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BUILDING INTEGRATION TECHNOLOGY OF SOLAR POWER: A REVIEW

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Abstract: With the energy saving and energy use in buildings published during the last decade were reviewed according to the different methods or approaches used. Using solar energy in buildings helps to reduce consumption of conventional energy The past decades have witnessed a rapid development of solar energy in buildings .And explored a new way of the solar technology and residence, and make use of solar energy into the overall design technologies .And make solar facilities to be part of the building. The multifunctional use of solar elements taking over one or more envelope functions .It require an extra effort to building designers, for some modifications in the original design of the collector, in the way it is mounted in some parts of the building. On the other hand, it provides the major advantages cost reduction and an enhanced architectural quality of the integration. Buildings consume energy throughout their whole lifecycles, and many stages of building development.

Keywords: Building integration, photovoltaic, optical, thermal, solar energy, Integration in residential building

I. INTRODUCTION

Building energy consumption plays an important role in the national energy conservation strategies ie.25% to 40% of the total energy consumption. Rapid development of technology, thus the electrical energy consumption is increasing and also increasing energy consumption in the building sector .There is no definite technical alternative for saving energy in the building sector. In the 21st century the ability of buildings to supply their own electricity through photovoltaic as a future area to lead the industry. With more than 66 million residential buildings, nearly 5 million commercial buildings, and approximately 2.5 million farm sand manufacturing facilities, many with multiple buildings, the energy savings potential is enormous .By utilizing PV modules as the facing material of buildings thereby enhancing various value added principles including economic efficiency. Inherent function of electric energy production, the BIPV system performs multi functional roles by outer wall, roof, window and door. By replacing high priced architectural exterior materials, which are used in recent buildings, the economic efficiency of building integrated photo voltaic system increases.

II. SOLAR INTEGRATION TECHNOLOGY

Solar integration technology is the application of solar collection equipment to the roof of a building. It performs the function of a roof and collects solar energy. Many different systems active, passive, glazed, unglazed, focusing and non-focusing systems can capture solar thermal energy. Four different characteristics distinguish the various types of BIST roofing is that, Size of roof panel, heat transfer fluid containment, glazing, focusing methods .Application of solar energy and building integration technology need the coordination and joint effort of several departments etc. Solar energy and building integration technology is a comprehensive technical which combines multiple disciplines .It also requires the integration of construction process and technology. The initial investment of solar energy and building integration technology is high, and the construction cost is also high. The application of solar building integration technology in residential building mainly has three aspect: thermal technology, photovoltaic conversion, optical technology, and mainly set on roofs, balconies [2].

A. Thermal Technology

In thermal it is mainly used to supply domestic hot water, heating etc. Designing of the integration of solar hot water system and residential buildings improve the form of the system itself. Traditional solar hot water system cannot meet the need of solar energy integration in building either in quality or in performance .To meet the hot water needs installation area is correspondingly increased, hot water is not just use for bath, used for heating and supplying domestic water. Integrating solar collector with the roofs, balcony rails of the south façade, bay windows and walls, can make the appearance of residential buildings be overall unified. When installed on the flat roof, the flat-plate solar collector can act as roof covering or insulation layer and investment and reduce the cost. Glazed flat plate collectors are used in space heating. They usually consist of 10 cm thick rectangular boxes of about 2 m2, containing several layers. Unglazed flat plate collectors are used for low temperature space heating systems and made of a selective metal plate and a hydraulic circuit connected to this absorber. Working temperature is 50-65°C. Evacuated tube collectors are especially recommended for applications requiring high working temperatures such as industrial applications and also used for domestic hot water production and space heating. They are made of several individual glass tubes, each containing an absorber tube. The very high insulation power of the vacuum allows reaching very high temperatures (120-180°C) [5] [3].

