Integrated Design of Solar Energy Utilization and Building Based on PLC

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Abstract. At present, fossil energy consumption still occupies a dominant position in China's energy consumption structure, and problems such as low energy consumption efficiency, high degree of carbonization and large environmental pollution persist for a long time. Under the background of advocating environmental protection and energy saving, the combination of solar energy and building is the inevitable trend of building energy saving development, and the integrated design of solar energy and building has become a concern of the architectural circles. With the deepening of people's understanding of environmental problems and the further deterioration of energy problems, more and more buildings begin to use clean and energy-saving solar energy devices. At present, the construction and development of urban residential buildings in China are mainly multi-storey and high-rise buildings. Therefore, higher requirements are put forward for the application form and scale of solar water heating system in residential buildings. In this paper, according to the current situation of solar energy utilization in buildings in China, based on PLC (programmable logic controller), the paper puts forward some suggestions to promote the integrated design of solar energy buildings.

1. Introduction
People today are facing severe energy crisis and environmental damage. Traditional non-renewable energy sources such as coal, oil and natural gas have been unable to meet the needs of the rapid development of human society. At the same time, the harmful gases released during the use of these traditional energy sources have a great impact on the natural environment [1]. Solar buildings have developed from traditional solar heating buildings to buildings that can integrate new technologies such as solar photovoltaic, solar hot water, solar absorption cooling, solar ventilation cooling, controllable natural lighting, etc., becoming a high-tech content, low resource consumption, and environmental load Small suitable building technology [2]. As the driving force of world economic growth, energy's importance directly affects the development of human society. My country is a major energy consumer. With the rapid development of the national economy and the improvement of people's living standards, the demand for energy in production and living has increased significantly [3]. Traditional fossil energy sources such as coal and petroleum are the main sources of energy for people's lives, but as one-time consumption of energy, they are increasingly depleted. At the same time, new alternative energy sources and their production systems have not yet been established [4]. As the pillar industry of our country's national economy, the construction industry has played a huge
role in promoting the national economic development and has also brought a huge energy consumption burden to the society [5].

The global climate continues to warm and the ecological environment is gradually deteriorating. The economic development and environmental problems of countries around the world are facing severe tests. The issue of energy conservation and emission reduction has become a top priority for many countries [6]. The problem of lack of energy highlights the benefits and has affected the sustainable development of our national economy and the normal production of industry and agriculture. Optimizing the energy consumption structure, improving energy utilization, and promoting the development of hydropower, nuclear energy, solar energy, and other renewable energy sources have become the first choice for solving the current energy consumption problems of buildings and environmental pollution [7]. Solar energy is the energy produced by the continuous nuclear fusion reaction process inside the sun. Compared with mineral energy, solar energy is inexhaustible, has a wide range of applications, and does not generate environmental pollution. It is a sustainable use of green energy [8]. The combination of solar energy and buildings provides a broad prospect for buildings in terms of energy saving and ecological development. PLC (programmable logic controller) is a controller specially designed for industrial environment. It has the advantages of high reliability, good adaptability, rich modules, perfect functions, flexible expansion, etc. It has been widely used in the field of industrial control [9]. In this paper, based on the current status of solar energy utilization in buildings in my country, suggestions for promoting the integrated design of solar buildings are proposed based on PLC.

2. Basic technology of solar photovoltaic building

Solar photovoltaic power generation means that solar energy is converted into electric energy through solar photovoltaic cell modules. Solar cells, also known as photovoltaic cells, generate electricity based on photovoltaic effect. When the sun shines on the solar cell, the cell absorbs light energy and forms photo-generated electron-hole pairs inside. Photovoltaic effect refers to the physical phenomenon that when a semiconductor is irradiated by light of appropriate wavelength, the semiconductor absorbs light energy and generates electromotive force. The application of solar energy in buildings is the need of saving conventional energy, which has remarkable social and economic benefits and broad development prospects. The combination of solar energy technology and architecture should take architecture as the main body, focus on architectural design and architectural function, and achieve the organic combination of solar energy products and buildings. Solar energy components can be used to enhance the facade effect of buildings by making architectural changes, contrasting with other elements, or simply because many solar energy components are attractive in shape, size, color or surface texture. Photovoltaic module array is composed of solar cells connected in series and in parallel according to system requirements, which converts solar energy into electric energy under sunlight. It is the core component of solar photovoltaic system, and it is also an energy conversion device. In the flat plate collector, solar radiation shines on the heat absorption plate coated with high solar radiation absorption rate through the transparent glass cover plate, the heat absorption plate heats up and transfers the heat to the heat transfer working medium in the tube of the heat absorption plate, and the heat insulation material plays a role in reducing heat loss.

