

SOLAR WALKWAYS IN TOWNSHIPS

An Effective Study Towards Self-Sustainable Townships

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Abstract: Energy Generation has been a topic of great concern in the recent days. Energy crisis due to overconsumption of non-renewable energy sources is a major threat today. Energy requirements of township projects is huge. They require energy for lighting street lamps, parking lights, water distribution pumps, etc. To fulfil these requirements of energy, instead of relying on conventional energy sources like petroleum, gas and coal, it is better to develop renewable energy sources within the township itself, like Solar Energy. This study focusses on the use of solar walkways in townships for generation of renewable energy. This will help to suffice the energy needs of the townships. Solar Walkways are Structurally-Engineered solar panels that can be used driven upon.

Index Terms – Sustainable energy, Solar walkways, township.

I. INTRODUCTION

Sustainable Energy Generation has become a trending topic these days. Advancement in this field has been growing rapidly since there is a need of new energy sources. To overcome the energy generation problems, it is necessary to switch to renewable sources of Energy like Solar Energy, wind energy, tidal energy, etc. Out of all these, solar power generation has emerged as one of the most rapidly growing renewable sources of energy. A lot of Solar Energy projects have been taken up in India in States like Andhra Pradesh, Tamil Nadu, Rajasthan, Gujrat, Maharashtra and Madhya Pradesh.

Energy requirements of township projects is huge. They require energy for lighting street lamps, parking lights, water distribution pumps, etc. To fulfil these requirements of energy, instead of relying on conventional energy sources like petroleum, gas and coal, it is better to develop renewable energy sources within the township itself. This will also help in reducing the pollution due to fossil fuels for generation of energy. Solar walkways are a recent advance technology that has been developing in the industry. It is a series of Structurally-Engineered solar panels that can be driven upon. Instead of walkways made out of Paver Blocks and Concrete, they can be made with solar panels, photovoltaic effect, LEDS and microprocessor chips with circuitry boards covered with high-strength glass material on the top. Solar Photovoltaic converts sunlight to electricity directly. So, in India, where sunlight is present in most of the daytime, this methodology of using solar panels in walkways will make the townships self-sustainable for energy use. It has many advantages like clean energy source, more life span of roads (30-40 years) and renewable. Few challenges have to be overcome for replacing the conventional walkways with this technology like high initial cost, high maintenance cost, traction, load carrying capacity of tempered glass, drainage, etc. In future, this technology can be used on a wider scale that will help create an intelligent and secure infrastructure that pays for itself while reducing the greenhouse gas emissions.

II. LITERATURE REVIEW

[1] Stephy Johny and Keerthi Susan John, "A REVIEW ON SOLAR ROADWAYS: THE FUTURE OF ROADS", Volume: 02 Issue: 03 March– 2017 (IJRIER).: In this study author presents the concept of Solar Roadway which is a series of structurally engineered solar panels that are driven upon. The idea is to replace all current petroleum-based asphalt roads, parking lots, and driveways with Solar Road Panels that collect energy to be used by our homes and businesses. This renewable energy replaces the need for the current fossil fuels used for the generation of electricity which in turn reduces the greenhouse gases

[2] Monalisa Hati, "Solar Roadways: An Effort to Make Safe and Smart Highways", DOI 10.17148/IARJSET.2016.3710: In this Study author mostly focuses on the use of use of solar panels in highways and make it smart highways also signifies use of solar panels (roughly 3.658m x 3.658 m) interlinks with neighbouring panels to form the solar roadways system concept is used to replace highways, roads, parking lots, driveways and sidewalks with such system. The energy generated by solar road panels will replace the current need of fossil fuel with little extra cost.

[9] Varsha Dadasaheb Shingate, Rohit Wangade, Ajitkumar Manedeshmukh, "Study on Solar Roadway", ISSN: 2454-132X Impact factor: 4.295 (Volume3, Issue6): Author states in this study about solar roadways which can be implemented roughly the same cost of the current systems (asphalt roads and fossil fuel burning electricity generation plants), author states that it will provide safer driving conditions & 70% reduces the accidents and feasible in nature.

