

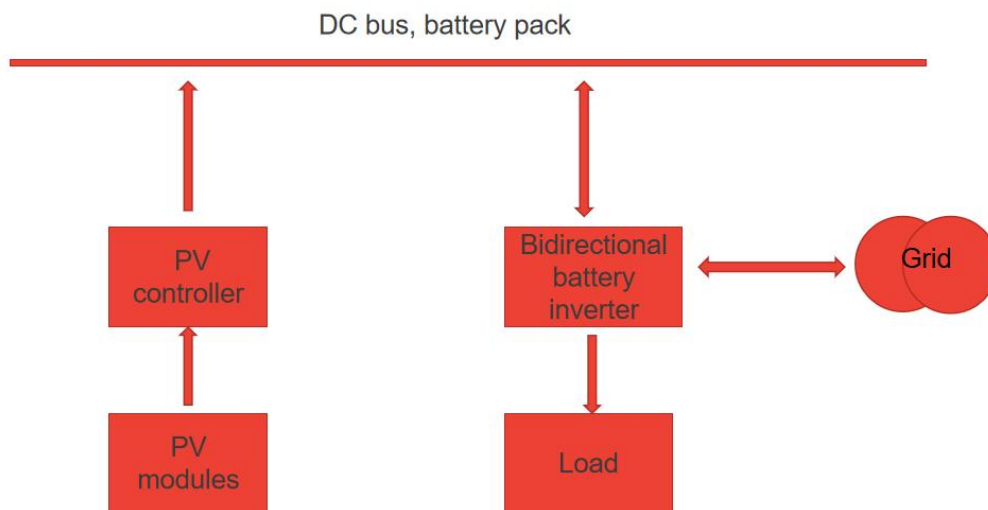
Whitepaper

DC Coupling VS. AC Coupling, How to Choose the Right Solution?

A PV energy storage system includes solar modules, controllers, inverters, batteries, loads, and other equipment. Today there are various technical routes, but whatever it is, the energy needs to be collected at a certain point. There are mainly two topologies in the market: DC coupling and AC coupling. Then you might ask: which configuration should be more preferred, AC or DC coupling? Today we are going to reveal the pros and cons of both.

DC Coupling

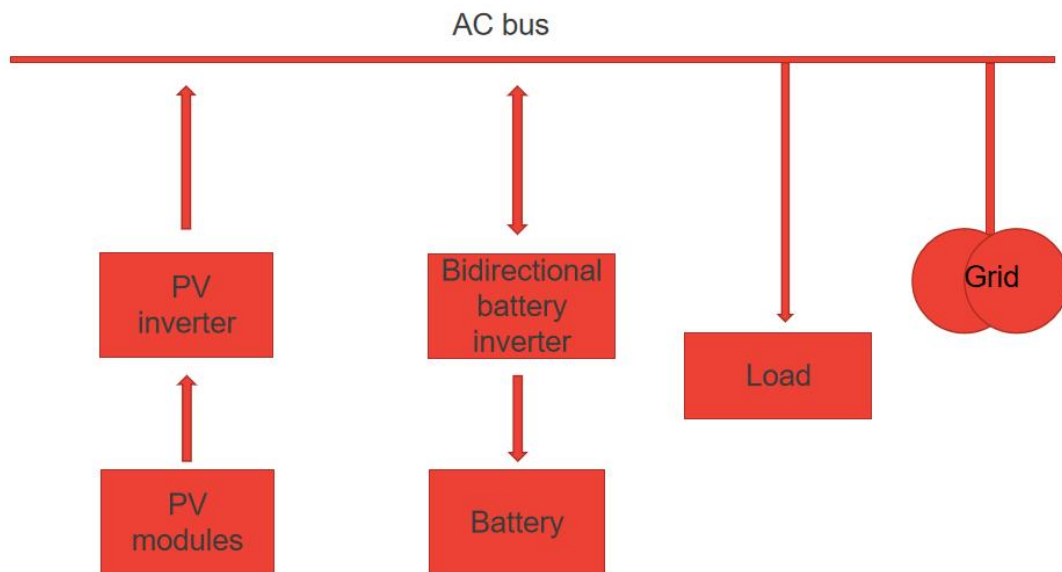
As shown in the figure below, the DC power generated by the PV module is stored in the battery pack through the controller, and the grid can also charge the battery through the bidirectional DC-AC battery inverter. The gathering point of energy is at the DC battery end.