Fig 1.Glazed flat plate collector

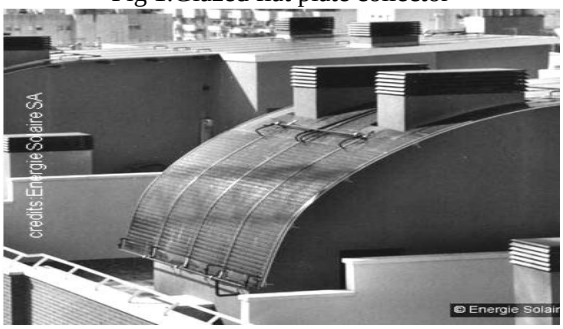

Fig 2. Unglazed flat plate collector

Fig 3. Vacuum tubes collector

B.Photovoltaic Technology

Photovoltaic is used in the building envelope will be described. Three main categories are used: roofs, facades, and external devices. These categories will include different technological ways of using PV in the envelope. Photovoltaic (PV) is a way of generating electrical power by converting solar radiation into direct current through the photovoltaic effect. Materials mainly used for Photovoltaic, include mono-crystalline silicon, polycrystalline silicon, amorphous silicon, cadmium telluride, and copper indium gallium selenite. The energy output from a single PV module is typically in the range of 180 - 250 Watts in bright sunshine. A photovoltaic system is normally built up from a number of panels (an array), linked together to produce a more significant energy output. Photovoltaic technology applying in residential buildings is mainly used for photovoltaic conversion and lighting. BIPV (Building Integrated Photovoltaic) is new application of solar power. Photovoltaic arrays do not take up additional floor space when integrate with the construction. BIPV can be divided into two categories according to the forms that photovoltaic array integrated with the buildings. One is the combination of photovoltaic array with building, the other is the integration of photovoltaic array with building.The PV modules produce direct current electricity .The inverter is used to convert the DC to AC .The AC output from the solar installation is wired back to the main consumer unit The consumer unit is connected to the electricity grid via an export meter. Such an installation is termed "grid-tied" because the electricity supply for the building is met by a combination of solar energy and grid electricity [1] [4].

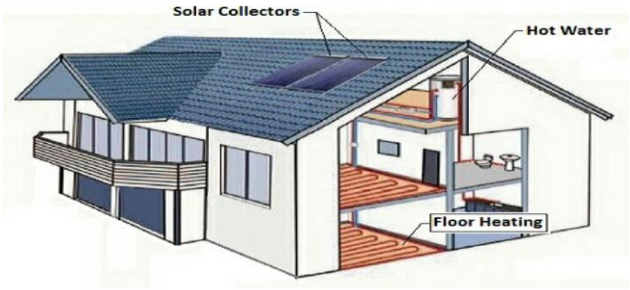

Fig 4. Scheme of a common grid connected roof integrated PV installation

C. Optical technology

Recently, energy and environmental concerns have made day lighting a rediscovered aspect of building lighting design. Day lighting is often integrated into a building as an architectural statement and for energy savings. The idea of piping light from a remote source to an interior space for illumination purpose appeared about 120 years ago light pipe is now being adopted and applied world widely for both artificial and natural day lighting purposes. With the increasing use of solar light pipes, more attention is being paid to their development, especially to the day lighting performance evaluation of the device.

Fig 5. Solar optical system on the roof

They generally have three main components, namely the daylight collecting device, daylight transmitting device and daylight emitting device. Optcal technology in residential buildings is for lighting, natural light can enter into the function rooms through the light guide tube, thus improve the indoor day lighting situation, such as under ground garage, equipment room and storage room. The light guide tube is mainly composed of three parts: a light collector for collecting the daylight; tubing portion for transmitting light; the light exit portion for controlling the distribution of the light in the room. Main components of light pipe are described below [7] [6].

- Daylight collector :- Daylight collector is mounted on the outside of the roof and seals the light pipe against ingress of dust and rain
- Light pipe tube:-The pipe is constructed by alloy aluminium material. The inner surface of the tube is laminated by prismatic optic film. It provides outstanding durability with no delarnination and with no decrease in total reflectance.
- Diffuser: - The diffuser is mounted on the ceiling inside the room to be illuminated, that are usually applied in places where uniform day lighting is required. The shape of a diffuser can be flat, convex, and concave.
- Sealing components: - The purpose of sealing components the purpose of achieving high heat resistance and preventing solar gain. The seal of the light tube is also important to keep dust, noise, insects, rain and snow out of the building interiors.

Passive solar tubular light pipes are used to collect light from the sun. Daylight then reaches the inner surface of the light pipe diffuser wherein a refraction followed by a light scattering takes place .For any given weather condition, the cross area of a light pipe, affects the light pipe's external illuminance admittance. Since the daylight illuminance is transmitted by means of internal reflection within the light tube. The daylight collected by dome enters light pipe. when daylight is transmitted through and diffused within the light tube. And then, a refraction phenomenon happens in light pipe diffuser and finally scattered into the interior space .The use of day lighting decreases costs and improves the well being of building occupants.

III. BENEFITS OF SOLAR INTEGRATION

1) It provide weather tight envelope systems
2) Different levels of thermal energy to match the varying needs of building
3) The potential cost savings in construction materials and labor
4) Enhanced aesthetics

IV. CONCLUSION

Residential building integration technology has broad application prospects. To capture the benefits of using BIST roofing systems in existing buildings by develop BIST screening tools, light weight, long life glazing materials that minimize loads on existing roof structure, low pressure, medium temperature, air to water heat exchangers, and assessment tools and measurement devices to predict the impacts of partial roof shading from trees and other obstructions. Analyze thermal and economic impacts of absorber color variations .Design BIST systems to meet clothes drying and cooling thermal loads within a building, backup heating systems which operate at a fraction of the output of typical heating systems, and low cost, low pressure, long life, storage tanks with integral air to water heat exchangers. Solar energy and building integration technology are closely combined with residential and broader development prospects.

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