III. RESEARCH METHODOLOGY

1. For the purpose of the research we considered a Township model that was generated using AutoCAD Software as shown below:

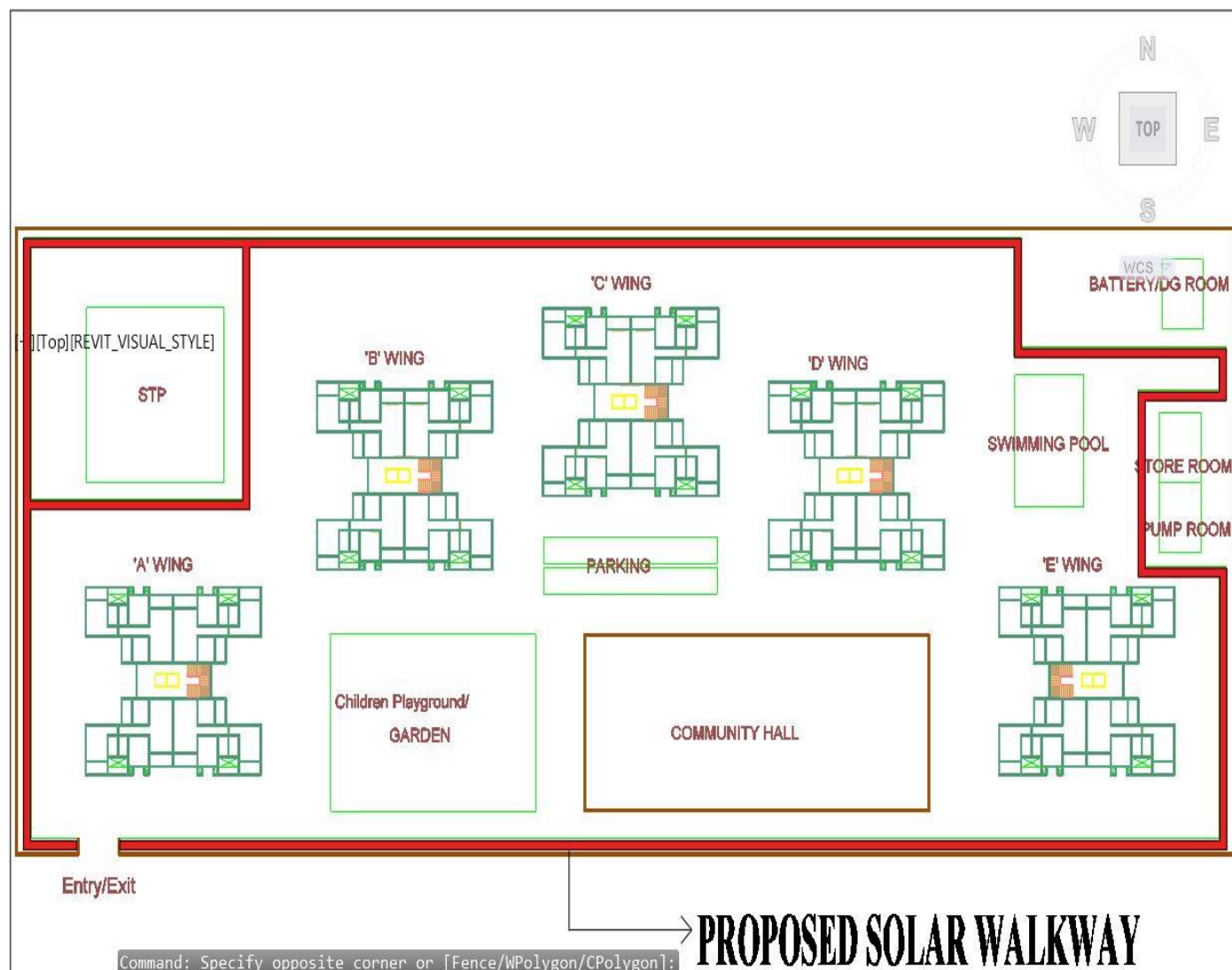


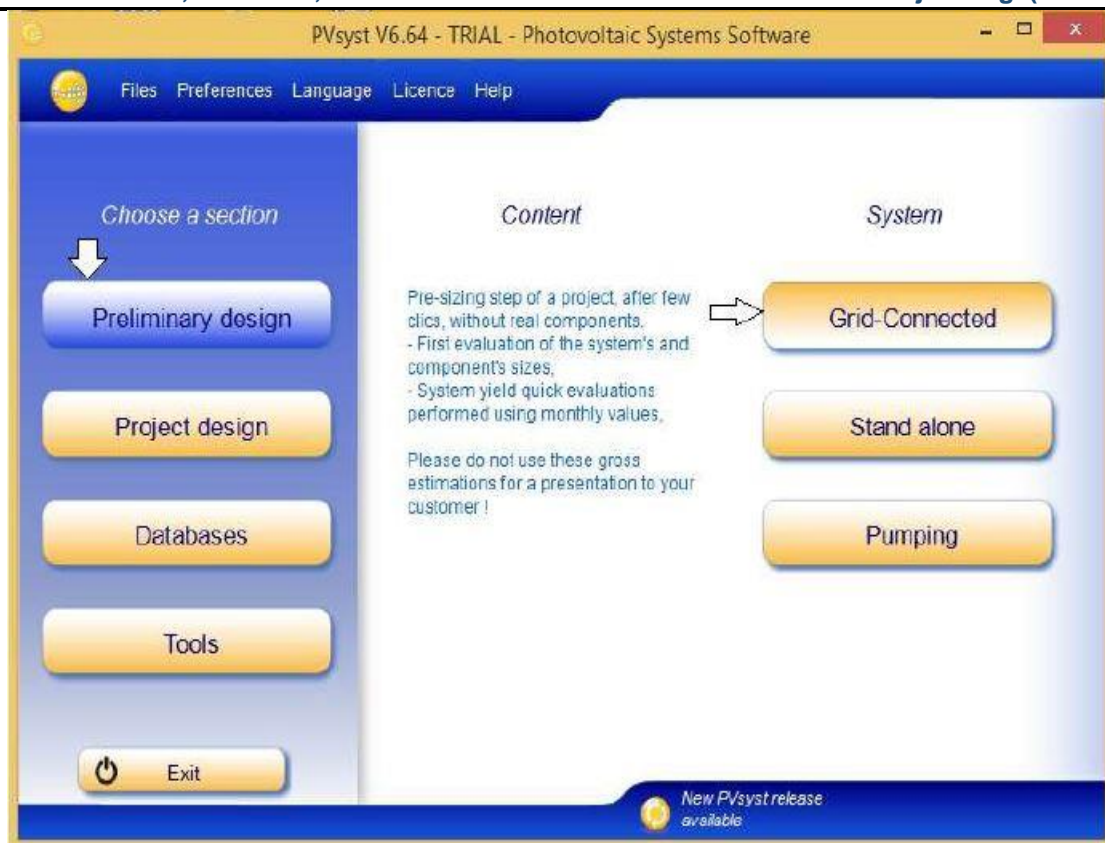
Fig.1 Township Model with Proposed Solar Walkway

The Proposed Solar Walkway is expected to generate renewable energy which will fulfil the electricity needs and make the township self-sustainable. Standard Size of Solar Panels manufactured in India for residential projects is 1.65 x 1 m. We used this Standard Solar Panels for our research. The total area of the proposed Solar Walkway in the Township Model was calculated in AutoCAD software.

