

# Efficient use of solar energy

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**Abstract:** This paper is mainly about the use of solar energy in life to make a summary, and how to improve the utilization of these aspects to make suggestions. Sunlight transmits electricity to the earth all the time. If the total radiation power from sunlight to the earth is converted into power generation power, it can reach  $1.77 \times 10^8$  kW, which is several hundred million times larger than the current global per capita consumption of electricity. There are not only a lot of sunlight, but also all green energy sources from sunlight, such as wind energy, tidal energy, microbial energy, hydraulic energy, etc., all belong to renewable energy sources. As long as there is sunlight, renewable energy sources are as constant as sunlight. In the process of the efficient development and utilization of solar energy, the photovoltaic utilization of nuclear energy has become the fastest progress around the whole world in recent years, the most vitality of the scientific research field.

**Keywords:** Solar energy; Green energy sources; Renewable energy sources.

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## 1. Introduction

Solar power system has its own unique advantages, mainly including: free power; No moving parts that will wear out, break or require replacement; Keep the system running with minimal maintenance; The system is a component that can be quickly installed at any location. No noise. According to statistics from the International Agency for Regeneration and Energy, the world's energy needs could be met by installing solar photovoltaic systems on four percent of the world's deserts. Therefore, the solar energy recovery system has a huge development prospect space, its development potential will be very huge. Besides, for the moment, the human has begun to gradually explore in the field of using solar energy, from the use of solar desalination, to the use of photoelectric effect to generate power, we will never be stopped on the study of solar energy utilization, this article will from the use of solar energy to generate power to start heating and desalination, and improve the efficiency of solar energy utilization at present.

## 2. Application of solar energy

### 2.1. Generate electricity and heating.

Solar water heater: Mainly using solar energy to convert light to heat.

Photothermal conversion: photothermal conversion refers to the process of using reflection, absorption or other means to aggregate the heat energy of solar radiation and convert it into a high enough temperature so that it can be more efficiently adapted to the needs of various loads.

Solar water heater is a heating device that converts solar energy into energy and heats seawater from low pressure to high temperature to adapt to the temperature application in the process of human activities and production. Solar Water heaters are divided into vacuum tubular solar water heaters and flat-water heaters panel type solar water heater according to the structure type, generally with vacuum tube-type solar water heater in the majority, occupying 95 percent of the market share in China. The vacuum tube household solar water heater is composed of the key components such as the collector, the storage bucket and the support. The conversion

of sunlight into energy is mainly dependent on the vacuum collector, and the vacuum collector uses the basic principle of temperature rise and cold water drop, so that the warm water circulation system to obtain the required temperature.

The main characteristics of vacuum tube type solar water heater, solar energy directly through the first layer of the Windows without straw on black without absorbing layer on the second floor window, attracted to the heat of the sun, because of the heat preservation and heat insulation layer inside the window is to use a vacuum, so the quantity of heat transfer will be greatly reduced (radiation heat transfer will still be in place, but the lack of heat transfer and thermal convection), and part of the heat pipe to the Windows Pipe the water in the heating of the surface, make the window, at the same time, hot water is lighter and up down the window tube heating surface into the water tank insulation window glass, the water in the bucket corresponding lower water along the pipe under backlight surface into Windows window, such repeated cycle, the water continued to heat up the water tank insulation window glass, and then achieve the purpose of the electric water heater.

The operating characteristics of the solar water heater system on the platform: the technology uses the heat collection plate for circulation because of the heat siphon, so that the energy on the solar light to the heat collection plate is quickly transferred to the sink, and the heat energy is transferred to the cold water through countercurrent heat exchange (jacket or coil) inside the sink. The medium can also be transferred through a pump system for energy transfer.

### 2.2. Solar water heater mainly consists of

#### 2.2.1. Collector

Vacuum tube: the structure is divided into outer tube and inner tube, and the outer wall of inner tube is coated with selective heat absorption coating. The panel of the flat solar water heater is coated with black manganese and other heat absorption film, welded to the panel with steel pipe

#### 2.2.2. Heat preservation water tank

Storage capacity for solar hot water. With vacuum tubes, the collected solar hot water must be stored in an incubator to avoid heat loss. The volume of the solar water heater refers to the liquid volume that can be used in the real air water heater,

excluding the volume of gas that cannot be used in the vacuum tube. For the pressurized solar water heater system, the volume is the medium volume for heat exchange. Solar water heater heat preservation water tank is mainly composed of three aspects, such as the inner liner, heat preservation plate and the shell of the box. The tank is the key place to store warm water from sunlight. The quality of the materials used and the anti-corrosion performance are the key points. At present, there are mainly stainless steel, enamel and other materials on the market. And the quality of insulation layer and other materials directly affect the insulation performance, temperature is particularly critical in the low temperature period. At present, the best waterproof method for polyurethane and other integral foaming waterproof. The shell is usually made of watercolor steel plate, aluminum zinc plate and other stainless-steel plate. Fireproof flume has good heat preservation performance, corrosion resistance, and clear water quality.

