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Solar Roadways-The future of roadways

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Abstract: Smart highway and smart road are terms for a number of different proposals to incorporate technologies into roads for generating solar energy, for improving the operation of autonomous cars, for lighting, and for monitoring the condition of the road. Solar roadways use solar panels, photovoltaic effect, LEDS and microprocessor chips with circuitry boards .The future of the roadways will consist of solar roadways taking energy efficiency and artificial intelligence into consideration.

Keywords: smart road, future road, energy, solar

I. INTRODUCTION

Solar Roadways Incorporated is a startup company based in Sandpoint , Idaho that is developing solar powered road panels to form a smart highway. Their technology combines a transparent driving surface with underlying solar cells, electronic and sensors to act as solar array with programmable capability. Solar Roadways Inc is working to develop and commercially produce road panels which are made from recycled material and incorporate photovoltaic cells.

IN 2006, the company was founded by scott and Julie brusaw, with scott as president and CEO. IN 2009,Solar roadways received a $100,000 small business innovation research (SBIR) grant from the Department of Transportation(DOT)for phase1 to develop and build a solar parking lot. IN 2011,Solar Roadways received $750000 SBIR grant from the

DOT for phase 2. IN 2014, solar roadways started a crowdfunding drive at indiegogo to raise money so they can get product into production.

A Solar roadway is a road surface that generates electricity by solar power using photovoltaic and includes solar panels and LED signage, that can be drive on.

1.1.1. SOLAR ENERGY: Solar roadways is the light and radiant heat from the sun that influences Earth's climate, weather and sustains life. In the environmental context, it is also used to refer to the process of generation of electricity by tapping the solar energy.

1.1.2. PHOTOVOLTAIC CELL: Photovoltaic is a method of generating electrical power by converting solar radiation into direct current electricity using semiconductor that exhibit photovoltaic effect. The photovoltaic power generation employs solar panels composed of a no of solar cells containing a photovoltaic material. Due to the increased demand of renewable energy sources that manufacturing the solar cells and photovoltaic arrays has advanced considerably in recent year.

1.1.3. WHY SOLAR: Solar power generation has emerged as one of the most rapidly growing renewable sources of electicity solar power generation has other advantages over other form of electricity generation.

1.1.4. ENVIRONMENTAL ADVANTAGES: Solar power production generates electricity with a limited impact on the environment as compared to other forms of electricity.

1.1.5. MODULARITY AND SCALABILITY: As a size and generating capacity of a solar system are a function of number of solar modules installed, application of a solar technology are readily scalable and versatile.

II. WORKING PRINCIPLE

A solar roadways is a series of structurally engineered solar panels that are drive on. The idea is to replace current petroleum based asphalt roads , parking lots and driveways with solar road panel that collect energy to be used by homes and businesses , and ultimately to be able to store excess energy in or alongside the solar roadways. Thus renewable energy replaces the need for the current fossil fuels used for the generation of electricity, Which cut greenhouse gasses and helps in sustainable development.

Parking lots, driveways and eventually highways are all target for the panel. If the entire united state interstate highway system were surfaced with solar roadway panels , it would produce more than three times the amount of electricity currently used nationwide.

Solar panel consist of three layers

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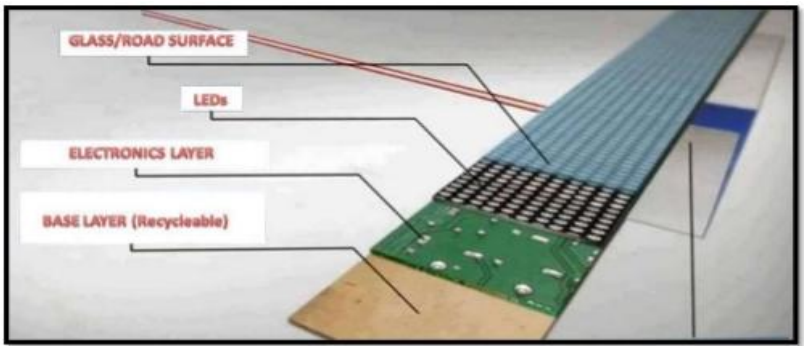

Fig.1.layers of solar panel

1-ROAD SURFACE LAYER : Translucent and high strength , it is rough enough to provide sufficient traction , yet still passes sunlight through to the solar collector cells embedded within , alongwith LEDs and heating element . This layer needs to be capable of handling todays heaviest loads under the worst of conditions and to be weather proof , to protect the electronic layer be neath it.

2-ELECTRONICS LAYER : It contains photovoltaic cells which absorb solar energy . It also contains a micro processor board with support circuit for sensing loads on the surface and controlling a heating element with a view to reducing or eleminating snow and ice removal as well as school and business closings due to inclement weather . the microprocessor controls lighting communication and monitoring etc.

3-**BASE PLATE LAYER** : It need to be weather proof to protect the electronic layer above it. Distributes power and signals to and from the panel.

III. ANALYSIS AND DICUSSION

ADVANTAGES :

1-RENEWABILITY AND LIFE SPAN : The main advantage of solar roadways concept is that is utilize a renewable source of energy to produce electricity. It has the potential to reduce dependence on conventional source such as coal , petroleum and fossil fuels .

2-MILITARY AND RESCUE ASSISTANCE : In the event of environmental disaster or military emergency, solar roadways should provide power when it is needed more . As solar power is renewable , it obviously required no external to an artificial power source.

3-**ROADWAYS ALREADY IN PLACE** : Another advantage of solar roadways is that they do not require the development of unused and potentially environmentally sensitive lands. This is very controversial issue with large photovoltaic installation in the south western us and other places.

4-LIGTHING UP OF ROADS : By adding LEDs beneath the transparent panels , road can be lightened up for safe night travel and aesthetic look.

5-INITIAL COST : The average cost of asphalt roads in 2006 was roughly $16 per square foot. The cost does not include maintenance or snow ice removal. The average lane width is 12 feet , so a 4 lane highway would be 12 *4*5280 is equal to 253400 square feet. Multiply this by $16 per square foot and your one mile stretch of asphalt highway will cost $4,055,040,00 and will last an average of last seven year.

CHALLENGES:

1-MAINTAINCE COST : They are more because road surface accumulate rubber, salt , soil and other substances that block sunlight and must be removed. The durability of the panels may also be less , further increasing maintenance cost.

2-SESSANAL EFFICIENCY: In India the solar road will work efficiently in summer, while it will give comparatively less efficiency in other seasons due to lack of solar radiation. Where as in the countries where summer last for more than half of year this technique can be efficiently used.

3-NEEDS A TOWN PLANING: If these roads are to be used town planning plays a vital role as these roads needs a accurate orientation of buildings , roads, sanitary lines, parking lots , playground etc.

IV. FUTURE SCOPE

In future, normal roads can be replaced by the solar roadways but huge initial investment is required. The solar roadway alternative could be made at less cost with an energy return while phasing out the old system . AS old roads are scheduled to be under maintenance , the process of solar roadway placement could occur seamlessly. The alternative of airports and parking lots are under varying timelines. Whenever fiscal dilemmas become the primary motivating factor for a state or municipal budget, the option of solar roadways should

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be presented and defended. With respect to solar roadways being future proof asphalt roads are a dead end . there are no redeeming features to asphalt that should hinder the progress of a new model. The ITS program seems to be begging for a concept that is readily available for the next step .solar roadways will answers our nations problem in the field of transportation pollution, waste pollution , coal pollution , transportation funding and energy .

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