

Solar Tiles As Rooftop

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Abstract

from last 50-60 years the energy consumption has rapidly increased in the world mainly due to increasing population and economic development of countries. Government is planning to take important steps towards compulsory usage of electric vehicles. As we know About 80-90% of the energy consumed in the world is obtain by combustion of fossils fuels such as oils, natural gas, coal and oil shales; hence, to overcome this, solar power is used in the form of reliable renewable energy. Now with the rise of new technology, innovations like solar roofs tiles have made solar power even more affordable and accessible. Solar roof tiles are smaller than the traditional panels. Solar tiles are about 12 inches wide by 86 inches long. Tesla is one of best and leading company in the field of solar products. Tesla solar roof tiles are more efficient than the other companies in market.

I. INTRODUCTION

Solar tiles as a roofing material may use to create and use opportunity towards sustainable and conserved development. In country like India, we need proper methodology for faster growth. While developing methodology we need to consider various issues we face like failure of system, proper maintenance, future requirements, etc. In case this project succeed in every aspect most parts of the cities may rely on their own for energy production, so villages and small towns don't have to face any load shading, even polluting type of electricity production may possibly extinct in future.

II. OBJECTIVES

- A. To consider solar tiles as rooftop covering material.
- B. To achieve goal without disturbing aesthetic view of building.
- C. Estimating amount of energy produced w.r.t. cost.
- D. To apply concerning government bodies for advantage of F.S.I. for such buildings.

III. LITERATURE SURVEY

- A. **Pallav Dutta, Ushnik Chakrabarti [2018]:** In this research paper gross of payable amount to Electricity Company is taken into account by monthly consumption of units (KWh) and tariff rate on units is calculated throughout the year for building of 14 houses. 120sq.m. of solar panels are installed on the building. It is found that the annual average the electricity consumption by houses is half covered by solar panels. Therefore, we can conclude that

hybrid type of electric connection will be more relevant in such case. According to the promises made by Tesla on solar tiles development at low cost will be better.

- B. **Jayanna Kanchikere, K. Kalyankumar [2018]:** Energy demand in India and especially in Karnataka state is continuously increasing, however the electric utilities failed to meet this load demand. As we know Photovoltaic (PV) solar power plant is used for larger development of solar power generation. The Simulation analysis of 8KW solar PV power plant located on the roof of a residential building in Davangere city is also carried out by the software PV syst. From the Assume results, the horizontal global irradiation is 5.708 Kwh/m². day and the available energy at inverter output is 44.59KWh/day.
- C. **Meghana A. Patankar, Sripadraj K Kanchi, Rajesha R N, Prasanna Kumar [2017]:** The research paper checks on the structure with solar panels mounted on the top and analyses stability with dead load, and wind forces. All the calculations done in research paper are according to the Indian standards from IS: 875-1987 and IS: 800:2007 It suggests use U-purlin for better carrying capacity and the screws required to have shear capacity more than 2.55kN against pull out force and fully threaded along axial length. The bolts shall be 8mm in diameter with 10mm nominal diameter.
- D. **Rajeev Kumar Sharma, Sohail Bux, V. K. Sethi A. C. Tiwari [2015]:** In this research paper the electrical system and components are explained with generation of electricity by solar panels as rooftop with respect to cost and reduction of carbon footprint due to use of solar panels as a rooftop. This paper concludes that in case we use solar panels as a rooftop cover can create jobs and labor in a new industry. It also claims that people will adapt the technology if Government of India provides subsidies and soft loans for the technology, which has already happened as Government of India is providing 30% of subsidy now.
- E. **I.A. Adejumobi S.G. Oyagbinrin F. G. Akinboro & M.B. Olajide** One of the primary needs for socio-economic development in any nation in the world is the provision of reliable electricity supply systems. This work is a development of an indigenous technology hybrid Solar -Wind Power that system harnesses the renewable energies in Sun and Wind to generate electricity. As we know to achieve a solar power capacity of 1000watts the capacities of Solar panel, Charging Controller, bank of battery and Inverter are determined. There is the need for the provision of an alternative sustainable electric power supply system to provide electricity to rural and the unreached communities. In addition, there is the need for rural banking and hospitals if the social and economic lives of rural citizens in Nigeria are to be improved. When considering the cost and overall efficiency, it is judicious for all the stakeholders who have concern for the rural community development to embrace solar and wind power.