The working principle of DC coupling: when the PV system is running, the MPPT controller is used to charge the battery; when there is a demand from the electrical appliance load, the battery will release the power, and the current is determined by the load. The energy storage system is connected to the grid. If the load capacity is small and the battery is fully charged, the PV system can supply power to the grid. When the load power is greater than the PV power, the grid and PV can supply power to the load at the same time. Because PV power generation and load power consumption are not stable, it is necessary to rely on the battery to balance the energy of the system.

AC Coupling

As shown in the figure below, the direct current generated by the PV modules is converted into alternating current through the inverter and is directly fed to the load or sent to the grid. The grid can also charge the battery through a bidirectional DC-AC inverter. The gathering point of energy is at the AC end.



The working principle of AC coupling: It includes a PV power supply system and a battery power supply system. The PV system consists of PV arrays and grid-connected inverters; the battery system consists of battery packs and bidirectional inverters. These two systems can either operate independently without interfering with each other or can be separated from the large power grid to form a micro-grid system.

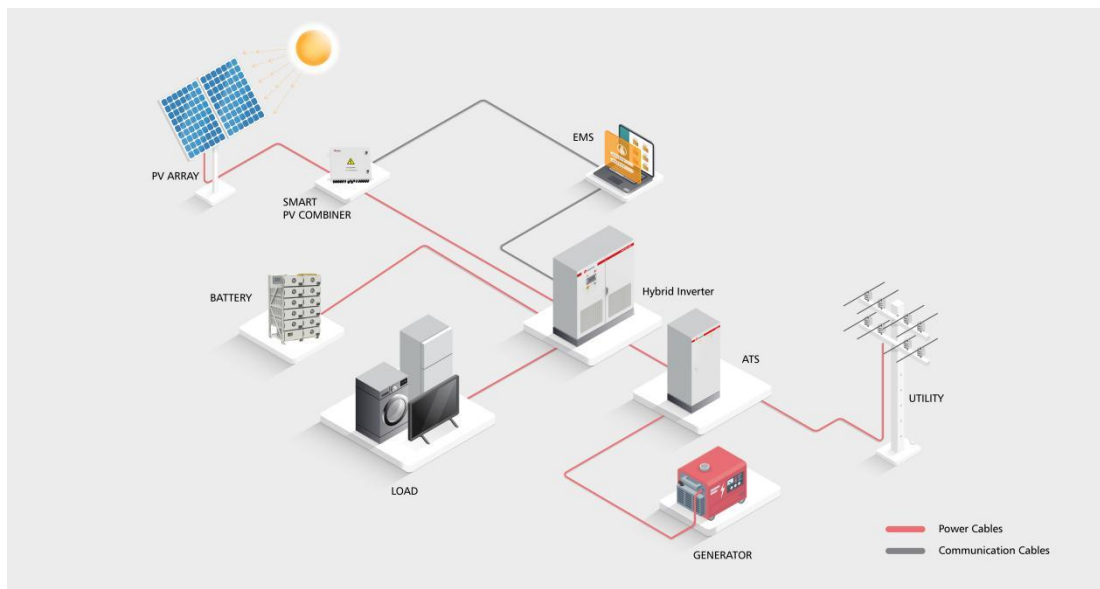
Applicability Comparison of DC Coupling and AC Coupling

In a DC coupling system, the equipment is connected in series, with a close connection and respectively poor flexibility. While The AC coupling system is connected in parallel, with less contact and better flexibility. As a matter of fact, AC coupling is more suitable to apply to the situation where grid-connected inverters have already been installed and users want to upgrade to energy storage system, and DC coupling is more for building a new system.



Application of DC Coupling in the HPS System

Our HPS is a hybrid inverter, which integrates a PV controller and a battery bidirectional inverter. The electricity generated by PV modules can be used to charge the battery through MPPT controller, and can also be converted into AC for load use. When the PV power generation is not enough to support the load, the battery discharges to make up for the insufficient energy. The HPS can also be connected to the grid as needed, and the grid can be used to charge the battery or supply the load. In the HPS system, the gathering point of energy is the battery. Our HPS has the function of on-grid and off-grid auto-switching. It can meet the needs of most users. Limited by hardware, the PV controller of HPS can only connect PV panels with a certain capacity.