2. Introduction to PVsyst simulation tool for Design of Solar PV Walkway:

Given future scenarios, renewable energy sources, in particular photovoltaic technology, will develop quickly. This has to be done in a sustainable way using the best technical economical solutions. It is essential to develop PV technology in an optimal and reliable way. Pursuing this objective, the PVsyst software is a tool that allows its user to accurately analyze different configurations and to evaluate the results and identify the best possible solution.

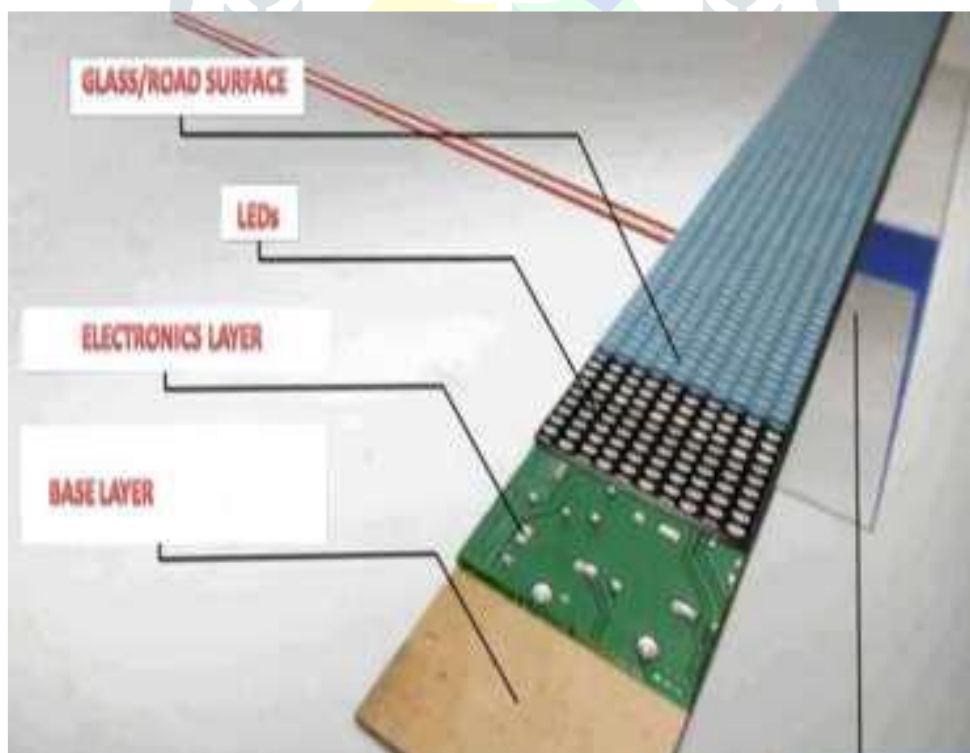
The development of PV technology depends on the existence of a large group of highly qualified professionals. To meet the needs of professional qualified engineers, PVsyst provides specific training on PV technologies and the PVsyst software. PVsyst is an energy modelling tool used by the solar industry to simulate the energy harvest of a potential project site. The energy harvest is a result of the effects of several parameters in PVsyst. Most of these parameters can be customized to produce a more accurate result. PVsyst can be used for quick design, just for the determination of approximate cost of the system (PRELIMINARY DESIGN). PVsyst can also be used for complete design and part by part simulation (PROJECT DESIGN). The simulation is very accurate if all meteorological data is fed correctly. Preliminary designing is used for the sake of synopsis of this project.



3. Proposed Walkway Components and Structure

The solar panels are classified into three basic layers:

1. Tempered Glass Surface Layer
2. Electronics Layer
3. Base Plate Layer



IV. RESULTS AND DISCUSSION

For this model we are proposing two types of solar panels:

1) 250-Watt Solar Panel Specifications:

Panel Dimension: 1660x990x50 mm
 Weight: 18 kg/panel
 Cell type: polycrystalline
 Cell size: 156x156
 Cell no: 60
 Cost: Rs 7000-7500/panel

2) 320-Watt Solar Panel Specifications:

Panel Dimension: 1660x990x50 mm
 Weight: 18 kg/panel
 Cell type: polycrystalline
 Cell size: 156x156
 Cell no: 60
 Cost: Rs 8500-9000/panel

Total no. of Solar Panels Required as shown in Model = 331

Total Approximate Cost of 250-Watt Solar Panel = Rs 23,17,000

Total Approximate Cost of 320-Watt Solar Panel = Rs 28,13,500

(This price is exclusive of Fitting and Maintenance cost.)

