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PV for Masses: New Era of Building Integrated Photovoltaics

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Abstract: **Energy makes the world go around. With the ever increasing energy demand and the depleting sources, the necessity of utilizing the abundant renewable energy is crystal clear. Sun provides life to the Earth in more ways than imaginable. In all the renewable energy sources available on our planet, solar energy is present almost everywhere, which makes it the foremost choice for harnessing.**

Building consume 40% of energy on global level, making use of photovoltaic panels a must in current times. Solar photovoltaic panels are now becoming a part of our cityscape. The advent of Green Rating Systems such as GRIHA and LEED has also given a much needed push to the integration of renewable energy systems in designs.

But still they are a pasted resort for either receiving benefit from the Government schemes or energy use reduction in some cases. This results in underutilization of the available solar energy, over sizing of the systems and increased costs. Ultimately making it a costly affair for interested middle strata of the society.

The whole issue remains too technical and complex for the masses. Customized Building Integrated Photovoltaic Systems such as shading devices will help in addressing such problems. These will have a wide spread use like solar light or lanterns. Such systems can be designed and then produced on a mass scale, making solar energy accessible to all. This paper discusses the Building integration of PV in design features like shading devices and the methodology of such prototype systems.

1. INTRODUCTION

Sun provides life to the Earth in more ways than imaginable. It’s the source which can fuel the earth for many more years. Its omnipresence makes it harnessing much easier than the other renewable energy sources like geo thermal energy. Building are energy guzzlers throughout their life time and making renewable energy efficient will create an immense impact on our energy demand. This has been understood by the people and PV panels, solar thermal are dotting our rooftops.

The numerous schemes of the government have given a much needed thrust to the green energy field. The current scenario shows that it has not percolated well in the middle strata owing to the lack of availability of technological know-how for selection, installation and then operation, which results into oversized systems, under optimization of energy and thus in increased costs.

There is a need for providing innovative design solutions on a mass scale, which will initiate people into this field. Prototype designs of PV integrated into building elements like shading devices will provide people with the ease of walking up to the store, buying and getting them installed.

2. BUILDING INTEGRATED PHOTOVOLTAIC (BIPV)

BIPV comprises a group of solar PV technologies that are built into (instead of installed onto) the host structure and may actually replace some building materials (such as windows or roof shingles). BIPV's potential to seamlessly integrate into the building envelope holds aesthetic appeal for architects, builders, and real estate holders, and this has been one of its principal sources of attraction in its three-decade lifespan.

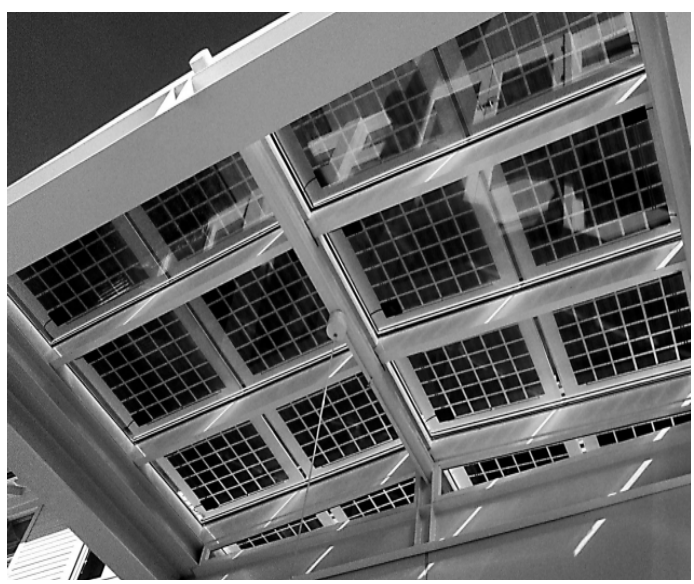

Fig. 1: PV as skylight [1]

Fig. 2: PV as A Shading Device [2]

Though they can be added to a structure as a retrofit, the greatest value for BIPV systems is realized by including them in the initial building design. By substituting PV for standard materials during the initial construction, builders can reduce the incremental cost of PV systems and eliminate costs and design issues for separate mounting systems.

Today, BIPV only claims about a 1 percent share of total PV installations worldwide, but several analysts foresee good times ahead for this niche technology [3]

2.1 Advantages of BIPV

Building-integrated, grid-connected PV systems has no additional requirement for land and it replaces the cost of the building element it replaces. Power is generated on site and replaces electricity that would otherwise be purchased at commercial rates and connecting to the grid means that the high cost of storage is avoided and security of supply is ensured.

The architecturally elegant, well-integrated systems will increase market acceptance. Building-integrated PV (BIPV) systems provide building owners with a highly visible public expression of their environmental commitments [4]

2.2 Applications for Building-Integrated Photovoltaic

Façade – PV can be integrated into the sides of buildings, replacing traditional glass windows with semi-transparent thin-film or crystalline solar panels. These surfaces have less access to direct sunlight than rooftop systems, but typically offer a larger available area. In retrofit applications, PV panels can also be used to camouflage unattractive or degraded building exteriors.

