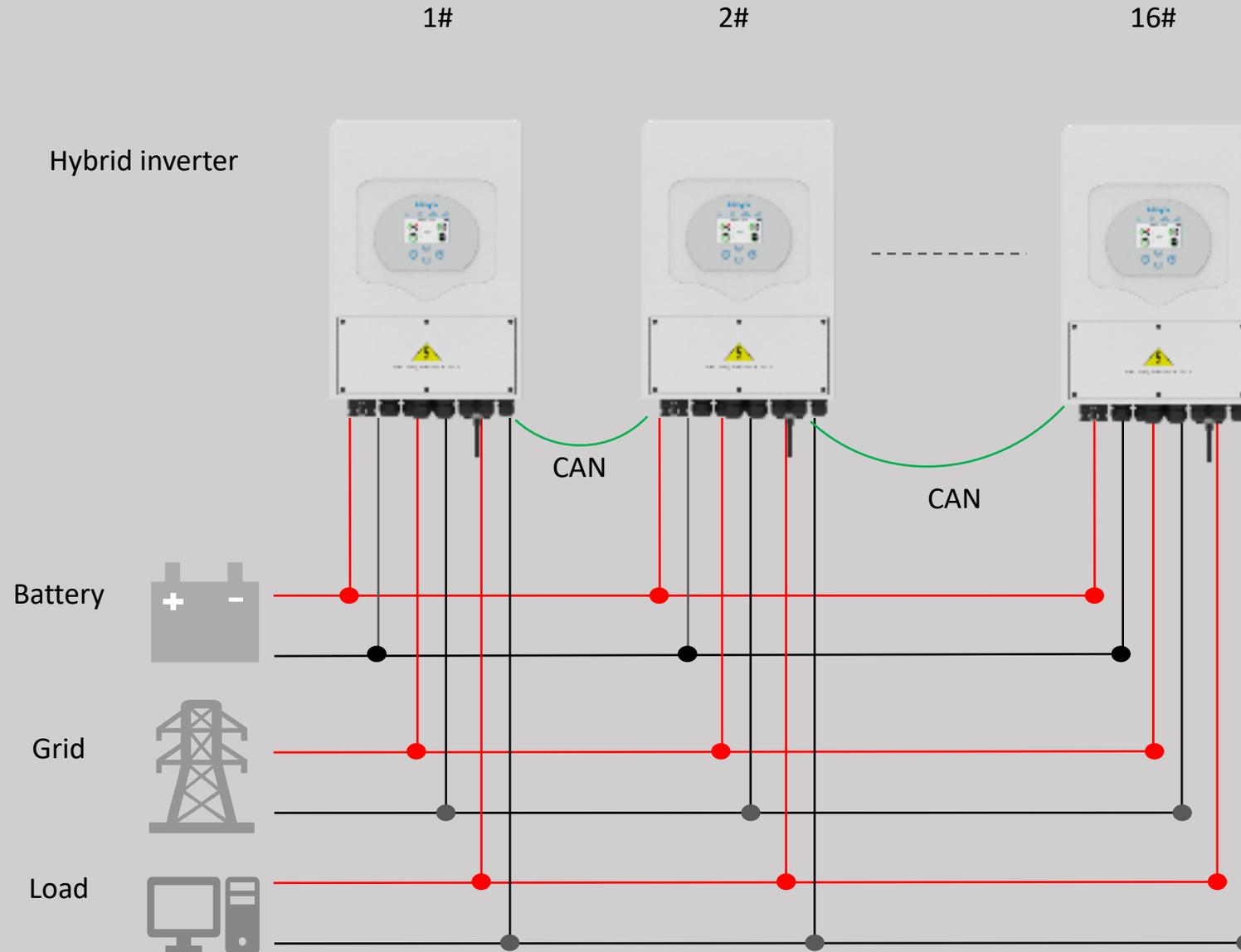


AC Coupled Type 2

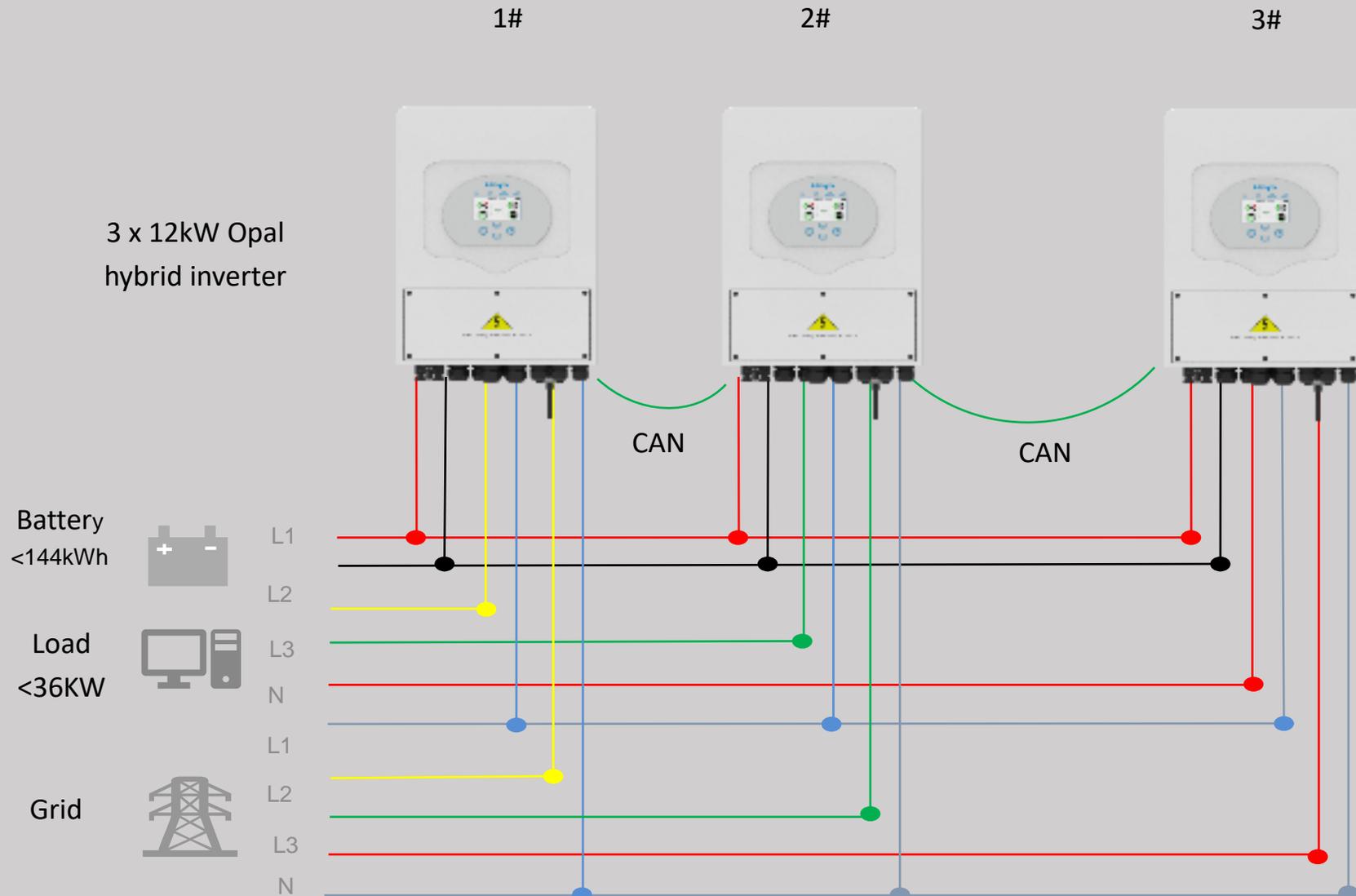
- Upgrade the existing solar grid connect system to energy storage system. The whole system will still run even when grid is not available.
- System allows string inverter output energy to charge the battery or supply load.



Able to parallel up to 16 units (Single Phase)

