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A Review Paper on PVC–Photovoltaic Glazing

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Abstract- There is a growing need for renewable energy sources, and solar power is a good option in many instances. Photovoltaic glass is a technology that enables the conversation of light into electricity. To do so the glass incorporates transparent semiconductor based photovoltaic cell which are also known as solar cells. Photovoltaic technology developed quickly in recent years with new configuration and methods for energy efficiency improvement. Most of the power is generated by conventional energy sources. In India which produces huge pollution in the environment. The consumption of fossil fuels and other conventional sources are increasing due to high demand of electricity. This focuses the solution of energy crisis in India by using renewable energy sources like solar, wind, biomass and ocean energy. Photovoltaic provides an elegant, non-polluting approach to providing future energy requirement, both in develop countries. To make a major impact the cost of the photovoltaic cell has to decrease while their energy conversion efficiency increases. This paper presents a review of the development of photovoltaic technology, mainly focusing on the past five years. In this paper, need, efficiency, cost factor, atmospheric effects are discussed.

Index Terms- Solar cell, Renewable Energy, Efficiency, Photoelectric Effect

1. INTRODUCTION

Life is directly affected by energy and its consumption research to resolve problems related to energy is therefore important. The solar photovoltaic (PV) cell application is one of the most alternative significant and rapidly developing renewable energy technologies and its potential future uses are notable. In 1905, Albert Einstein described the lights nature and the photoelectric effect on which the photovoltaic technology is based, for which he later won a Nobel Prize in physics. Photovoltaic is the field of technology and research related to the devices which directly convert sunlight into electricity. The solar cell is the elementary building block of the photovoltaic technology. Solar cell are made up of semiconductor materials, such as silicon. Photovoltaic glass is a special glass with integrated solar cell that convert solar energy into electricity. This means that the power for an entire building can be produced within the roof & façade areas. The solar cell are embedded between the panes securely wrapping the solar cell on all sides. Each individual cells has two electrical connections, which are linked to other cells in the module to form a system which generate a direct electrical current.

2. LITERATURE REVIEW

Garg and Adhikari (1997): Worked on a steady state model and pointed out that the increased transmission losses due to additional front cover do

not justify the heat loss reduction and beyond certain limit the single glass cover collects more heat than double glass cover

Zodang et al (2007): Reported that the efficiencies of PV and thermal system if considered separately are higher than a combined system but PV/T collector produce more energy than a single PV and thermal collector next to each other which is an important thing to be considered in situations where space are availability is much significant.

Fujisawa and Tani (1997): on the conducting analysis uncovered and single covered design indicate that energy output density of unglazed collector was much higher than single cover design for the reason that thermal energy contains unavailable energy.

Dubey and Tiwari (2008): Examined and performance of a sustained single glazed PV/T water collector with partial coverage of PV module in New Delhi.

3. FACTORS AFFECTING PVC GLASS

3.1 Need of photovoltaic glass

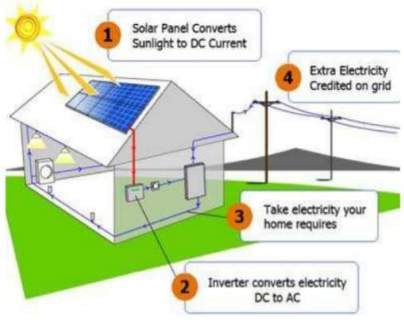


FIG. 1 Schematics of utility interactive applications. [2]

Apart from providing privacy and protection from noise and air other features such as a thermal insulation and shading are becoming increasingly desirable. All of these functionalities can be obtained simply by installing photovoltaic glass to the shell of building.

3.2 Efficiency

The efficiency of solar cell used in a photovoltaic system in combination with latitude and climate, determines the annual energy output of the system.

Table 1: Energy performance of PV/T

System	Annual thermal Efficiency	Annual electrical efficiency
PV	-	0.072
Sheet and tube PV/T-collector uncovered	0.24	0.076
Free-flow PVT-collector	0.34	0.063
Thermal collector	0.51	-

3.3 Cost factor

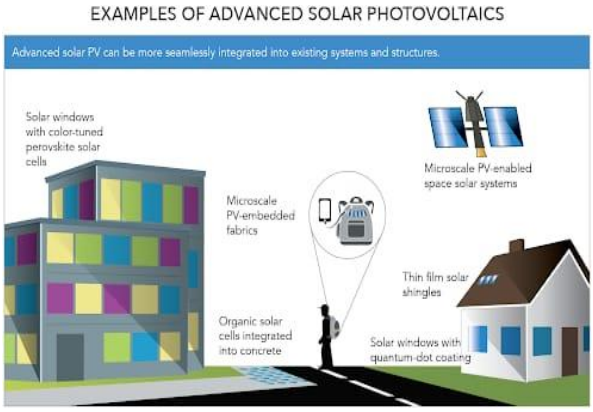
According to data by Heike Hessen Kemper, professor of glass and enamel technology at the Technical University (TU) of Freiberg, Germany, cover and carrier glass currently cost about RS. 7346.08 ($109.69) per kilowatt-hr of module output. This means glass accounts for at least 10% of present module prize of Rs. 55,094.74 ($822.62) Rs.73, 459. 47($1096.88) per kW-hr.

