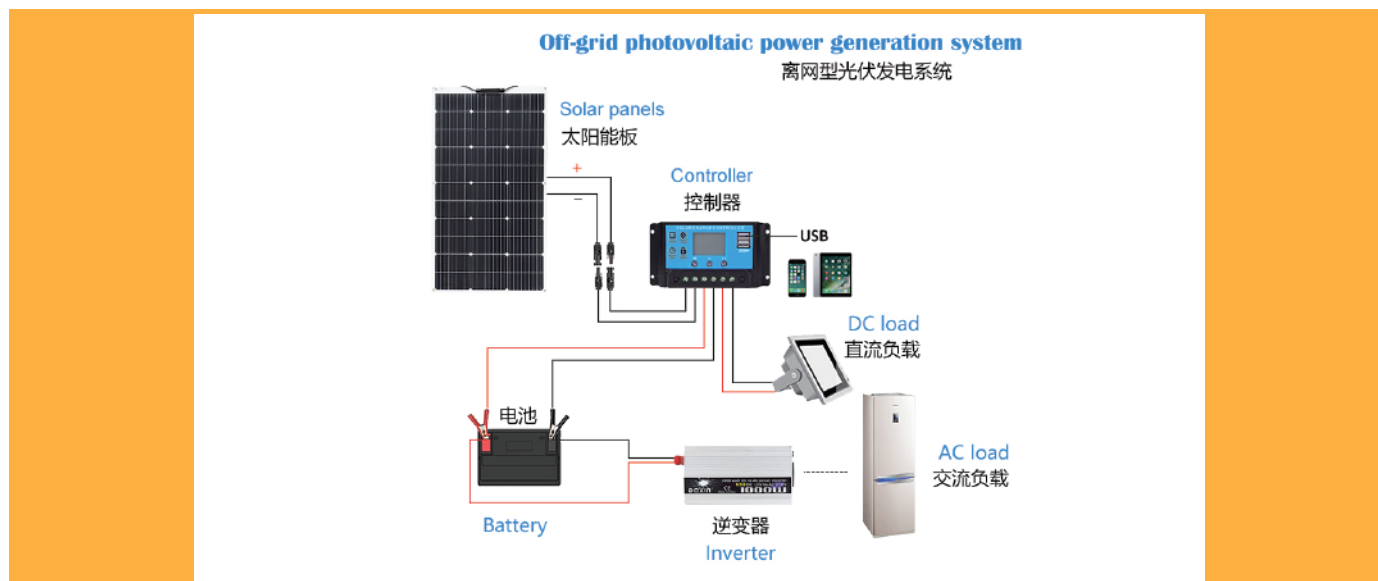


## The Applications of Off-grid Photovoltaic Power Generation System in RV, Yacht and Refrigerated Vehicles

离网型光伏发电系统在房车，游艇，冷藏车上的应用



### Off-grid photovoltaic power generation system

Off-grid photovoltaic power generation system is generally composed of photovoltaic array composed of solar cell modules, solar charge and discharge controller, battery pack, off-grid inverter, DC load and AC load. It is widely used in RV, yacht, refrigerated vehicle and other application places

离网型光伏发电系统

离网光伏发电系统一般由太阳电池组件组成的光伏方阵、太阳能充放电控制器、蓄电池组、离网型逆变器、直流负载和交流负载等构成。其广泛应用于房车，游艇，冷藏车等应用场所。