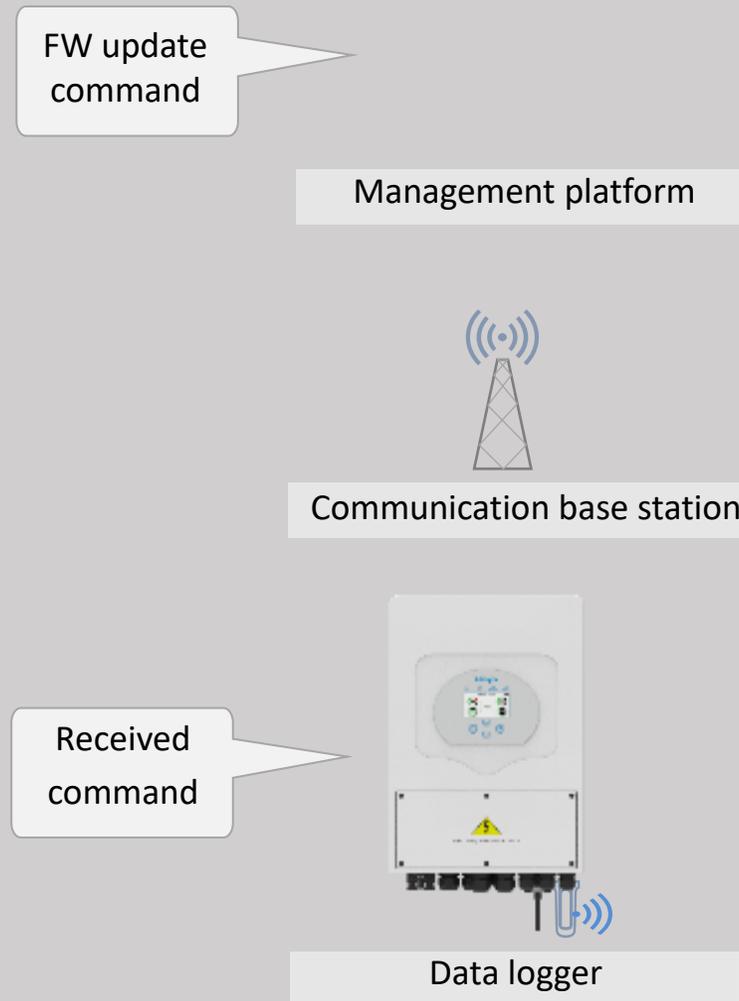


Commercial & Industrial three phase package



Remote Monitoring

Support set parameters and FW update remotely



Short time for FW update