IV. RESULT AND DISCUSSION

Discussion of Design:

As we know, there is culture of mounting the solar panels/tiles on frames but have few limitations to use as rooftop such as. We keep a few centimeters of a distance between each panel (not between the tiles) and cannot consider as a full functioning rooftop as one cannot provide protection against sun and rain too. So, as we considered a building's plan to integrate a rooftop with complete methodology and developed as below,

Components to Use in Solar Rooftop:

- A. **Trusses:** In Maharashtra, the average angle of solar panels or tiles is 19°-23° tilt and the

trusses facing north and can have the angle between 19°-23°. In case the north comes along the length of the roof we need to use the flat horizontal trusses for east-west solar panels or tiles with no tilt angle at all but will lose efficiency by 30%.

- B. **GI Sheets (For Tiles Only):** The tiles cannot mount on purlins itself, as the tiles are too small. Therefore, we need either meshing on the truss (nothing available) or easier option as GI sheets to mount tiles on.
- C. **Safe Walkway:** A solar panels or tiles require timely washing every 30 days and maintenance to maintain efficiency of a system. As, the system is at top of building the maintenance workers require special safe way to do the job. Therefore, we need safe walkway of 500mm width along the edge of a system with lightweight FRP grating and 0.50kN live load. Despite of walkway the worker should use safety equipment such as helmet, safety shoes, roof grab arrestors to sidebars and rubber gloves.
- D. **Sprinkler System:** In case the building has huge roof, the system will obviously produce more energy. Therefore, the same energy can use to pump water through sprinkler system to cleanup dust and waste on panels thus the system does not require maintenance every month up to 6 months.
- E. **Joints:** Now The in case of just solar panels require sealing tight to create protective rooftop cover in order to protect from sun and rain. Thus, require 5mm gap between consecutive solar panels, which is sealed with silicon glue, and the gap is covered with rubber strip to make it air tight and waterproof.

Cost Estimation of the System:

In order to estimate cost of the system we took a case study,

Item No.	Description	Quantity	Rate (Rs.)	Cost (Rs.)
	Area under rooftop	284 sq. m.		
1.	Area of FRP safe walkway	28.5 sq. m.	3200/ sq. m.	91,200.00
2.	Opening	1.80 sq. m.		3,000.00
3.	Area for Solar Panels or Tiles (Producing about 34.14kW)	253.7 sq. m.	8073.19/ sq. m. (with all electrical components)	20,48,170.10
	Subsidy By Government of Maharashtra	30%		6,14,451.03
	Total Cost Of Solar System			14,33,719.07
4.	Brickwork	72 cum.	5600/ cum.	4,03,200.00
5.	Plastering Work	480 sq. m.	225/ sq. m.	1,08,000.00
6.	GI sheet with Steel Frame	284 sq. m.	410/ sq. m.	1,16,440.00
	Sprinkler Cleaning System	300	550/ piece	1,65,000.00
	Contingency Charges Includes Silicon Sealant, Rubber Strips, etc.	2%		44,527.18 and 42,198.38 respectively
	Total Cost with GI Sheet			22,70,886.25

	Total Cost without GI Sheet (Solar Panels)			21,52,117.45
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Table: Cost Estimation of the System

V. CONCLUSION & FUTURE SCOPE

- As per cost estimation, the cost of the system ranges between Rs.7577.10-7996.10 per sq. m. in 2019-20.
- The system can produce up to 34.14kW of electricity that means it will take about 65 years to recover the cost.

Future Scope of Work:

- As we know Governments of states as well as center are looking forward towards solar energy as a green way to produce energy,
- Pavagada Solar Park, Karnataka (2000MW), Kadaladi Power Station, Tamil Nadu (4000MW) and so on.
- If Government provides advantage of FSI area under solar roof:
 - In India, the central government pays 30% subsidy for solar systems.
 - If governments provides advantage of FSI, the cost of buildings in Pune average is high as Rs.4, 500 per sq. ft.
 - In the case study, it will cost as high as Rs.1, 37, 56, 275, which makes it good investment for builders and greater deal for sustainable development.
 - If the requirement of electricity in cities like Pune and Mumbai decreases, the power generated by power plants can provided to villages in need. By this, we reach the target from sustainable development to development of all.

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