Roof tops – In these applications, PV material replaces roofing material or, in some cases, the roof itself. Some companies offer an integrated, single-piece solar rooftop made with laminated glass; others offer solar “shingles” which can be mounted in place of regular roof shingles.

Glazing – Ultra-thin solar cells may be used to create semi-transparent surfaces, which allow daylight to penetrate while simultaneously generating electricity. These are often used to create PV skylights or greenhouses. [3]

2.3 Building Design Considerations:

A critical part of maximizing the value of a BIPV system is planning for both environmental and structural factors, both of which influence the economics, aesthetics and overall functionality of any solar system. The Environmental Factors include insolation, climate and weather conditions, shading and the location of the site. Whereas the structural factors include the building energy requirements and the solar system design.

3. BUILDING INTEGRATED PHOTO VOLTAIC DESIGNS

The study aimed at developing ideas for architectural integration of Photovoltaic panels in the built form. The mechanical prototype of these designs is in development (Patent pending for one of them), which will be tested in field conditions, appropriate changes will be done and then these will be mass manufactured as a ready to install solutions for the masses.

Traditional sloping overhangs have been a part of our architecture since ancient times. This design is based on the same. One fixed PV panel shades the window all day. A movable panel sits over the fixed panel. The inclined panel provides a better angle for harnessing maximum possible sun light. This panel slides over the fixed one during the noon time. This panel serves 2 functions: it provides full shade from afternoon onwards and takes advantage of the higher level of insolation during noon to generate maximum energy.

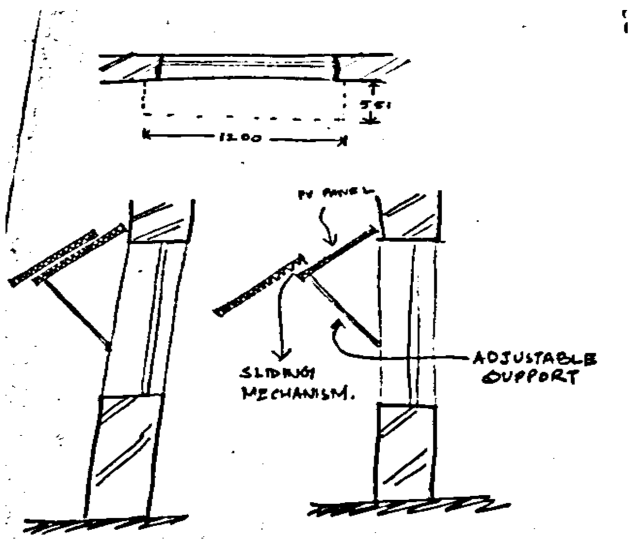

Fig. 3: Plan, Section of the Shading Device

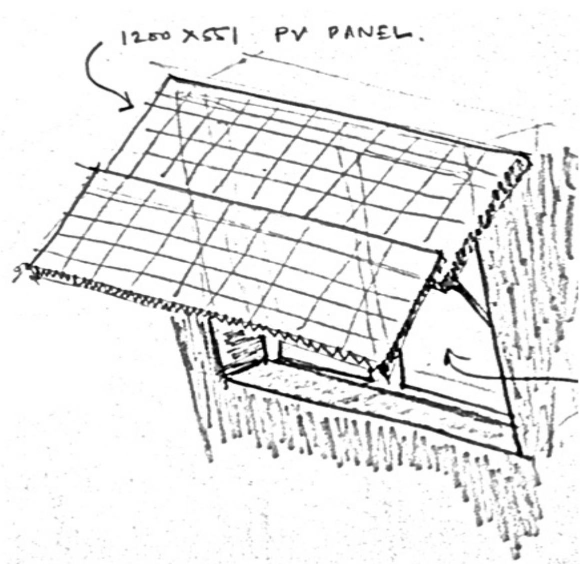

Fig. 4: View of the Shading Device

This design can be produced for a single window size (1200 mm wide, based on a PV panel size) which can be multiplied for a series of windows in the building as and when needed.

4. CONCLUSION

The people have knowledge and inclination about the global warming, the climate change and are willing to take action towards a greener Earth. The green technologies are widely advertised and made accessible to the public. But the first step is always the most difficult one. Such designs can help in testing these relatively unknown waters and give people confidence in this seemingly complex technology.

Solar lanterns and lights are the proofs of easy spread of such technology. Once such products are road tested by people, it will instill good faith in the technology and open a whole new market for the same.

REFERENCES

[1] Patrina Eiffert, G. J. (2000). Building-Integrated Photovoltaic Designs for Commercial and Instituitonal Structures. U.S. Department of Energy.

[2] Gregory Kiss, J. K. (1995). Optimal Building Integrated Photovoltaic Systems. Newyork: National Renewable Energy Laboratory.

[3] Travis Lowder, N. (n.d.). The Challenges of Building-Integrated Photovoltaics.

[4] Reijenga, T. H. (2003). PV in Architecture. In Handbook of Photovoltaic Science and Engineering. John Wiley & Sons.