- Remotely inverter parameter setting and software upgrade within 20 minutes

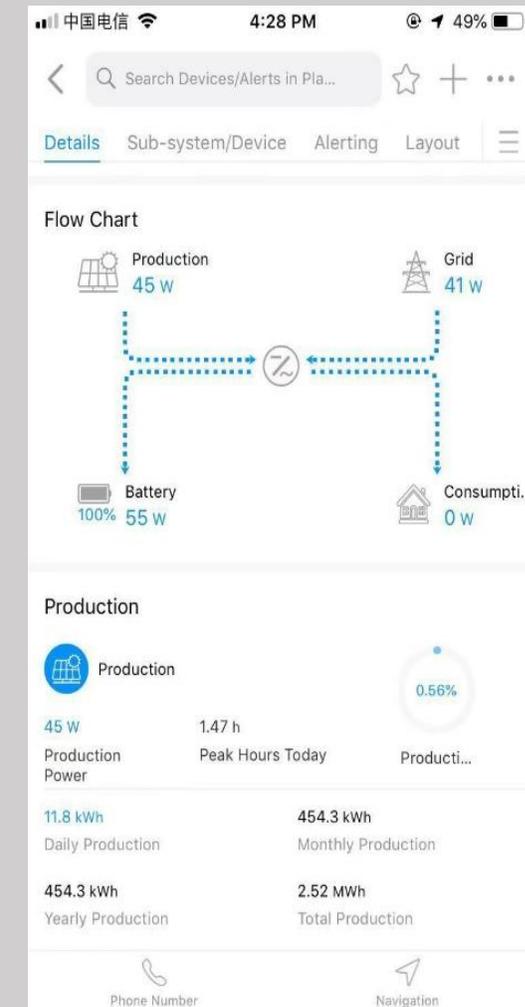
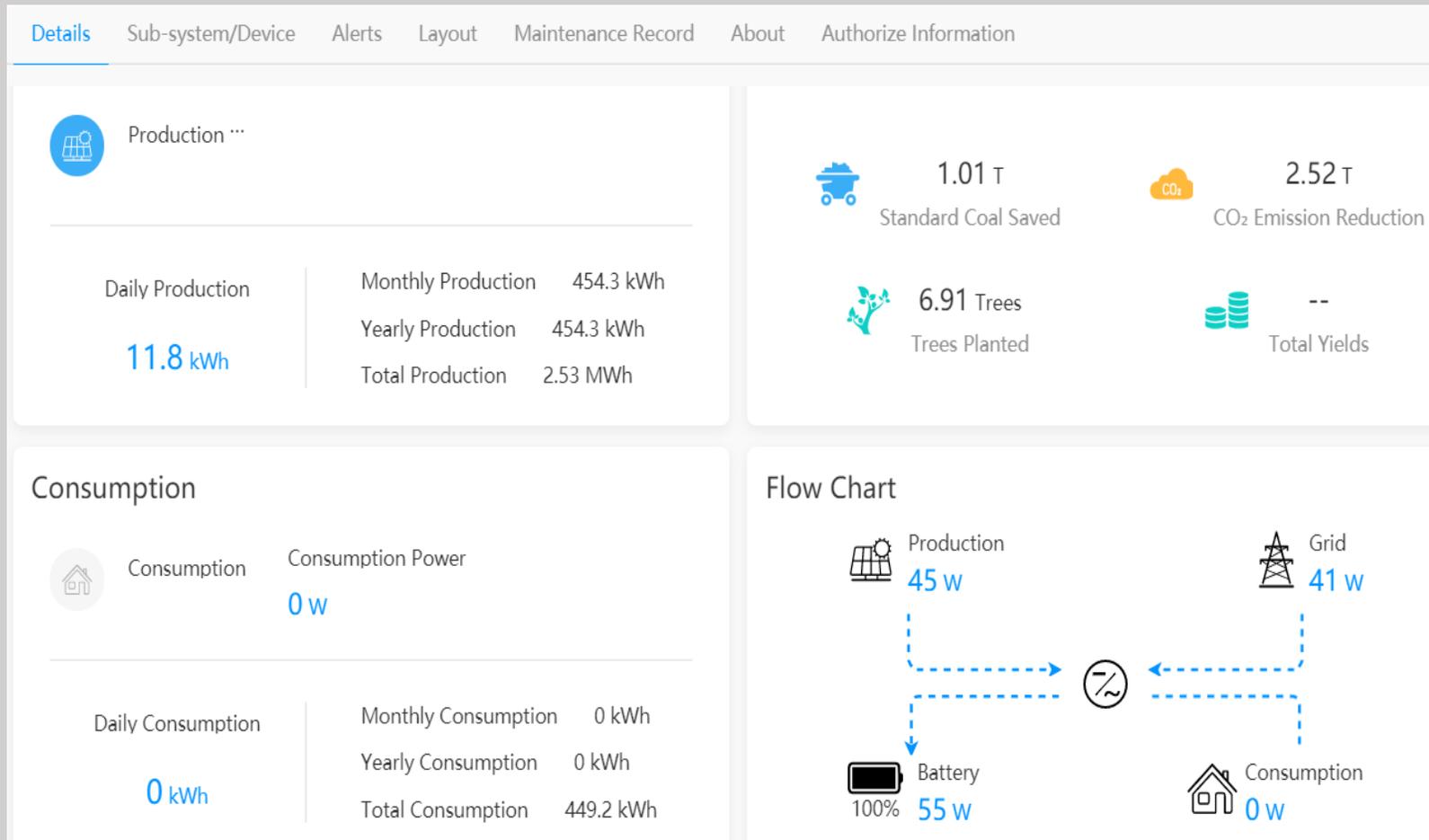