Photovoltaic cell module or photovoltaic cell array can only convert light energy into direct current energy under illumination, and the output power of electric energy is related to the intensity of light radiation, so it is necessary to combine photovoltaic cells with other equipment to form a photovoltaic power generation application system. After receiving the calculation request received by the service port, the security check service terminal will select the calculation method according to the specific calculation content and evaluate the accuracy of the calculation result. Fig. 1 shows the scanning speed modulation architecture of the power prediction model.
In order to maximize the collection of solar energy, the roof of the building is often perpendicular to the direction of the sun, so that a naturally inclined roof of the building is formed. For the calculation of the inclined plane radiation, you need to refer to the relevant formula and use the total horizontal plane radiation data to calculate:

$$H = H_b + H_d$$  \hspace{1cm} (1)

In the formula: \(H\) is the total solar radiation on the horizontal plane, \(H_b\) is the direct radiation on the horizontal plane, and \(H_d\) is the scattered radiation on the horizontal plane.

Because traditional fossil fuel reserves are used in the process of power limitation, the use of traditional fuels seriously harms the environment, and smart grids require large amounts of renewable energy as a new type of power source. Like the two non-cross protection rings in Figure 2, the "2" on the link indicates that the link consists of two fibers in opposite directions. When the working path of the service with bandwidth \(W\) passes through the link, the working link \(a\) or \(b\) belongs to only one ring network, and only one ring network protects the link of the service delivery node. If the service working link is \(a\), the protection capacity \(W\) of the ring network \(1a\) and the protection capacity of the ring network \(1b\) are 0.

If solar photovoltaic cells are connected by wires to form a solar panel, the solar panel with an area of one square meter can generate electric energy on average. And the greater the intensity of sunlight, the stronger the current. Solar photovoltaic building integration system is a complex system involving architecture, materials, electricity and other disciplines. Because the position of photovoltaic array and the intensity of radiation received are different, the output voltage and current of photovoltaic cells are also different. As a manufacturer of solar energy equipment, the main focus is on product development.
and upgrading, while the understanding of solar energy by architectural designers is limited to the application of passive solar energy technology in buildings. How to make more rational and full use of solar energy resources on the carrier of buildings, so that solar energy products can be combined with buildings in a standardized way. The current generated by solar photovoltaic cells is direct current, so it is necessary to convert the direct current into charging current and charging voltage that meet the requirements of the battery pack.

3. Integrated design of solar energy and architecture

3.1. Combining solar energy technology with architectural space aesthetics
In the past period, because the installation of solar water heaters was not organically integrated with the design of the building, or the overall shape of the building was not enough, especially on the roof of residential buildings, the installation of solar water heaters formed roofs with different specifications and variable forms, causing a disorderly and disorderly state and destroying the appearance of the building. The direction of integration is the key to solving this problem. For a long time, my country's solar water heaters are basically in a small, bulk, and domestic use state. Extensive installation and use methods have had many adverse effects on building energy efficiency and appearance image [11]. In the integrated design of solar energy buildings, solar equipment components form part of the building together with other building components to form the overall shape of the building. In the initial design, the effect of the solar system on the appearance of the building is fully considered, and the solar energy and the building are functionally and aesthetically tried Coordination. The integrated design of solar energy and building is to take the solar energy system as an organic part of the building, unified planning in the building design, design at the same time, construct at the same time, and put it into use at the same time. The auxiliary heating device is an important guarantee that the hot water can still be used normally when the sunlight is insufficient.

3.2. Integration of solar energy and building construction
With the development of new PLC technology, it has outstanding characteristics and advantages in processing digital operations, analog input and output, human-machine switching, and network communication. It has realized the progress from analog control to digital control, and its application scope and direction are becoming wider and wider. It is also used in the integrated control of solar hot water engineering and construction, which makes the control mode more user-friendly. In some designs, the roof slab is both the sloping roof of the building and the collector plate of the solar system. In order to achieve coordination between solar components and building components, it is necessary to have a corresponding understanding of solar technology and its products. The concrete body of the building will store the heat collected in this way and release it at night to heat the room [12]. In order to ensure the normal heat exchange of the household water tank, the correct judgment of the household temperature sensor, the water temperature in the circulation pipe should be kept within a certain range with the water temperature in the hot water tank. However, if the water temperature in the pipeline is too low, the household water tank cannot perform normal heat exchange. Therefore, when the water temperature in the pipeline and the water temperature in the hot water collection tank reach a certain temperature difference, the circulation mill must be turned on to heat the pipeline.

4. Conclusions
Energy is the cornerstone of human social progress and economic and technological development. Many local wars in the world are caused by competing for oil resources. After decades of development and application, solar water heating technology has become a mature technology. There are many kinds of solar water heating systems, and various products are also abundant. Solar building integration system is an effective way to solve the problems of high energy consumption and high pollutant discharge in construction industry, and at the same time, it can effectively promote the expansion of photovoltaic industry and optimize energy structure. The integrated design of solar
energy and architecture is to take solar energy system as an organic component of architecture, and to plan, design, construct and put into use in architectural design. When we design the integration of solar energy and buildings, we need to consider the factors such as building scale, environment, use function, economy, etc., determine the reasonable solar energy application scheme, and select the appropriate solar energy equipment or cooperative manufacturers, so as to reduce the one-time investment and operation cost of solar energy buildings. The application of the design concept and method of integrated collaborative design of photovoltaic buildings can effectively promote the cooperation among different specialties in architectural design, realize the integrated design of photovoltaic system and building components, and help promote the development of integrated photovoltaic buildings.

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