

# Fossil fuel Energy 0 Solar thermal desalination system Applied Research

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**Abstract:** Solar thermal production steam system and seawater desalination system, solar thermal energy as the system power source, photovoltaic power generation and other renewable energy source, as a system device power source, integrates high-temperature steam and seawater desalination devices into an integrated system to achieve a fossil fuel energy 0 energy consumption Sun Thermal desalination system. and taking a solar thermal desalination demonstration project in Hainan as an example, the detailed performance and effect of the system are applied in the analysis, the system configuration is summarized after the system is successfully produced, and the future development direction and prospect of solar seawater desalination are prospected.

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water resources are basic natural resources and strategic economic resources, The sustainable use of water resources is a major strategic issue related to China's economic and social development. The situation of freshwater resources in China is not optimistic. National 660 multiple cities with @ Multiple cities lack water, where 108 is a serious water-deficient city. The shortage of freshwater resources and even water crisis is a major constraint factor in the process of sustainable development of China's economy and society.

Seawater utilization is an important measure to solve the water resource crisis in China. I. Develop efficient and isolated solar thermal seawater desalination systems, facilitate the use of clean, unlimited solar energy to make fresh water in the, and achieve real fossil fuel energy zero through the comprehensive renewable Energies Supplement Consumption is of great economic, social and military significance.

This so-called fossil fuel energy 0 power consumption, refers to the system equipment operation requires energy from solar energy, wind and other new energy. the combines the first demonstration project of solar thermal desalination in the whole country to study the comprehensive operation characteristics of a variety of energy sources including solar energy, solar light and wind power. Through the solar light Atami Water Desalination system internal different forms of energy (Wind/Light Scientific Schedule<sup>[1]</sup>, research to meet the production requirements of high quality water desalination, real Now increases energy efficiency and reduces system energy consumption.

## 1. Solar thermal Production steam system

Solar thermal Steam production system See map 1, the system main package The includes solar collector modules, steam-water circulatory systems, and steam-drum replenishment system.

Figure 1 Solar thermal Production steam system

Fig. 1 Solar Thermal Steam generation system

Solar collector module adopts linear Fresnel solar collector system EC<sup>[2]</sup>, the reflective array will be a one-dimensional planar horizon array of solar energy volume set reflected on the collector in the. The collector is

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arranged inside the pipe, and the sun heats the collector, which causes the water flowing in it to evaporate.

the steam-water system consists of a drum, a circulating pump and a circulating pipe. Water flows out from the bottom of the drum, through a circulating pump that pumps water into the collector's inlet box, the water absorbs heat in the collector and returns to the drum, forming a loop back to the drum. The saturated steam in the drum is discharged from the top and into the seawater desalination device.

The Steam Drum Replenishment system is composed of a feed water pump and a recharge water tank. The system is mainly used to balance the water vapor of the steam drum before the equipment is started and to ensure that the equipment runs.

## 2. Seawater Desalination System

seawater desalination In this system adopts low-temperature and multi-effect distillation method, which refers to the maximum evaporation temperature of brine, °C desalination technology, its feature is a series of horizontal tube falling film evaporator in series and is divided into several groups by the, with a certain amount of steam input through a number of steam hair and condensation, resulting in more than the amount of heating steam of distilled water<sup>[3]</sup>. The power energy required for this desalination plant is high-temperature steaming, while the solar thermal steam system provides the required energy for this device, so the combination of the two can make up the solar energy thermal desalination system, ideal for islands off the continent.

Put into use.

## 3. Electrical System

in order to achieve zero fossil fuel energy input, the system power supply should mainly include photovoltaic power generation, wind power generation, diesel power generation. The normal runtime system is mainly photovoltaic power generation, supplemented by wind power generation. Diesel the oil generator works only when power is cut off from the power grid to simulate conventional power generation on a typical island. New energy sources such as photovoltaic and wind power are made up of small grids with diesel generators through inverters. At the same time, the project set up a set of batteries for the lack of new power generation.

the project electrical system also sets the load adjuster. the load adjuster automatically adjusts the load of the input based on system power generation to allow the system to output power completely from load consumption and to power balance.

## 4. Solar Thermal Desalination System Application Example

The First National solar Thermal Desalination demonstration project as an example of application analysis. The project seawater desalination plant is powered by solar energy, the steam generated by the thermal system, and photovoltaic power is auxiliary, using low-temperature-efficient seawater desalination technology to produce desalination water. Realize the power, water, heat and other comprehensive energy utilization maximize, reduce system energy consumption. Solar light heat seawater desalination system as shown in Figure 2.

internal different forms of energy (Hot/electricity; Wind/light/Steam etc) Science scheduling to meet the production requirements of high quality desalination water and improve the implementation energy efficiency and ultimately the purpose of reducing system energy consumption.