Save time, save cost

- Not need O&M engineer on site to check and operation

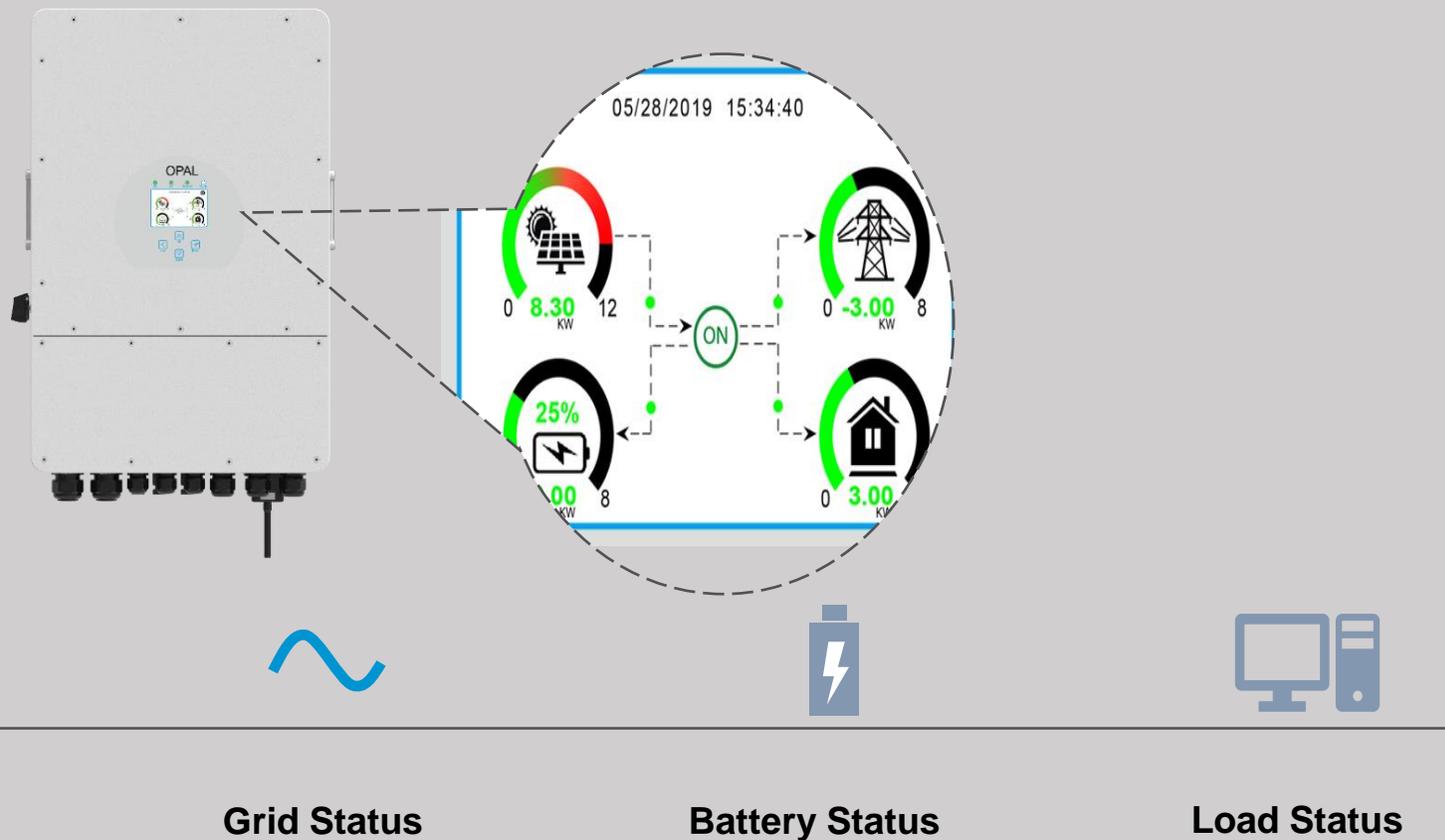
Remote O&M

- Check your solar station by your mobile phone and PC at any time and any where.
- For distributor and installer, they can find and fix problems before end user complaint