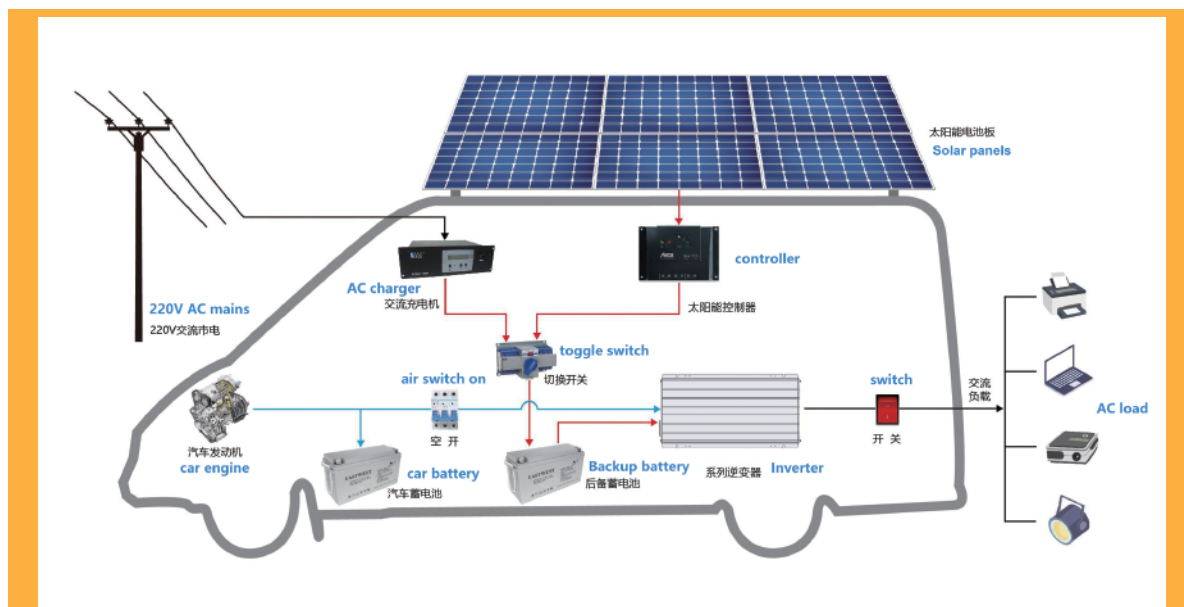
### The off-grid solar RV system

离网太阳能房车系统

#### 1.What is off-grid solar RV system (什么是离网太阳能房车系统)

Also known as on-board photovoltaic power generation system, it refers to the installation of a complete off-grid photovoltaic power generation system on the vehicle, which is mainly composed of solar cell modules, controllers and batteries. If the output power supply is AC 220V or 110V, it also needs to be equipped with inverter.

又称车载光伏发电系统，是指在汽车上安装整套的离网光伏发电系统，主要由太阳能电池组件、控制器、蓄电池组成，如输出电源为交流220V或110V，还需要配置逆变器。



The benefits of installing solar photovoltaic panels on the roof are huge:

- First, solar energy is a kind of clean energy, which can effectively reduce carbon emissions;
- Second, it can make rational use of the roof space, avoid the high temperature caused by direct sunlight and effectively reduce the temperature in the car;
- Third, its energy source constantly converts light energy into electric energy. It seems that the power is small, but the accumulated energy can not be ignored, which can effectively prolong the service life of the battery.

将太阳能光伏发电板装置在车顶上，带来的好处是巨大的：

第一，太阳能是一种清洁能源，能够有效降低碳排放；

第二，能够合理利用车顶空间，避免阳光直射带来的高温，有效降低车内温度；

第三，它能源源不断将光能转化为电能，看起来功率不大，但累积产生的能量却是不可忽视的，能有效延长电池寿命。

## 2: Constituent elements(组成要件)

The photovoltaic power generation system is generally composed of photovoltaic array composed of solar cell modules, solar charge and discharge controller, battery pack, off grid inverter, AC load, etc.

系统一般由太阳电池组件组成的光伏方阵、太阳能充放电控制器、蓄电池组、离网型逆变器、交流负载等构成。

## (1)光伏方阵(Photovoltaic array)



The photovoltaic module array on the roof converts solar energy into electric energy when there is light, supplies power to the load through the solar charge and discharge controller, and charges the backup battery pack placed in the vehicle; When using electricity, the backup battery pack supplies power to the AC load through the solar charging and discharging controller. If there is mains power, you can also quickly charge the backup battery pack through the AC charger.

车顶的光伏组件方阵在有光照的情况下将太阳能转换为电能，通过太阳能充放电控制器给负载供电同时给放置在车里的后备蓄电池组充电；在用电时，通过太阳能充放电控制器由后备蓄电池组给交流负载供电。如果在有市电的情况下，也可以通过交流充电机给后备的蓄电池组快速充电。

## (2)Solar charge and discharge controller(太阳能充放电控制器)



Also known as "photovoltaic controller", its function is to regulate and control the electric energy generated by solar cell modules, charge the battery to the greatest extent, and protect the battery from overcharge and over discharge. In places with large temperature difference, the photovoltaic controller shall have the function of temperature compensation.