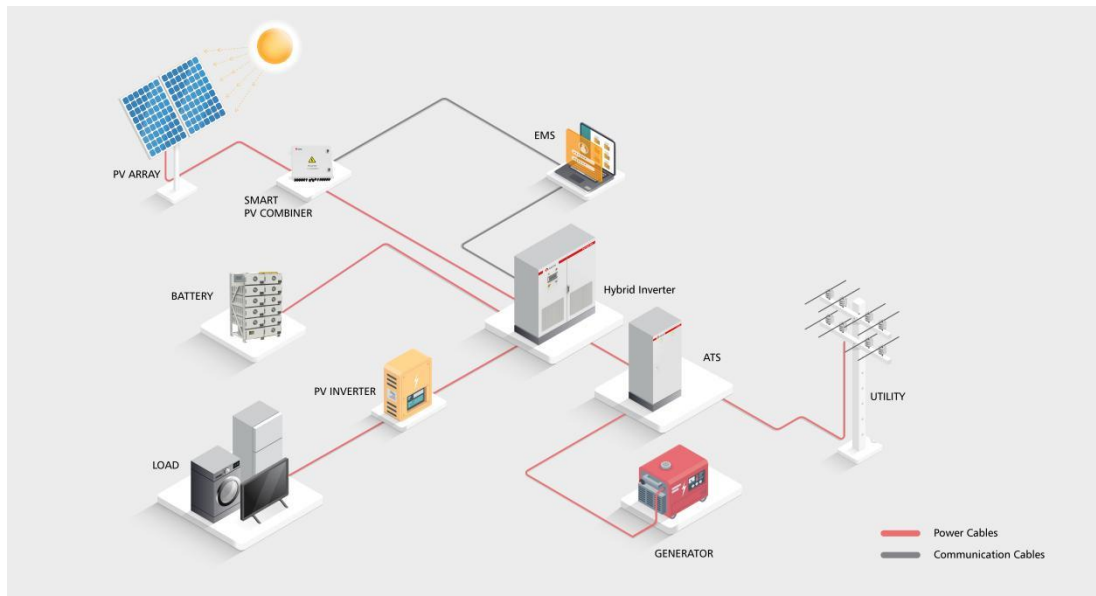


Application of AC Coupling in the HPS System

Due to historical reasons, many customers used to install grid-connected inverters. As we all know, the operation of grid-connected inverters must have a reference voltage. Once the power grid fails, the grid-connected inverter will stop running. And our HPS can run off-grid. Therefore, many customers ask, since HPS can run off-grid, if there is a solution to let the grid-connected inverter refer to the output voltage information of HPS to generate power. In this way, the original PV power generation system can be utilized to reduce investment costs. The answer is yes. This requires the aforementioned AC coupling. The specific method is to connect the grid-connected inverter to the load end of the HPS, and after the



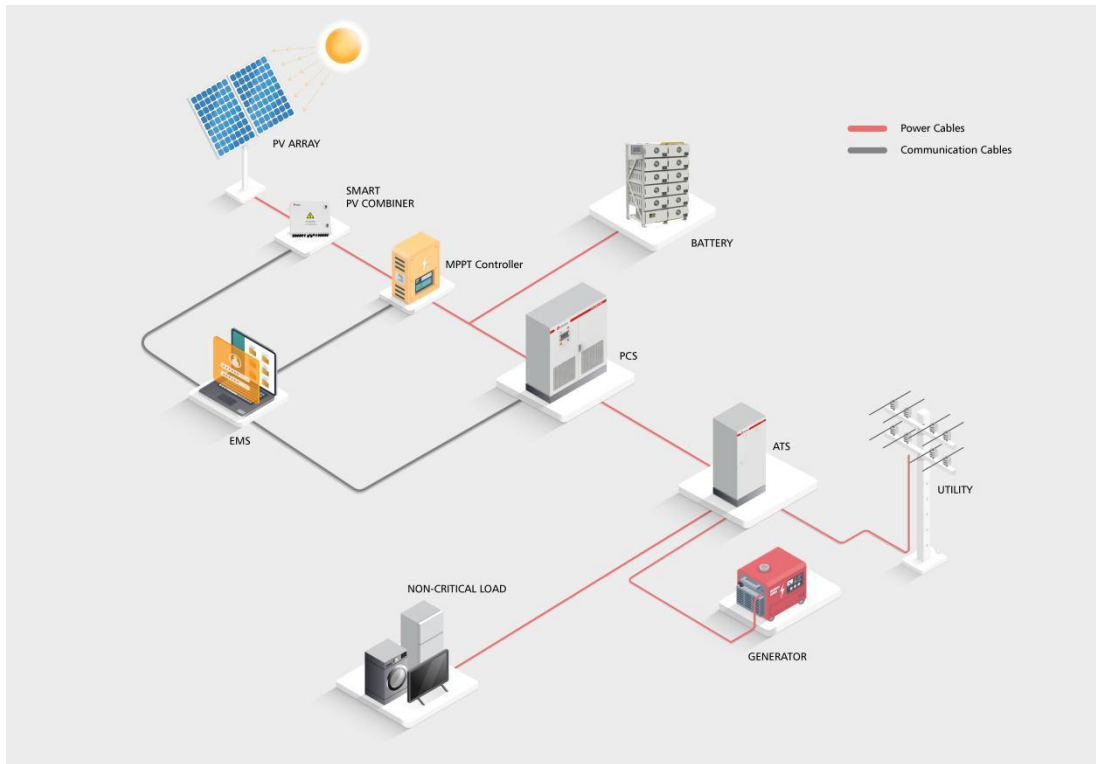
grid-connected inverter matches the communication protocol of the HPS, it will adjust the power generation of the grid-connected inverter according to the instructions of the HPS. In this way, the idea that grid-connected inverters can also be used in off-grid conditions is realized.