Colour Touch LCD Screen

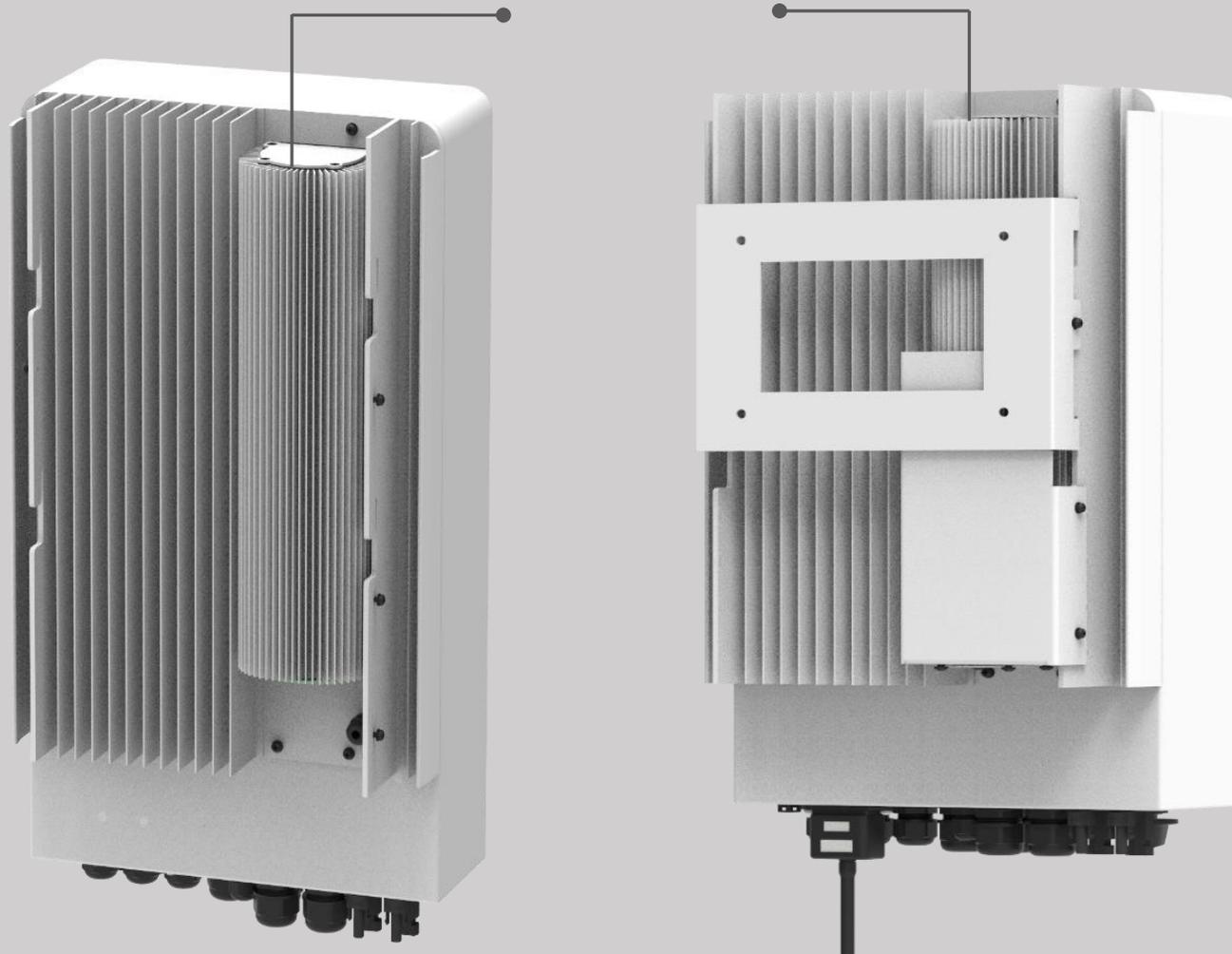
- Local colorful touch LCD screen with buttons, more reassurance after seeing the data
- Graphic shows the system energy flow direction real-time, easy understand.



IP 65 Protection Degree

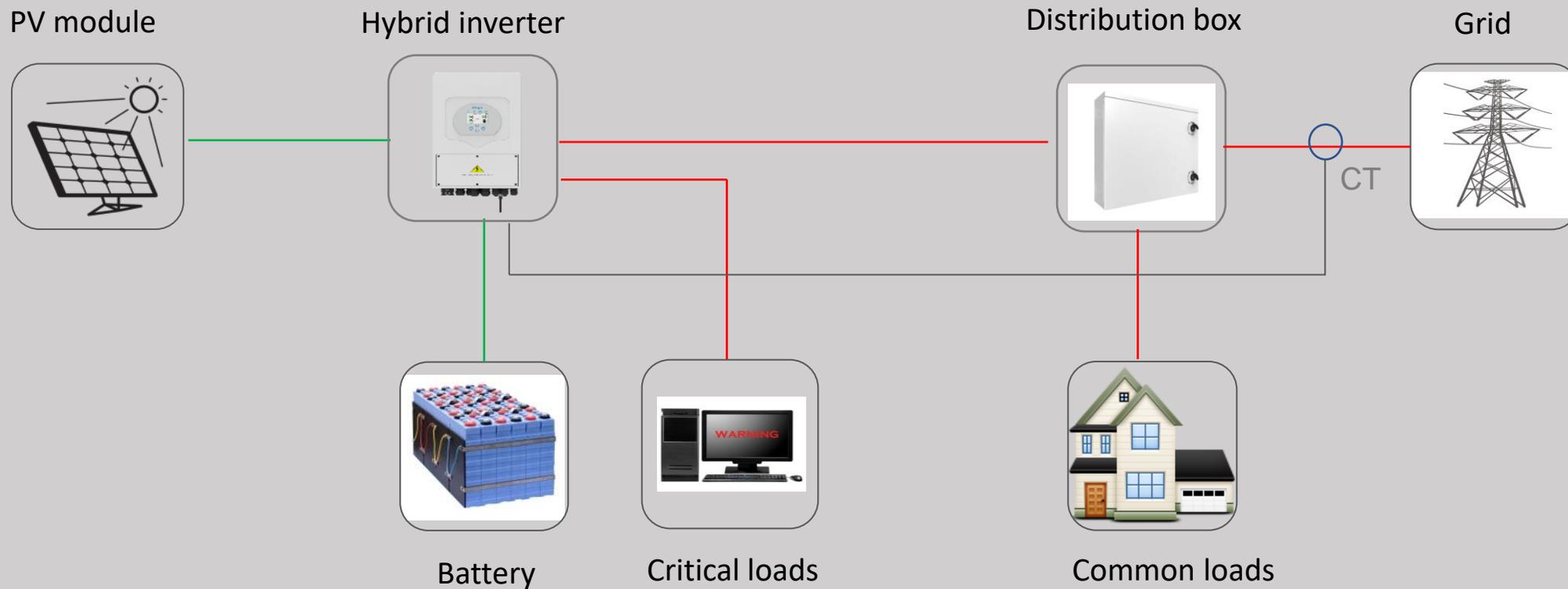
- Full series IP65 protection degree, sufficient heat dissipation, adapt to harsh environment, high reliability.