Solar collector module with 5M<sup>2</sup> Linear Fresnel Solar Tracking Focus set Thermal module, production 170 °C, 0.7MPa of steam to meet the requirements of low-temperature and multi-effect seawater desalination devices. Steam system is closed loop, with 2 Table Circulation Pump (1 the open 1, and the media water is continuously heated by a collector. The system works when the sun's light is strong or weak, maximizing heat from the solar light heat, and turning water into saturated steam in the drum as a heat medium for the desalination plant. In order to replenish the steam drum evaporation consumption of the water, set another 2 table Feed pump (1 open 1 Prepare add water from fill the box hits the drum.

the system PV power generation equipment includes block photovoltaic panels, total count 380 kW. The direct current generated by PV is converted to 380 V AC power through the inverter. The wind power generation system takes a set of 5 kW WindForce Generator set of, matching the grid-connected inverter with 5 kW. This item is configured with block voltage to V Battery, block battery Press 4 block the 1 Group is divided into 4 Group, per group 1 Ah, +V, groups and groups. It uses a parallel connection between page Ah. In addition, the item is also configured with 1 set kVA the diesel generator for works under the condition of disconnecting the power grid. This project seawater desalination distribution system is shown in the Figure 3.

system by Linear Fresnel solar focusing system, steam systems, photovoltaic systems, wind power systems, low temperature, multi-effect seawater

Fig.3 Seawater desalination Power distribution system

The Solar thermal desalination system includes seawater diving pumps, thick salt water pump, product pump, etc. more than 10 units, through the analysis of the load function, seawater diving pump, thick salt water pump, product pump can run separately when other loads are stopped, and you can not participate in the intermediate process of and desalination. The drum filling pump can be run only when is required. In addition, the evaporator circulation pump, seawater feed pump, cold

The photovoltaic equipment selected in this project is more than the load demand for a long time and can satisfy the normal operation of the seawater desalination system, and the initially realizes zero energy consumption seawater desalination. Figure 4 Show Project New Energy system daily Time (8.30~16.00 The output power of the).

area is  $m^2$ , seawater desalination device covers an area of  $m^2$ , Steam-producing equipment floor area  $m^2$ .

Solar Thermal Desalination Station after the completion of a single project can be solved summary people live with water. The construction of this project in the remote from the mainland to fill to the difficult island, can effectively reduce ocean island regular replenishment times number and replenishment, especially fresh water traffic, so that a large number of no The water uninhabited islands have the conditions of habitation and exploitation.

## 5. knot theory

With the first national solar thermal Desalination demonstration project as an example, through the application of solar thermal steam system, seawater desalination system, multi-energy coupled power generation system, the following conclusions are obtained:

### 5.1 through experiments, as long as the thermal system is operating normally, 0 energy consumption

In most cases, the new energy generation system configured for this project The output power of the EC is abundant after satisfying the load demand. Because this target Seawater desalination system is mainly for island areas, the area of electricity net more for small grid or solitary network, if not take measures to make surplus to lose The power consumption, the generation of overvoltage over current problems will be reduced to set The useful life of the standby, even affecting the stable operation of the system. Therefore, you should take steps to balance the new energy output with the load requirement. The project takes the form of a heater to adjust the load to convert the new energy power from the rich to heat. The Load regulation system adopts the combination of multiple Group heaters, which can be used to regulate multiple stalls and increase the precision and range of regulation. The heater can be installed in the steam Pack of the seawater desalination system heat part, with a set of hot arrays to increase steam production. The entire system is controlled by the PLC through the individual heaters

the opening and closing of the loop switch can automatically adjust the operation. load tuning system logic diagram

See diagram 5. At present, the project has been fully put into use for solar thermal production

Desalination is technically feasible. But new energy is affected by the weather.

Large, output power is not stable, if on the island, need to be equipped with storage power pool or diesel engine to stabilize output or as an emergency power supply.

5.2 wind turbines run unstable. Mainly in the wind speed low when the fan does not start, wind speed high when the fan will also be protected by the need and downtime. Moreover, even in the allowable wind speed, due to the wind speed of the variable caused the fan output power fluctuations are also large, resulting in access to the wind machine, the load regulator heater frequently cast back, not to facilitate the stable operation of the system.

The use of solar energy and wind energy renewable energy for seawater desalination of the power source, effectively solve the seawater desalination energy consumption problem. Solar can be light and heat desalination technology industrialization can lead to pollution-free low-carbon through Jinan, water resources efficient recycling economic development of the industry.

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