

SOLAR ROADWAYS: THE ROADWAYS TO NEXT GENERATION

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Abstract: Solar roadways is an innovative idea that incorporate roads into generating energy and consist of structurally engineered solar panels and some more layers to make it strong that can be driven upon and it will also accomplish the need of roadways in future when there will be no fossil fuels available to make traditional asphalt roads. Through solar roadways we will be able to 1. Make a smart grid in the road system 2. Prevent accidents and significantly decrease its proportionality 3. Melt snow in cold countries 4. Reduce pollution significantly and many more advantages and hence these have been appropriately termed as "Smart roads". Solar roadways will consist of some layers including Transparent concrete, Solar panels, LEDs, Microprocessors and base plate layer etc.

Key Words: Smart Highways, Solar Energy, Global Pollution, Fossil Fuels, Photovoltaic cell/Solar cell.

1.INTRODUCTION

According to a survey Coal and natural gases are expected to last a little longer. If we continue to use these fossil fuels at the current rate without finding additional reserves, it is expected that coal and natural gas will last until 2060 that means some 40 years ahead. And we know that we are very much dependent on these fossil fuels so for this problem we had found the solution that we will replace our petrol/diesel car to electric car and our Natural gas systems to Inductions and many more alternatives. But, what about the roads. A traditional

asphalt road also requires fossil fuels to be built so for this problem the solution is Solar roadways/ Smart highways.

Solar Roadways Incorporated is an American Company based in Sandpoint, Idaho, that is aiming to develop solar powered road panels to form a smart highway. It was a startup of 2006 and the company was founded by Scott and Julie Brusaw. They are using rough and strong glass instead of transparent concrete, with underlying solar cells and microprocessors with a layer of base plate.

2.SOLAR ENERGY

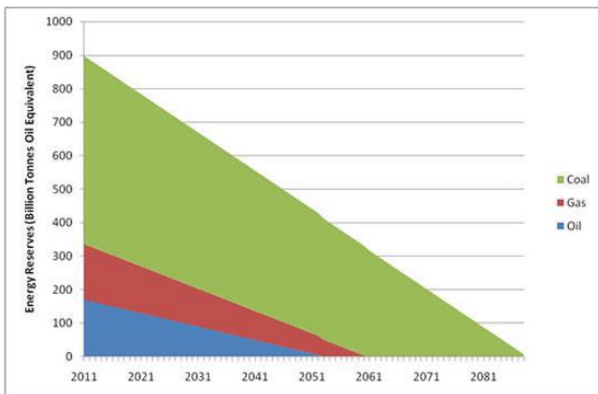
Solar energy is radiant light and heat from the sun that is harnessed using a range of ever evolving technologies such as photovoltaic cells, Solar thermal energy etc. It is a clean renewable energy. In 2011 the International Energy Agency said that "the development of affordable in exhaustible and clean solar energy technologies will have huge longer-term benefits and will enhance sustainability.

2.1 Why Solar instead of asphalt?

This topic will consist the following points of comparison

1. Solar roads are smart and intelligent
2. In measure have double life span
3. Produce independent energy
4. will be able to melt snow or ice
5. Have a faster maintenance
6. no paint required
7. Good and look and many more points.

2.2 Declining of fossil fuels

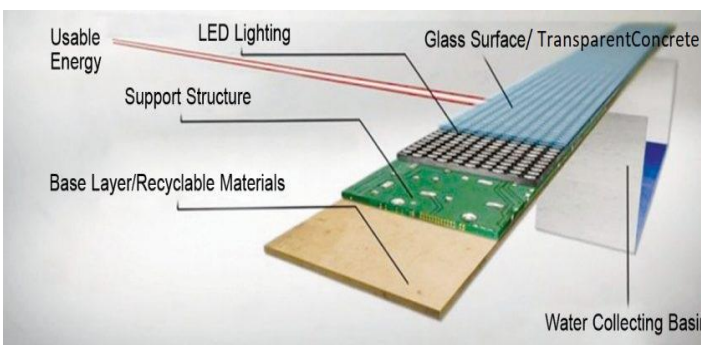


This graph shows the declining of fossil fuel, till the time they will last long, hence it can be seen easily that why the requirement of solar roadways is so important. Solar energy being a renewable energy is a real solution to all this problem and even if we will manage it accordingly may be, we will be able to produce more energy than our needs and will also save it doing a sustainable development.

2.3 Photovoltaic cell

A photovoltaic (PV) cell is an energy harvesting technology, that converts solar energy into useful electricity through a process called the photovoltaic effect. There are several different types of PV cells which all use semiconductors to interact with incoming photons from the Sun in order to generate an electric current.