External fully enclosed glue-filled inductor, greatly inducing heat and noise from inductor



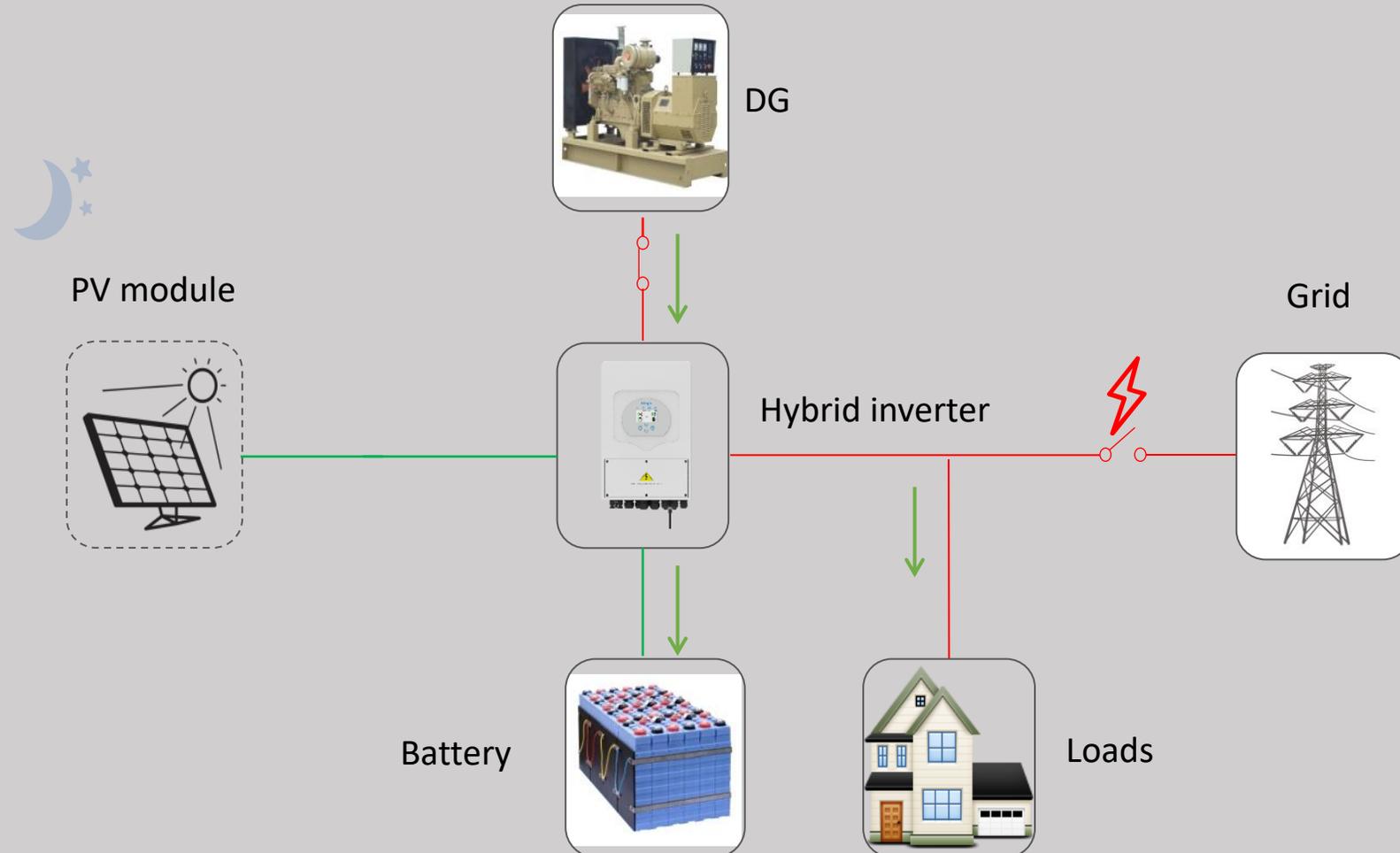
Export Control Output

Output power can be adjusted from 0-100%, meeting different requirements



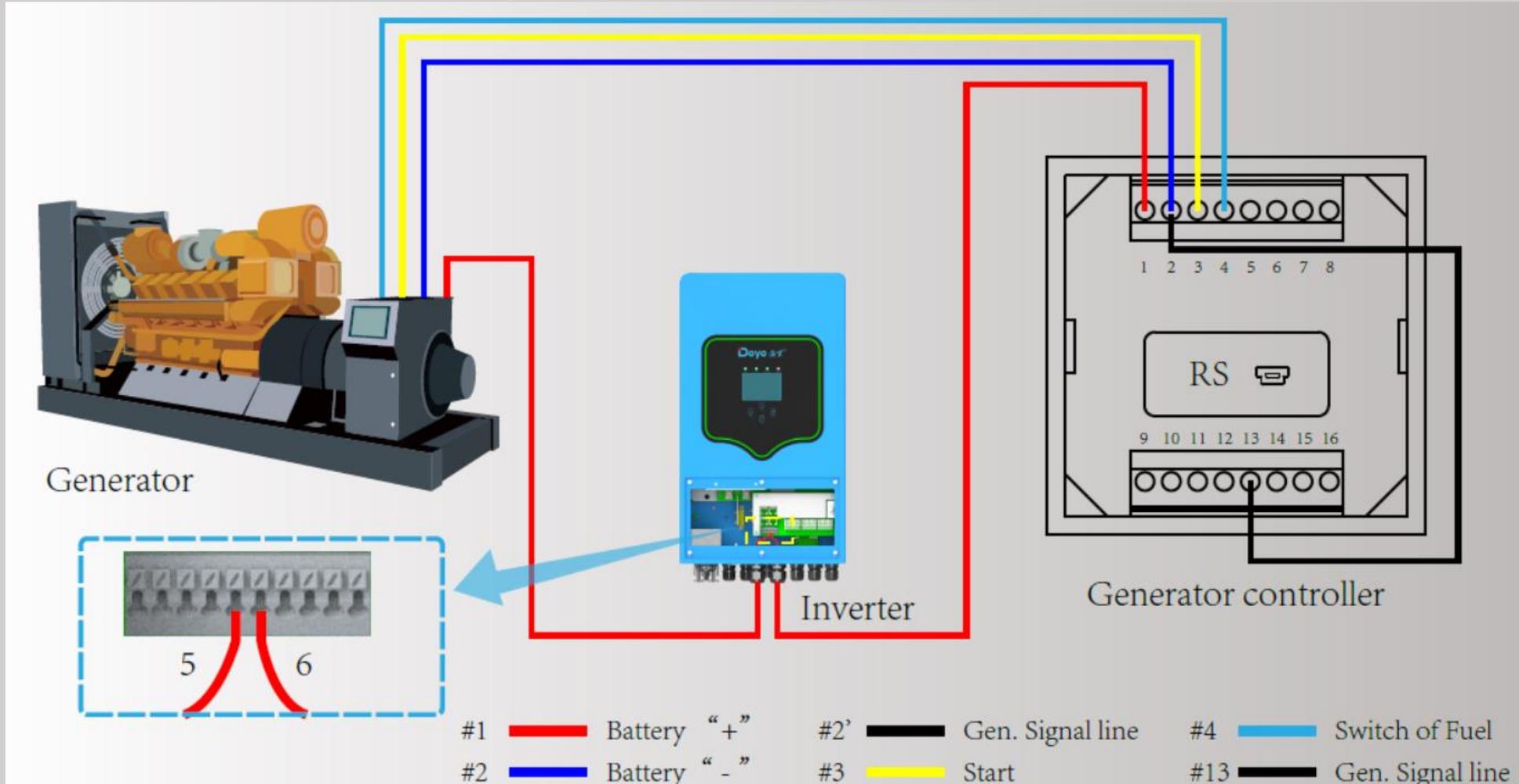
Compatible with Diesel Generator

- When utility grid cuts off, the hybrid inverter is able to start DG to supply load and charge battery.
- 90% of the hybrid inverter do not allow generator to connect directly to the inverter
- 90% of the Hybrid inverter requires a separate ATS and battery charger to the battery



Compatible with Diesel Generator

- Built-in DG control interface, the hybrid inverter is able to start or stop DG to supply load and charge battery automatically
- Generator switch off when battery reach 95% SOC



Energy technology Chosen

