Research on Electric Control Device of Hybrid Energy in Household Air Conditioning

Yanyan Zhang
School of Energy and Architectural Engineering, Shandong Huayu Institute of Technology, Dezhou, Shandong, China
e-mail: nyyjzgcxy@huayu.edu.cn

Abstract. Hvac energy consumption is the construction of large energy consumption, in order to realize building energy conservation to reduce the energy consumption of hvac operation, through the research by a thin film solar battery, connecting wires, charge and discharge controller, the electric control board outdoor, indoor machine electric control box, electronic circuit control board, switch and battery of household air conditioning hybrid energy electrical control devices, When it is sunny, the direct current generated by the solar cell group is directly supplied to the indoor unit. When it is cloudy, it is switched to the power supply to the indoor unit, forming a hybrid power supply mode for complementary use, which can effectively reduce the electric energy consumed by the operation of HVAC and realize energy saving in the operation of HVAC.

1. Introduction
Building energy consumption has a large proportion in the total social energy consumption, generally accounting for 30% ~ 40% of the total national energy consumption, and HVAC energy consumption is a large part of building energy consumption, accounting for up to 22.75% of the total energy consumption, the control of HVAC system operation energy consumption can achieve building energy saving. At the present stage, with the continuous innovation and development of science and technology, new energy and new technology are gradually applied in the field of building HVAC. Through the continuous improvement of the core technology of the air conditioning system, the goal of low consumption and low cost of modern buildings is realized. For example, the voice of renewable energy in the energy production industry is rising day by day. As a clean, renewable and green energy, solar energy is inexhaustible. The utilization of the energy generated by the sun has increasingly become the focus of people's attention. If the use of solar power, it can provide a large amount of renewable energy, can effectively alleviate the energy shortage. Currently, home solar conversion systems are either photovoltaic solar collectors or solar water heaters. In cities, however, the installation of solar panels is limited by the availability of space, which limits the type and amount of solar panels that can be used. Therefore, the study of a household air conditioning hybrid energy electrical control device provides a solution for HVAC energy saving.

2. Performance analysis of household air conditioning hybrid energy electrical control device

2.1. Hybrid energy electrical control device structure of household air conditioning
In order to solve the high energy consumption of air conditioning caused by comfortable environment, it is imperative to study a hybrid energy electrical control device for household air conditioning to
replace the original electrical control device for indoor units. Household air conditioning hybrid energy electric control device, the structure including thin film solar battery, connecting wires, charge and discharge controller, the electric control board outdoor, indoor machine electric control box, electronic circuit control board, switch and battery, mainly divided into three parts: thin-film solar battery, electrical control module, battery. As shown in figure 1.

Figure 1. Schematic diagram of household air conditioning hybrid energy electrical control device.

The first part is thin film solar battery, thin film solar battery pack 1, charge and discharge controller outdoor parts 2, 3 wires and electric control board 4, this part mainly is to thin film solar battery pack is installed in the shell, outdoor when sunny solar energy collection and delivery to the air conditioning indoor machine electronic control board. As shown in figure 2.

Figure 2. Schematic diagram of outdoor electrical control board

The second part is the electrical control module, which is composed of the indoor electrical control box 5, the electronic circuit control board 6 and the transfer switch 7. The electronic circuit control board receives the direct current transmitted by the connecting wire and is directly distributed to the rectifying filter power supply circuit. After voltage stabilization, it is sent to CPU circuit, signal drive circuit, internal fan control circuit, indoor blowing direction control circuit and display and remote control receiving circuit to maintain the normal operation of indoor unit. When the power stored by the battery group is not enough to drive the indoor unit circuit to work normally, the transfer switch will automatically switch to the mains power to ensure the normal work of the indoor unit. As shown in figure 3.
The third part is the battery group. The eight parts of the battery group are mainly to collect the solar energy from the thin film solar cell group 1 when the sun is sufficient for storage, for the use of the electronic circuit control panel of the indoor unit when the light is insufficient.

Thin film solar cells are a new type of photovoltaic devices to alleviate the energy crisis. They only need a few microns in thickness to realize the photoelectric conversion, and the current conversion efficiency can reach up to 13%. Thin film cell Solar cell is not only flat, but also flexible and can be made into non-flat structure. It can be combined with buildings or become a part of buildings. It has a wide range of applications and is the ideal material for reducing cost and improving photon circulation.

2.2. Working principle of hybrid energy electrical control device for household air conditioning

The thin film solar cell pack 1 is installed on the top, front (leave the fan outlet) and both sides of the air conditioner outdoor unit, responsible for collecting solar energy when the sun is sufficient, and converting the collected solar energy into direct current. By connecting wire 3, the converted direct current is directly transmitted to electronic control line 6 of indoor air conditioning unit for daily use through charge and discharge controller 2, and the other part is transmitted to battery group 8 for storage. After receiving the direct current from the connecting wire, the electronic circuit control board directly distributes it to the rectifying filter power supply circuit, and then sends it to the CPU circuit, the signal drive circuit, the internal fan control circuit, the indoor blowing direction control circuit and the display and remote control receiving circuit to maintain the normal operation of the indoor unit.

When the power stored by the battery group 8 is not enough to drive the indoor unit circuit to work normally, the transfer switch 7 will automatically switch to the mains power to ensure the normal work of the indoor unit. This can save the power consumption of the indoor unit of household air conditioning, reduce the energy consumption of air conditioning, and achieve energy saving.

2.3. Installation scheme of household air conditioning hybrid energy electrical control device

Thin film solar cell pack 1 size and air conditioning outdoor unit shell size is equal, installed and fixed on the top of the air conditioning outdoor unit, the front (set aside fan air outlet) and two sides; Charge-discharge controller 2 is installed on the outdoor electrical control panel 4; Connecting wire 3 and other signal wires are fixedly connected to the indoor electrical control box 5; Electronic circuit control board 6 and transfer switch 7 installed in the indoor electrical control box 5, fixed to the upper left corner of the indoor machine; Battery pack 8 is made into a rectangular shape with the same length and width as the back plate of the indoor unit, and is installed and fixed to the upper space position of the outer shell of the indoor unit. As shown in figure 4.
The concrete realization methods of household air conditioning hybrid energy electrical control device include: Will thin film solar battery pack is installed on the top of the air conditioning separate-bodied air-conditioners, front (set aside the fan outlet) and two side, is responsible for the collection when sunny solar energy, and convert the collected solar energy into direct current, by connecting wires to the converted dc part of the charge and discharge controller directly to the air conditioning indoor machine electronic control circuit used in daily work, A portion is fed to the battery bank for storage. The electronic circuit control board receives the direct current transmitted by the connecting wire, and directly distributes it to the power supply circuit of the indoor unit. After voltage stabilization, it is sent to the CPU circuit, signal drive circuit, internal fan control circuit, indoor wind direction control circuit and display and remote control receiving circuit to maintain the normal work of the indoor unit. When it is cloudy outside, first use the electricity stored by the battery group to work. When the electricity stored by the battery group is not enough to drive the indoor unit circuit to work normally, the switch will automatically switch to the mains power, so as to ensure the normal work of the indoor unit.

3. Conclusions
Through the application of this research project, the power consumption of the indoor unit of household air conditioning can be saved, the energy consumption of air conditioning can be reduced, and energy saving can be realized. At present, the indoor unit of household air conditioners in the market does not have dual energy working characteristics, so the device has low transformation cost, simple structure, simple installation, good energy accumulation effect, and makes full use of solar energy to reduce the energy consumption of air conditioners. It has strong novelty, creativity and practicality, and has a broad potential market and high economic benefits.

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