也称“光伏控制器”，其作用是对太阳能电池组件所发的电能进行调节和控制，最大限度地对蓄电池进行充电，并对蓄电池起到过充电保护、过放电保护的作用。在温差较大的地方，光伏控制器应具备温度补偿的功能。

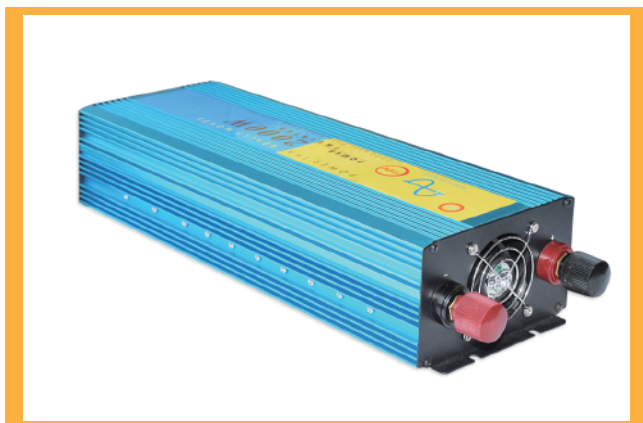
### (3) Battery pack (蓄电池组)

Its main task is to store energy so as to ensure load power consumption at night or in rainy days.

其主要任务是贮能，以便在夜间或阴雨天保证负载用电。



### (4) Off-grid inverter (离网型逆变器)



Off-grid inverter is the core component of off grid power generation system, which is responsible for converting DC into AC for AC load. In order to improve the overall performance of photovoltaic power generation system and ensure the long-term stable operation of power station, the performance index of inverter is very important.

离网型逆变器是离网发电系统的核心部件，负责把直流电转换为交流电，供交流负荷使用。为了提高光伏发电系统的整体性能，保证电站的长期稳定运行，逆变器的性能指标非常重要。

### (5) AC load (交流负载)

AC load is to convert electrical energy into mechanical energy. Electric motors can convert electric energy into mechanical energy, and electric bulbs can convert electric energy into heat and light energy.

交流负载是把电能转换成机械能。电动机能把电能转换成机械能，电灯泡能把电能转换成热能和光能。





### 3: Application Scenarios (应用场景)

Vehicle mounted photovoltaic power generation system is widely used in field exploration, field communication, police car and other special vehicles. When far away from the power grid, it can rely on solar power generation system to supply power and use load equipment. Especially for those who love camping, off-grid solar RV system is definitely the best choice. Equipped with off-grid solar power generation system, it can provide you continuous energy wherever there is sunshine.

车载光伏发电系统被广泛应用于野外勘探、野外通讯、警车等特种车辆在远离电网的情况下可以依靠太阳能发电系统来供电使用负载设备。尤其对于喜爱露营野游的人来说，离网太阳能房车简直是最理想的选择。配备离网太阳能发电系统，无论行至何处，只要有阳光的地方，它就能为你提供持续的能量。



## Off-grid Solar Yacht System

### 离网太阳能游艇系统



#### 1: What is off-grid solar yacht system (什么是离网太阳能游艇系统)

Off-grid solar yacht system is mainly to convert solar energy into electric energy required for yacht operation, so as to provide sufficient power for yacht. The solar power system on a solar yacht is usually composed of solar panels, batteries, charging controllers and inverters. When the battery stores the energy obtained from the solar panel, the charging controller can prevent the battery from overcharging. Household appliances on yachts usually need the help of inverters to convert DC energy into AC.

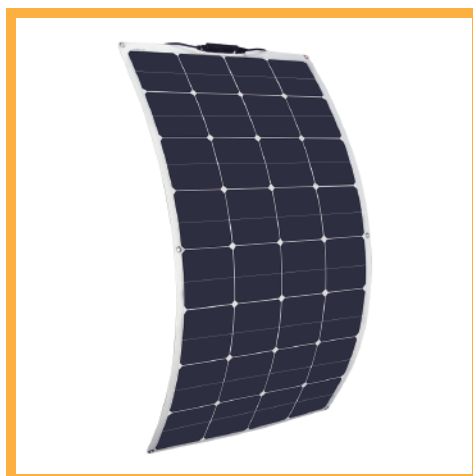
离网太阳能游艇系统主要是将太阳能转变为游艇运行所需的电能，从而为游艇提供充足的电力。太阳能游艇上的太阳能动力系统通常由太阳能电池板、电池、充电控制器和逆变器组成。当电池储存从太阳能电池板获得的能量时，充电控制器可以防止电池过度充电。游艇上的家用电器通常需要在逆变器的帮助下将直流能量转换成交流。

#### 2: Constituent elements (组成要件)

##### (1) 太阳能电池组件(Solar cell modules)

Solar cell module is the core of solar photo-voltaic system, most of which are made of poly-crystalline silicon materials.