- Uses Safer Lithium Iron Phosphate Technology
- Low DC voltage safer to operate especially in residential usage
- Compact design and small in size
- Ease of upgrading, able to parallel up to 31 packs without additional BMS
- Long cycle life >6000 times (0.5C up to 80% DOD 25deg.C)
- Modular allows ease of transportation and installation



High Quality Lithium Iron Phosphate Cell

Long Life

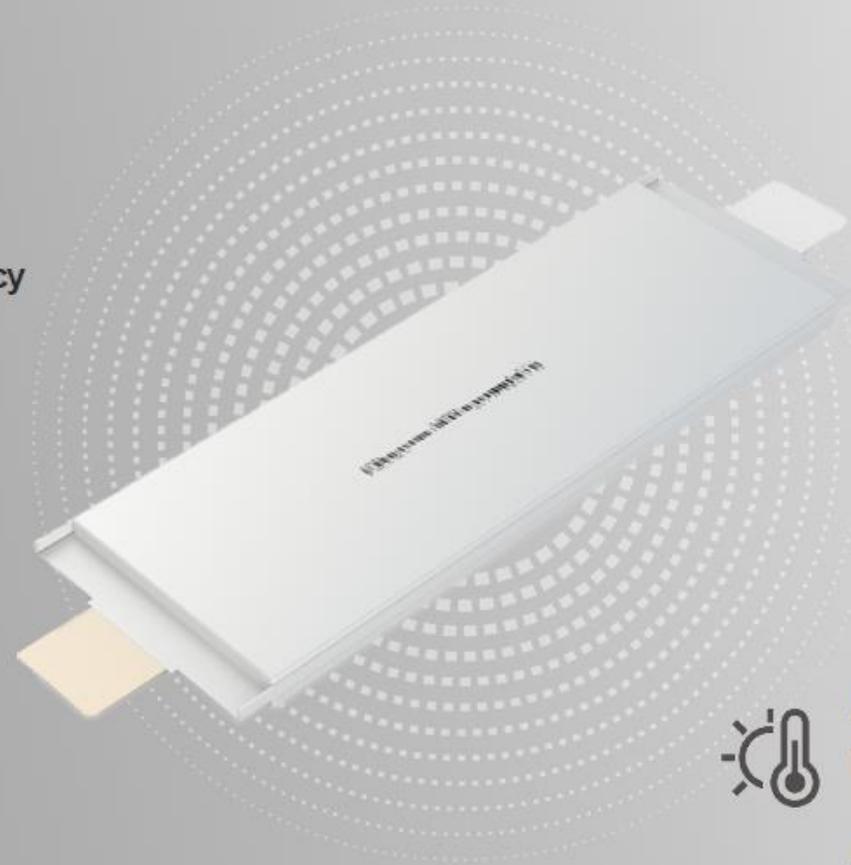


Long life, no attenuation of efficiency
Low maintenance & iteration cost

Safe and Reliable



Safety management in life cycle
Multilevel safety management measures



High Energy Density



Product slimming and weight loss
Effective housing space to store
more energy + capacity

Applicable in Wide Temperature Range



Applicable in abundant scenarios
Applicable at temperatures $-20^{\circ}\text{C} \sim 55^{\circ}\text{C}$