3. WORKING METHOD AND METHODOLOGIES



The Solar roadways consist of some layers: -

3.1 Road surface layer

The road surface layer is the topmost layer of the assembly and is made of transparent concrete. Transparent concrete is used for paving the surface of solar roads, there are the two main constituents of this i.e., 1. Fine concrete 2. Optical fibre and the transparent concrete can bear up 10 times more pressure than normal concrete. Some rough and strong glass surface can also be used in this layer. Transparent concrete also gives fire protection and high UV resistance.

3.2 Solar cells/LEDs Layer

It is the second layer of the assembly and the layer which absorbs the Solar energy containing all solar panels. Also in the night time the LEDs in this layer will glow up making the road visible in darker conditions.

3.3 Electronic layer

It is the third layer of the assembly consisting of microprocessors and all the electrical chips and wires which will get the energy from solar cell and will transfer it to the battery also all the LEDs are connected to this layer and also a day-night sensor so that it can glow up all the LEDs which will help to make the road visible in dark areas. It also consists of a sensor which will alert the driver 100 meters away when any animal or a person is passing by the road, preventing accidents.

3.4 Base Plate layer

The primary strength to the road is provided by the first layer in the assembly and this is the fourth layer giving the secondary strength, the solar energy collected by the solar cell is distributed using the base plate to all buildings connected to solar roadways. This was the structural design of Solar roadways. At the end there can

be a water collecting basin also to preserve water from rain and use it later.

4.WHY IN INDIA?

For giving an example of astonishing effect of solar roadway let's do some calculation. If we replace our National Highway 44 (NH44) that is from Srinagar to Kanyakumari with 1feet*1feet solar cell (solar road) rated 15 watt , then NH 44 covers the length of 3745 kms and with of 3.5*6 lanes(on an average) that is 21 meters then the area will be $3745000*21$ equals to 78645000 m^2 . So covering NH 44 with solar panel will give us nearly 12000 MW and the peak electricity requirement of the capital of India that is Delhi was 6000 MW as per latest survey of CSE India, So nearly 6000 MW electricity can be stored an be used for different purposes. So just imagine that India has world's second largest road network of 58.98 kms , How much electricity will be produced.

5.ADVANTAGES

5.1Life Span

According to a survey it has been found that an asphalt road have a life span of nearly 15- 20 years but a solar roadways will have a life span of nearly 30-40 years, that is double in measure. This is a huge difference in average life span that tells us that we require less frequent maintenance of solar roadways as compared to asphalt roadways.

5.2Prevention from Accidents

A special type of program will be built in the processor that will sense (a sensor will be there for this) any sort of animal or person movement and will notify an alert to the automobiles in a range of 100 meters , hence preventing any sort of accidents.

5.3Maintainance

Unlikely the asphalt roads the solar roads do not require this much hustle for maintenance the damaged part will either be repaired or replaced very easily because the structure of road is in a pattern manner.

5.4Pollution

For repairing purpose or for the purpose of construction the asphalt road need to have the fossil fuels but here in the case of solar roads we do not require any sort of fossil fuel hence it is also eco-friendly.

6.SOME PRATICAL EXAMPLES OF SOLAR ROADWAYS



6.1France opened 1 Km solar road in 2016

Consisting of somewhere in the region of 2880 m^2 of solar panels, this solar road in France was one of the first in the world. It was built using Colas Wattway tech and runs for 1-Km in Tourouvre-au-Perche.

6.2Wattway's solar roads have also been installed in Georgia



After the success of the Wattway's installation in France, another test stretch was installed near the Alabama and Georgia border. The Ray C. Anderson Foundation helped fund a 50 m² of the first Wattway pilot in the United States.

6.3 China has built an 1 km solar road



Back in 2018, China completed works on a 1- Km stretch of an expressway in Jinan. Qilu Transportation development group it consists of three distinct layers. Base layer with primary insulation, Solar cells in the middle layer and for the top layer transparent concrete was used.

7. CHALLENGES

1. Actually the Idea of solar roadways sounds so interesting and a very practical and real solution for the future transportation system but practically it is very costly to cover the entire road network by solar panel.

2. The top layer if made by rough and strong glass then the efficiency can be satisfying, but if transparent concrete is used to make the top layer it can decrease the efficiency significantly.

8. CONCLUSION

Solar roadways are one of the best solutions for future transportation system. But it is still in its primitive stage. With proper planning small scale prototypes has been built and tested successfully as some examples of China, France is given above. In India also we need to think about it and start taking actions on it that will help us grow faster especially the electricity problem can be reduced to some extent.

“The greatest threat to our planet is the belief that someone else will save it”

“Its always better to be late than to be never”

“Let’s move to the next generation roads”

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