太阳能电池组件是太阳能光伏系统的核心，大多数有多晶硅材料制造而成。





## (2) Battery (蓄电池)



The battery is the power storage pool in the photovoltaic system, which can store the electric energy converted from solar energy absorbed by the battery module for emergency use.

蓄电池是光伏系统中的电力存储池，能将电池组件吸收太阳能转变而成的电能储存起来以备不时之需。

## (3) Charge and discharge controller (充放电控制器)

The charge and discharge controller manages and controls the electric energy of the solar photovoltaic system, and plays the role of protecting the circuit at the same time.

充放电控制器对太阳能光伏系统的电能进行管理和控制，同时起到保护电路的作用。



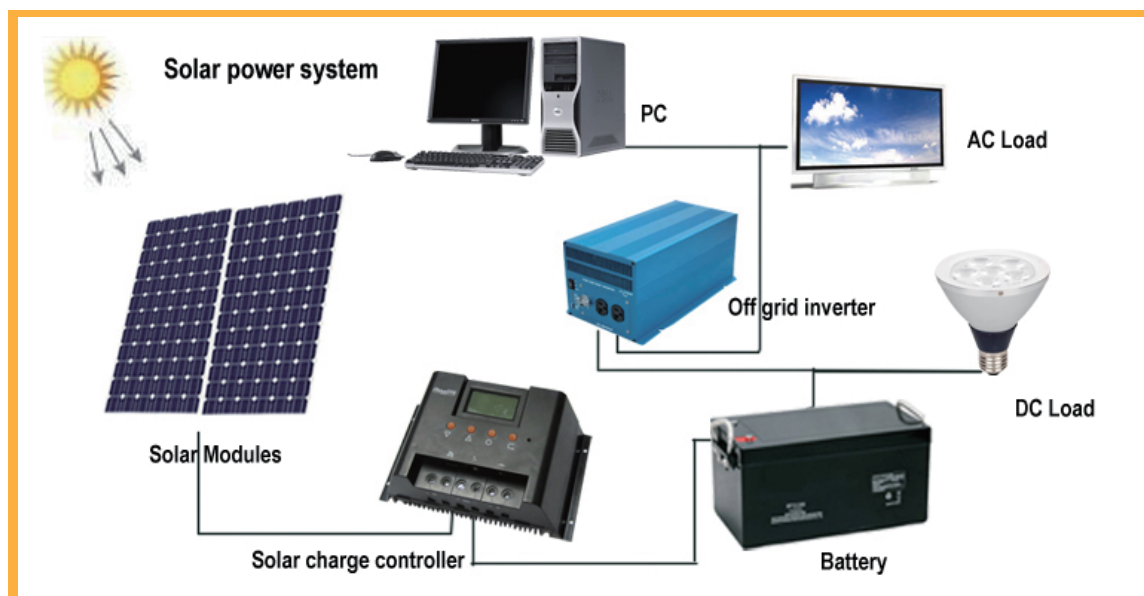
## (4) Inverter (逆变器)



The inverter performs current conversion to convert DC into AC required for AC charge.

逆变器进行电流转变，将直流电转变为交流电荷所需的交流电。

### 3: Work procedure(工作流程)



Firstly, the solar cell module receives the irradiation of sunlight, absorbs the heat energy of the sun, converts it into electric energy and transmits it to the controller;

Secondly, the intelligent controller is used to manage the electric energy transmitted by the battery module to provide sufficient DC power for the operation of the yacht. On the premise of ensuring that the yacht has sufficient power, store the remaining electric energy in the battery structure of the system, and meet the functions of power failure and recovery to protect the structure of the photovoltaic system;

Finally, according to the AC load demand of the solar photovoltaic system, the inverter of the photovoltaic system is used to convert the current generated in the solar photovoltaic system or the DC power released by the battery into the AC power required by the AC load, so as to meet the power demand of different functions of the yacht.