Multiple Communication Paths

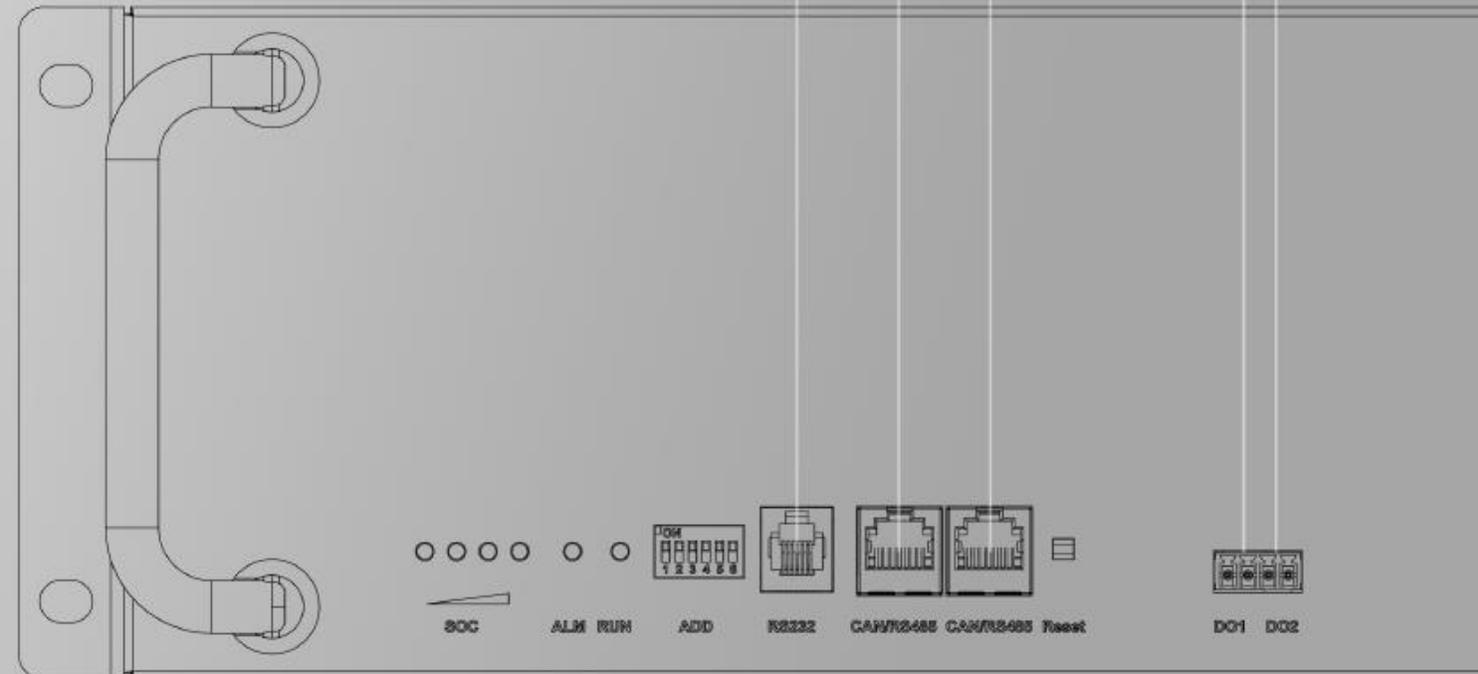
RS232 interface, fast connection with PC

Support both RS485 and CAN communication

Support two-channel dry contact communication



SOC and Alarm Display



Enclosure

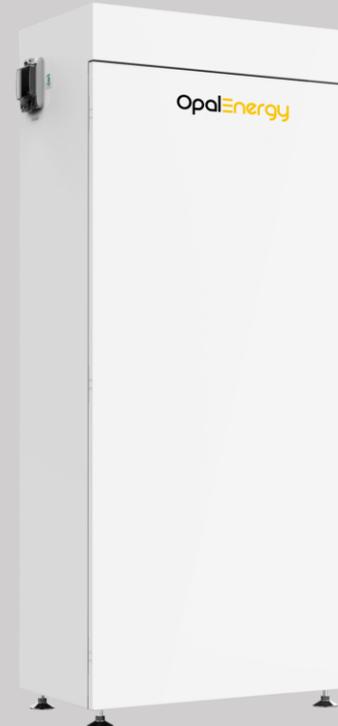
- Outdoor IP54 rating
- As battery life span are affected by heat, it is always best to avoid exposure to direct sunshine
- Enclosure are made with quality steel and powder coated for outdoor use
- Enclosed come with safety isolator and pre-assembled wiring for ease of installation



OPAL-1-ESS



OPAL-2-ESS



OPAL-4-ESS

Conclusion

- OPAL ENERGY offers value for money solution that fit for both residential and commercial for both urban and rural consumers
- OPAL ENERGY storage provides sophisticated multi functions features including
 - 4mSec uninterrupted power supply to critical loads in the case of power failure probably the fastest in the market
 - Up-to 6 different time flexible setting to power at time you need (usually at peak utility price)
 - Able to access and change setting the system remotely
 - Able to take 2 times of the rated power for critical loads
 - Able to take both Solar and Wind input
 - Able to connect diesel generator directly into the inverter.
 - Able to operate as an off-grid system
- Easy upgrading and expansion up to 16 inverters in parallel for single phase and 9 inverters in parallel for three phase
- 31 units of OPAL 48100LV-ES can be parallel without the need to add additional BMS.
- The system is design to maximize the system life
- Standard warranty is 5 years but we could extend warranty to 10 years