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Solar Roadway: Modular Approach for Renewable Energy

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Abstract – The need of energy sources and new technology for electricity generation is increasing day by day, one suchsource can be solar energy, which is renewable source and is limitless. A major drawback of solar source is that it needs more space for electricity generation. As pavements are often exposed to a vast amount of solar radiation, it is possible to extract a portion of this energy through the implementation of solar roadways. Infrastructural growth of India and area availability for roadways is only reason to use road surface for electricity generation. A modular approach isadopted to elaborate and understand the theory of solar roadways. Surface area about 60-65% is covered by solar panels which are converting solar energy to electrical energy. This study concludes that this can be implemented in large scale as resulted in model.This is an energy saving approach to meet the energy demands of India.

Keywords: Renewable Sources, Fossil Fuel, Solar Roadways, Solar Panels, Electricity Generation.

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INTRODUCTION

Majority of the world's current electricity supply is generated from use of fossil fuels such as coal, oil and natural gas. Their over-consumption can lead to some serious environmental issues which are harmful for human life. They are non-renewable sources of energy as they are derived from pre-historic fossils. This means we are currently using fuels which were originated 50 years ago and there will be no fuels in future for our energy needs, once depleted.

As a result of this, there is a need of alternative energy sources and new technologies for electricity generation. One such alternative source can be solar energy which is a renewable source and is limitless.

Solar energy is radiant light and heat from the sun that can be used in many ever-evolving technologies such as solar voltaic, solar heating, solar thermal energy, etc. The large magnitude of solar energy available makes it highly appealing source of electricity.

One such source of electricity can be used in the form of solar rooftops and is considered a common and major source. A major drawback of this source is that we need more space to generate electricity. Often pavements are exposed to vast amount of sun radiation, it is possible to extract a portion of solar energy through solar roadways implementation.

Solar roadways are a network of solar panels laid on the road that generate renewable energy. Solar road panels are a technology that replace petroleum-based asphalt highway infrastructure with an intelligent road. Solar roads pay for itself through the generation of electricity. Also, the electricity generated can be stored and supplied to nearby areas. Worlds first solar roadway was implemented in 2011 by United States of America. They envisioned replacing asphalt surfaces with structurally engineered solar panels that are capable of withstanding vehicular traffic.

Another company named Wattway inaugurated solar road on December 22,2016.

LITERATURE STUDIES

Nowadays, the issues of energy shortage and global warming due to growing demand of human for energy sources allow the renewable sources, such as wind and solar energy, to take part for energy production. It is possibly able to end human dependency on fossil fuels.

Also, land is often considered as the topmost challenge for deploying solar energy technology. Land is becoming scarce resource in India in recent years and this land should be used in an effective way. As the road network is biggest in India, we can utilize this for generation of energy.

Solar roadway plays important role in offering wide range of eco solutions such as stopping changes of climate and generating sustainable energy. This idea could allow the roads in countries to supply energy sources continuously as Solar roadways pay for itself.

METHODOLOGY

Roads:

Indian road network is considered as the second largest network in the world. This network is further divided into National highways, State highway, Expressways, etc. Our analysis began by studying these different road systems in terms of layers and loading conditions Expressways were selected as they pass through completely new routes but not through large centres of population. This will keep the roads more cleaner and will be exposed to large amount of sun radiations.

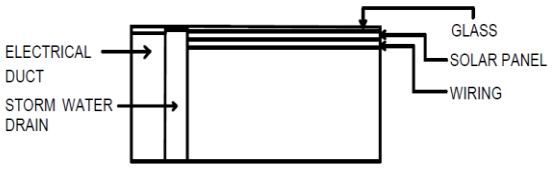
Solar panels:

According to our studies and research done in past, solar panels must be laid flat on the road. The panel's surface area available for sun exposure will be more in case of flat laid panel rather than laid at an angle and thus produces more energy.

The solar panel for roads comprises of glass that is strong enough to withstand vehicular load as well as provide enough traction. Also, a solar panel should be transparent so that the sunrays can pass through it and is able to produce energy when exposed to sunrays. The topmost layer is the glass which acts as a protective case to protect the solar cells. Then comes the electronic layer i.e. solar panel on which leds are placed for lighting purpose and last layer also consist of a glass for protection.

Road bed:

A base was prepared which actually consist of recycled glass as aggregate.Cable corridor for electrical installation and drains for safe flow of storm water is provided on one side road bed. Solar panels are placed flat on prepared road base along with its electrical installation. The panels are also connected to a battery device for storage of energy so as to further supply nearby villages, cities or industrial areas. A model was prepared on the above methodology which was able to produce enough energy.



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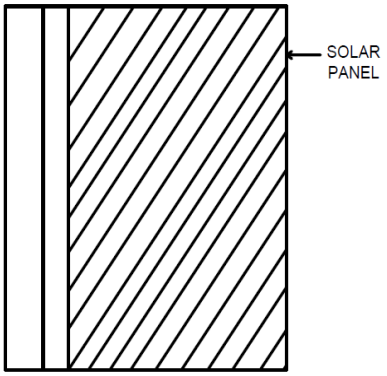

TOP VIEW

OBSERVATIONS

- The solar panels cover almost 60-65% of road bed surface which is made up of recycled glass as aggregate. The energy generatedby the solar panels can be supplied to nearby areas.
- Solar roads should be implemented in a cleaner environment or roads that are free from any dust as it may affect the amount of energy generated. Thus, it is possible to implement solar panels on Indian roads.
- Solar roads generate enough energy that can solve the problem of electricity in rural areas of India. This generated electricity can be supplied to nearby areas or cities.
- The maintenance of solar roads is not so critical. If any of the solar panels placed gets damaged, that panel can be easily replaced by another panel. It does not affect the whole working of solar roadways.

- The sub grade of road prepared for the implementation of solar panels is not much affected by the weight of panels. Hence, Solar roadways prove to be the best for energy generation.

CONCLUSION

Fossil fuels are non-renewable sources. As their supply is limited and also scarce to find, they will eventually run out. So, to counter this problem, solar roadways are considered as the most competent technology in terms of energy generation. Even though initial cost is high, as it is a system that pays for itself, it is a better choice. Hence, it is possible to actually implement this system on Indian roads and is capable of producing clean and large amount of energy.

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