### 2.2.3. Stents

Supports the shelf between the collector and the insulated sink. General requirements for strong structure, high thermal stability, wind and snow resistance, aging resistance, no rust. The material is usually made of stainless steel, aluminum alloy or steel sprayed with plastic.

### 2.2.4. Connection pipe

The principle of solar water heater is to make cold water first into the storage tank, and then use the collector to put energy into the insulation performance box. The electric storage tank is connected with the indoor external cooling and heat pipe, so that the whole device constitutes a closed loop. It is very important to set up and connect the proper solar energy pipeline to obtain the best operating environment for the solar energy installation. Because the solar pipeline needs thermal insulation design, it is necessary to install the heat belt on the outer wall of the pipeline in the cold areas of the north to ensure that users can still use first-class solar hot water even in the cold winter.

### 2.2.5. Control unit

General household solar water heater system requires automatic or zero-point five manual work, so the control is not less, the most common control is manual water, water full off water and indicate the temperature and level, and the solar water heater system with electric auxiliary heater has leakage protector, prevent dry burning and other control functions. There are intelligent solar water heaters remotely controlled by SMS in the market, which have the functions of temperature level information, fault alarm, turning on Sheung Shui, turning off Sheung Shui, turning on electric heating, etc., which greatly facilitates users.

## 3. Solar energy panel

Solar panels are devices that convert solar radiation into energy directly or indirectly through the photoelectric and photochemical effects of collecting sunlight.

### 3.1. Structural components

Solar photovoltaic piece of glass material must be adopted by the light transmittance over ninety-one percent and super white toughened glass, and packaging material must be used Eva, the transparent Eva material quality is directly related to the life of the product, and the solar cell is also the foundation of the whole system, power systems products the main material is crystalline silicon solar cell and thin film too Yang

can cell, low cost of crystalline silicon solar cells, but energy consumption and power battery compared to the cost is higher, but the photoelectric conversion efficiency is high, and thin film solar cells compared to the cost is higher, but the energy consumption and power battery, cost little, and the photoelectric conversion efficiency is lower than crystalline silicon cells, but also can be in weak light With electricity.

The frame is generally made of aluminum alloy, and the film is required to be sealed, insulated, waterproof, and aging resistant materials, such as TPT and TPE

The function of the junction box is mainly to protect the whole power generation system and play the function of the current transfer station, and the most important thing in the junction box is the use of the bipolar body. Due to the different types of batteries in the module, the corresponding secondary tubes are also different.

### 3.2. The water distillation

Solar brine distillation device, also known as "solar distilled water device", "solar purification equipment". It is a device that can directly treat sewage, ocean desalination and salt crystal of salt water by sunlight. Therefore, it is also called "solar desalination device", "solar salt crystal device". It can use sunlight to generate heat energy to increase the temperature of sludge, seawater or salt water and make it vaporize. The high salt and hydroxide remaining in sewage are condensed into distilled water, so that the sewage is purified, water quality is desalinated and crystallized salt is obtained.

A disc solar still is a small, fully sealed greenhouse with a thin layer of seawater inside a shallow, blackened dish made of glass or transparent material with a transparent roof. After a small part of the solar radiation is reflected in the water through the roof, the remaining part is absorbed by the surrounding water through the black lining of the plate, and the surface temperature rises and starts to evaporate.

Cover because by air cooling, cap air temperature is less than the room temperature, steam of the steam produced in the chart under the cap surface condensation and emits latent heat of vaporization to the cap of the right Angle, condensation water is under the influence of pressure along the hood down, gathered to set flow groove, finally through the device exhausted from port of discharge of as finished sea water distiller.

Active solar distillation apparatus equipped with auxiliary equipment, so can improve the working environment temperature, the inside of the heat and mass transfer process has also improved, and the most active solar still, which can take the initiative to use water vapor produced in the process of condensation latent heat, so the active solar distiller can obtain more than ordinary disc solar stills or several times in the water production rate.

The solar radiation energy of the concentrated solar water still is attracted by the CPC solar collector (compound parabolic concentrator), which is a heat pipe vacuum tube collector) and then reflected to the lower part of the installed water tray, so as to increase the heat supply at the lower part of the water still. The CPC solar collector of this kind of equipment is installed on inclined plane, so it is especially suitable for application in high latitude area. Moreover, because the height Angle of sunlight is small in high latitude area, it is especially convenient to bring sunlight into CPC solar collector, so the utilization rate of CPC solar collector is also very high. Moreover, the water yield per unit daylighting

volume of the device can be increased by about 20 percent compared with that of the traditional disc solar distiller.