V. ADVANTAGES

1. Renewable Source of Energy required for Township.
2. Lifespan of about 20-30 years.
3. Environment Friendly and causes no pollution, produces no greenhouse gases.
4. Solar Walkways are modular; hence repairs will be quicker and easier.

VI. LIMITATIONS

1. High Initial and maintenance Cost
2. Problems of Traction
3. Load carrying capacity of tempered glass
4. Less efficient in Rainy Season

VII. FUTURE SCOPE

1. This technology can be further evolved into Roadway and Highway applications.
2. It has future scope for development of Smart Townships.
3. It can be used for development of self-sustaining Smart Cities.
4. There is a lot of opportunity for innovations in this area of research.

VIII. CONCLUSION

This Solar Walkway Technology is an alternative to current paver block walkways which will also generate electricity to minimize the use of conventional energy sources for lighting street lamps, floor passage lights, lifts and water pumps. Though it has a high initial cost but in the long run the cost to benefit ratio is good which makes the project feasible. PVsyst software can be effectively used for designing the grid and analysis of power generation. In addition to present technology, in future this model and technique will very much be in implementation.

IX. REFERENCES

- [1] Stephy Johny and Keerthi Susan John, "A REVIEW ON SOLAR ROADWAYS: THE FUTURE OF ROADS", Volume: 02 Issue: 03 March– 2017 (IJRIER).
- [2] Monalisa Hati, "Solar Roadways: An Effort to Make Safe and Smart Highways", DOI 10.17148/IARJSET.2016.3710
- [3] Singh Ajay Ranveer¹, Mukesh pandey², Sohit agrawal³, "SMART ROAD SYSTEM TO ENSURE ROAD ACCIDENTS & TRAFFIC FLOW: AN OVERVIEW", Volume: 04 Issue: 06 | June -2017
- [4] Frank L. Roth, Raymond L. Driscoll, and William L. Holt, "FRICTIONAL PROPERTIES OF RUBBER", *Journal of Research of the National Bureau of Standards*, Volume 28, April 1942
- [5] ASST.PROF. INGAWALE P.K, DESHMUKH S.P, 1GAIKWAD A.S, 1AAWALE S.K. "A Review on Solar Roadways" ISSN 0975 – 668X| NOV 16 TO OCT 17, VOLUME –04, ISSUE – 02
- [6] Mrs. Saranya.K1, Renu.S2, Sinduja.N.C3 "REVIEW ON SMART ROADWAYS – FOR A SUSTAINABLE FUTURE USING SOLAR ENERGY", Volume: 3 Issue: 1 Mar,2017, ISSN_NO: 2320-723X
- [7] Alark A. Kulkarni "Solar Roadways" – Rebuilding our Infrastructure and Economy, ISSN: 2248-9622, Vol. 3, Issue 3, May-Jun 2013, pp.1429-1436
- [8] Mr.A.Johny Renoald, 2V.Hemalatha, 3R.Punitha, 4M.Sasikala, 5M.Sasikala(B.E), Solar Roadways-The Future Rebuilding Infrastructure and Economy, ISSN 2348-6988 (online) Vol. 4, Issue 2, pp: (14-19), Month: April - June 2016,,
- [9] Varsha Dadasaheb Shingate, Rohit Wangade, Ajitkumar Manedeshmukh, "Study on Solar Roadway", ISSN: 2454-132X Impact factor: 4.295 (Volume3, Issue6)