首先，太阳能电池组件接受太阳光的照射，吸收太阳的热能，并将其转变为电能输送到控制器；其次，采用智能控制器对电池组件输送的电能进行管理，为游艇的运行提供充足的直流电。在保证游艇具有充足动力的前提下，将剩余的电能储存在系统的蓄电池结构中，同时满足断电，恢复等功能对光伏系统结构进行保护；

最后，根据太阳能光伏系统交流负载的需求，使用光伏系统的逆变器进行转变，将太阳能光伏系统中产生的电流或蓄电池放出的直流电转变为交流负载所需要的交流电，满足游艇不同功能的电力需求。



#### 4: Applications of solar power in yachts(太阳能发电在游艇上的用途)

##### (1)Maritime safety emergency support (海上安全应急保障)

If the diesel engine or motor breaks down at sea and cannot be used, it can be powered by solar energy, which still ensures that the yacht can start navigation, GPS navigation and satellite phone.

柴油机或者马达电机在海上出现故障，坏了不能使用，可通过太阳能发电，仍保证游艇能启动航行、GPS导航、卫星电话使用。

##### (2)Domestic electricity(生活用电)

Small systems: lighting, mobile phone charging, MP3, fan, refrigerator, TV, etc, Large system: air conditioning (high-power solar panels and batteries are required to reserve enough energy)

小系统：照明、手机充电、MP3、风扇、冰箱、电视机等都可以满足，  
大系统：空调(需要大功率太阳能板与蓄电池储备足够的能量)。

#### 5: Advantages of solar power generation system on yachts(太阳能发电系统在游艇上的优势)

(1)Provide power through solar power generation. As long as there is solar energy, it can generate electricity continuously and stably, and solve the hidden danger that the battery can no longer provide electric energy after running out;

通过太阳能发电提供动力，只要有太阳能，就能持续稳定发电，解决蓄电池用完不能再提供电能的隐患；

(2)Solar power generation can be combined with electric motor and diesel engine to reserve a new type of energy for yacht energy use;

太阳能发电可以和电动马达、柴油机结合使用，为游艇的能源使用储备一种新型能源；

(3)Solar power generation has the function of environmental protection, no noise and no vibration. It is a kind of sustainable energy.

太阳能发电对环境具有环保作用，没有噪音，没有振动，属于一种可持续性能源。

## Off-grid Solar Refrigerated vehicle System

### 离网太阳能冷藏车系统



#### 1: What is the off-grid solar refrigerated vehicle system (什么是离网太阳能冷藏车系统)

Solar refrigerated vehicle is a new system that uses solar energy resources to provide energy for on-board refrigerator. The system can maximize the use of solar energy resources and ensure the normal operation of cold storage when the engine is stopped. The traditional oil-fired power generation refrigeration is to frequently start the generator refrigeration mode, which has high requirements for the generator, large loss, and emits gases that pollute the environment. Solar refrigeration can greatly reduce energy consumption, noise and environmental pollution. It is a new type of environment-friendly refrigerated vehicle.

太阳能冷藏车是一种利用太阳能资源为车载冷藏机提供能量的新型系统，该系统可最大限度的利用太阳能资源，同时可在发动机停机状态下保证冷库正常工作。传统的燃油发电制冷是频繁启动发电机制冷模式，对发电机的要求高，损耗大，而且排放出污染环境的气体，而太阳能制冷可以大大减少能耗、噪音和环境污染，是一类新型环保型冷藏车。

#### 2: 独特优势(Unique advantage)

(1) Low energy consumption and less pollution. It uses solar energy for power generation. Through the conversion system of reverse electric appliance, it greatly saves energy and reduces exhaust emissions;

能耗低，排污少，它利用太阳能发电，通过逆电器这一套转化系统，大大节省了能源，减少了尾气排放量；

(2) Beautiful appearance. Just install a photovoltaic panel on the top of the carriage.

外观精美。只需在车厢顶部加装一个光伏板即可。

(3) Easy to use. Solar cars are equipped with automatic energy supply switching system, which can use traditional energy for energy supply in bad weather.

使用方便。太阳能车装有供能自动切换系统，在天气不好的情况下可以利用传统能源供能。

(4) Reduce the number of engine starts and delay the service life of the engine.

减少发动机启动次数，延缓发动机使用寿命。

(5) Refrigeration cooling speed is fast, improve work efficiency and reduce engine energy consumption.

冷藏降温速度快，提升工作效率，减少发动机能耗。

### 3: Constituent elements(组成要件)

#### (1) Solar power generation system(太阳能发电系统)



The whole system consists of solar cell module, charging controller, inverter and battery.