## 4. Improve the efficiency of solar energy utilization

### 4.1. Power generation and heating -- materials

Power generation: the selection of solar cell material is the primary reason related to the quality of the entire solar panel. We currently use to power most of the solar panel's solar cells for polycrystalline silicon battery production, and make material of polysilicon enterprise's main advantage is relatively simple, low cost, although can be popular, but its photoelectric conversion efficiency is only fifteen percent, compared with DianZhuan open speed by twenty-four percent for single crystal silicon is far short power battery, and its life is greatly Not as good as a single crystal silicon solar cell. Now a large amount of monocrystalline silicon power battery project has been invested in our country. With the further improvement of monocrystalline silicon power battery technology, its photovoltaic conversion efficiency is also increasing, but the cost of manufacturing and production is still huge, which makes it unable to be widely and deeply applied. Third generation solar energy for perovskite solar cells, is the use of the perovskite structure material for solar battery material suction light, belongs to the third generation of high efficient effect of representative in the battery, with high efficiency, low cost, high and advantages of the perovskite ghost height is adjustable, can produce efficient laminated batteries, the theory of two laminated batteries conversion efficiency can be as high as forty percent, 3 The theoretical conversion efficiency of photovoltaic cells with segments or more could be as high as 50%, far exceeding current silicon-based solar technologies. The best available material is double-junction gallium arsenide, which uses 32.9% of the solar energy. GaAs is a group III-V compound zero-point five conductor material, which has an ideal match between the energy gap and the solar spectrum and can withstand high temperature. Compared with silicon solar cells, GaAs solar cells have high characteristics, and has the advantages of high conversion rate, strong plasticity, good temperature resistance, good low light. But its high price and low battery life are among the big problems it has to overcome before it can officially enter the energy sector.

### 4.2. Solar distillation -- thin liquid film and thermal localization

The main reasons for the great harm to the evaporation surface are :(1) the distance between the graphite particles on the evaporation surface; (2) Volatilization coefficient of water on evaporation surface; (3) Evaporation surface superheat. On the solar distiller, the mass of the distiller can be increased by suspending the micron particle layer, because these particulate matter makes the sunlight attracted from the evaporation surface, so that the energy is concentrated on the evaporation surface, resulting in the effect of heat localization, thereby reducing the heat loss, but also increase the system's working temperature and distillation speed. With the addition of one wt% of suspended graphite micron particulate matter, the distiller's capacity was increased by nearly 50%. Adding phase change material to a still containing graphite particles can increase the total capacity of a still by about 65 per cent. A floating solar evaporation device would allow graphite or micron particles to float on the surface of the ocean, rather

than beneath it. The device produces a thin liquid layer on the steam surface, which further strengthens the thermal localization effect on the steam surface, thus greatly improving the solar energy efficiency. Under the solar radiation of 1 kW /m<sup>2</sup>, the thermal efficiency of floating distillation equipment can reach 78 percent. When the graphite particle size changes, the efficiency of distillation energy increases slightly. But when the graphite content increases, the evaporation energy efficiency increases at first and then decreases. The suspension evaporation system uses the free convection mode of brine to dilute the high concentration organic wastewater salt solution in distillation. In addition, when the evaporation unit of the suspension distillation system produces a small wide depth ratio, it has a higher salt discharge characteristics and thermal efficiency, which is more conducive to the solar distillation machine.

## 5. Conclusion

For solar power generation and heating, they have strong stability, and to improve their efficiency, we should mainly start from the aspect of materials. Currently popular semiconductor materials are an important entry point to improve the efficiency of solar power generation and heating. Solar power generation and heating can serve various fields with the help of semiconductor materials.

For the field of producing fresh water by solar energy, there are more new technologies and new methods to increase the evaporation efficiency. For example, the mass of the evaporator can be increased by suspending the micron particle layer of graphite. At the same time, the energy can be concentrated on the evaporation surface, so as to produce the effect of thermal localization, reduce heat loss and improve work efficiency.

In modern times, due to the emergence of the third generation of solar cells, it will mean that human's exploration of solar cells has reached a new height, but on this basis, we still face some problems. One is the price problem. We should develop low-cost semiconductor materials as soon as possible to achieve mass production of efficient solar cells. The second problem is the conversion rate of solar energy. The current conversion rate is relatively low. Improving the conversion efficiency should be the focus of the current solar energy research. Due to the increasing demand for new energy, solar energy will gradually show greater advantages in the future.

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