Application of DC Coupling in the PCS System

The application of DC coupling in the PCS system is obvious. As shown in the figure, the power generated by the PV module is charged to the battery through the PV controller PBD, and can also be converted into AC power through the PCS to supply power to the load or to the grid. Different from HPS, in the DC coupling system of PCS, the PV controller PBD and the bidirectional inverter PCS are separated, and the user can configure the appropriate number of PV controllers PBD and batteries according to the needs in order to obtain the maximum economic benefits.

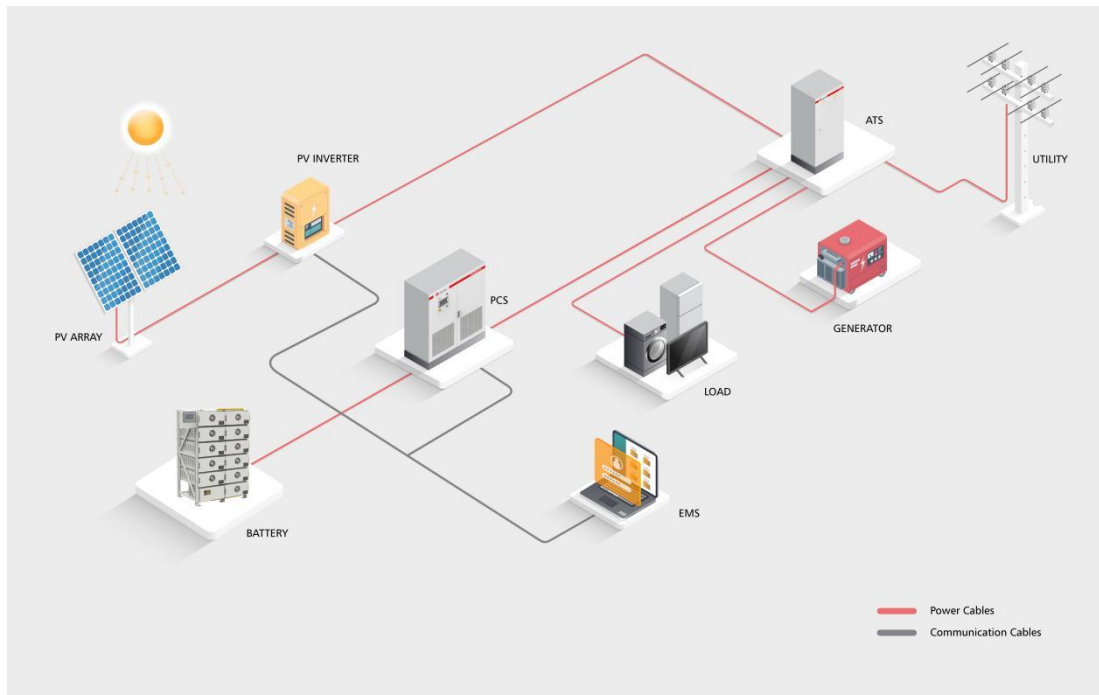




Application of AC Coupling in the PCS System

Regarding the application of AC coupling in the PCS system, we have already taken it into consideration when designing the product. There is a PV inverter interface on the bypass cabinet, which is specially used to connect to the grid-connected inverter. Similarly, the grid-connected inverter needs to match our inverter communication protocol. At present, the inverters that can communicate directly with our inverters are limited to some of the brands that are members of SUNSPEC.





From above we can see that ATESS products can be used for both DC coupling and AC coupling, and the right solution is project specific. ATESS mainly focuses on DC coupling systems and has accumulated rich experience in this field. But also, we can provide AC coupling solution as per customer demand.

Through this article, you must have gained a clear understanding of these two coupling methods, if you still have question when designing your system, please keep in mind that ATESS is always here to help.