整个系统由太阳能电池组件，充电控制器，逆变器和蓄电池组成。

## (2)Heat pipe radiator (热管散热器)

Compared with the general radiator, the heat pipe radiator has high heat transfer performance, no moving parts, reliable operation, compact structure, small volume, light weight and high heat dissipation efficiency. It can be designed into various shapes according to the design requirements.

与一般散热器相比，热管散热器具有高传热性能，无运动部件，工作可靠，结构紧凑，体积小，重量轻，散热效率高，可根据设计要求设计成各种形状。

## (3)Support frame (支撑架)

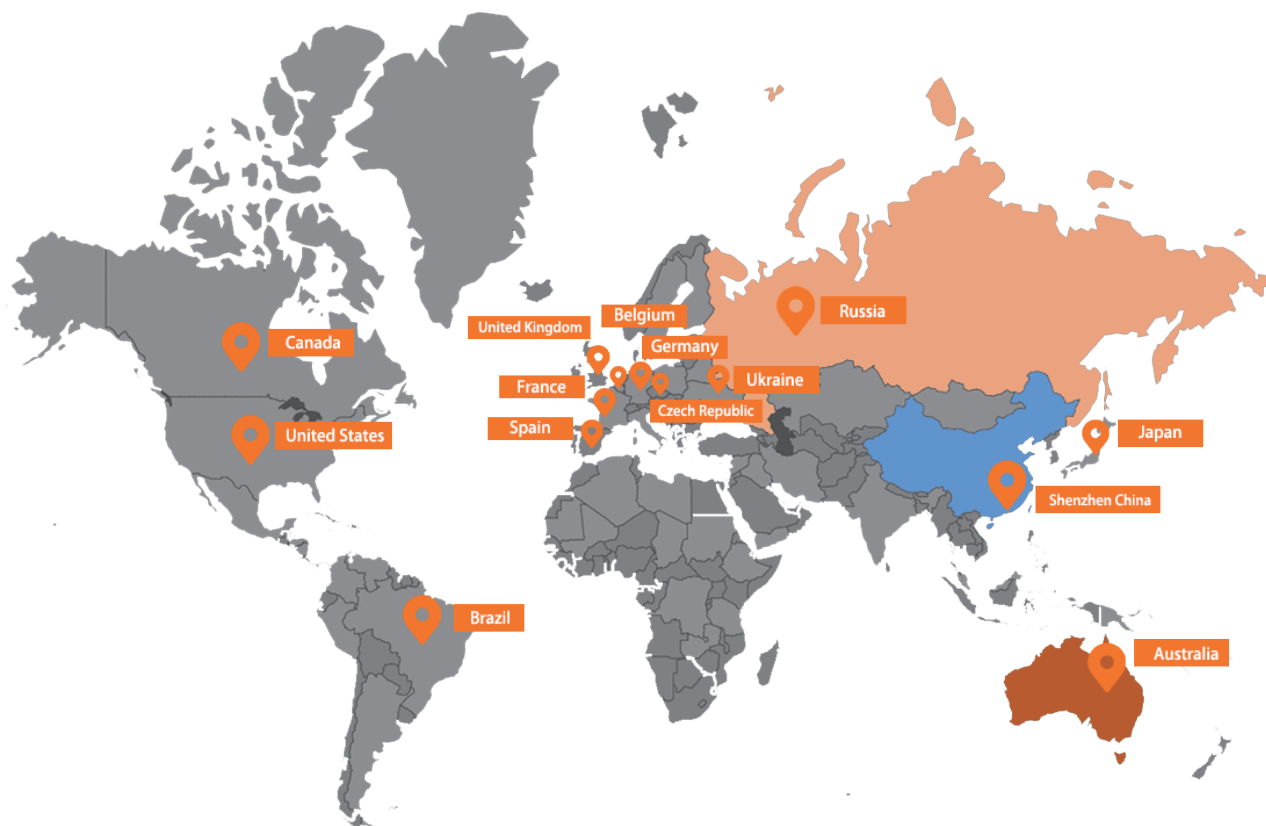
Properly adjust the angle of the solar panel on the top of the carriage according to the change of region and solar height, so as to make the sunlight incident vertically as much as possible, which is conducive to improving the power generation efficiency of the solar panel.

适当根据地域，太阳高度的变化调整车厢顶部太阳能电池板的角度，使太阳光尽可能垂直入射，有利于提高太阳能电池板的发电效率。





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