Table 2: Traditional Residential Roofing Materials

Roofing Product	S/m^2	S/W
Asphalt shingle	$25.08	$0.18
Wood shingle	$51.13	$0.37
Concrete shingle	$57.86	$0.42
	$78.58	$0.57
Metal shingle	$101.45	$0.74
Clay shingle	$116.52	$0.85

3.4 Life of PV cell

Photovoltaic modules typically come with 20 year warranties that guarantee that the panel will produce at least 80% of the rated power after 20 years of use. The general rule of thumb is that panels will degrade by about 1% each year. The 1% rule was somewhat pessimist for panel made prior to the year 2000, and todays panel with better technology and improved manufacturing techniques, have even more stamina than their predecessors.



3.5 .Atmospheric Effects :

Atmospheric effects have a several impact on solar radiation at the earth surface. The major effect for photovoltaic application are-

1) A reduction in the power of solar radiation due to absorption, scattering and reflection in the atmosphere.

2) A change in the spectral content of the solar radiation due to greater absorption.

3) The introduction of a diffuse or indirect component into the solar radiation.

4) Local variation in the atmosphere (such as water vapor clouds and pollution) which have additional effect on the incident power spectrum and directionality.

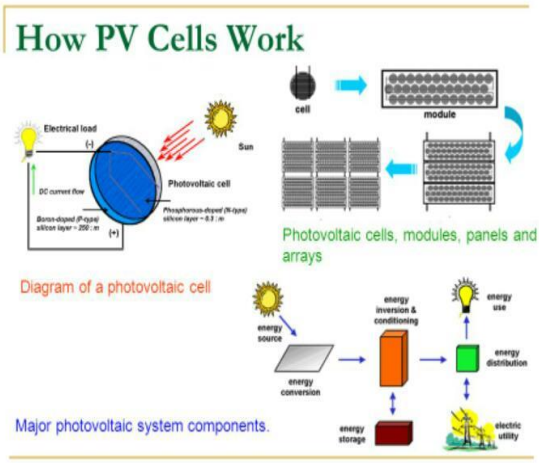
3.6. Materials and Methodology

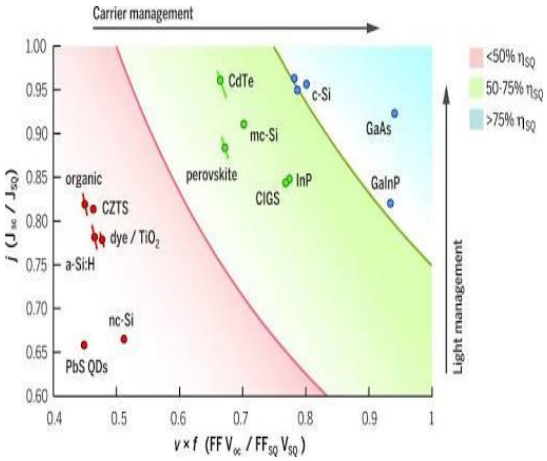
PV modules can be made of different types of materials, of which crystalline silicon is the most significant one. The following four types account for the most proportion of the commercial market- Mon crystalline silicon (M c-Si) module is made using cell saw cut from a single cylindrical crystal of silicon. They are effectively a slice of 2 to0.3 mm thick from a crystal growing from very pure molten silicon.

Polycrystalline Silicon (Pc-Si) module is made from cells cut from an ingot of melted and recrystallized silicon using a casting process. Amorphous Silicon (A-Si) is non-crystalline silicon. A-Si module is composed of silicon atoms in a thin homogeneous layer rather than a crystal structure. I absorb solar radiation more effectively than crystalline ones so the module can be thinner.

4. Working:

Basically, when light strikes the cell a certain portion of it is absorbed within the semiconductor material. This means that the energy of the absorbed light is transferred to the semiconductor. The energy knocks electrons loose, allowing them to flow freely. PV cells also have one or more electric field that acts to force electrons freed by light absorption to flow in a certain direction. This flow of electrons is a current, and by placing metal contacts on the top and bottom of the PV cell, we can draw that current off for external use, say, to power a calculator. This current , together with the cell's voltage defines the power that the solar cell can produce.





5. Result and discussion

Much of the work to integrate PV modules into the design of buildings has focused on the issue of power generation efficiency and thermal performance, with many examples placing the devices on roofs, since this location has greater solar irradiation intensity and less shade. Most PV modules adopt poly- or alpha-Si solar cells to make a trade-off between construction cost and electrical generation.

6. CONCLUSION

1. The efficiencies are not good enough. More efforts should be given to maximize heat extraction from thermal absorber to working fluid. The combination of PV/T collectors with a heat pump system, where the collector acts as the direct expansion evaporator, could be a good attempt for the improvement of thermal and electrical efficiencies, due to the low boiling temperature of refrigerant.
2. Finally it can be said that the process of Solar Photovoltaic Conversion is involved with some regular procedure and strict maintenance. Further study and research is going on for the betterment of the conversion process and to increase the efficiency.

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