

Integrated Intelligent Digital Green Roads

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Abstract--- Roadways are major civil structures for transportation. Transportation systems use 25% of the world's total energy production and are one of the prime sources of CO2 emission. For sustainable development and to reduce carbon emission, renewable energy is becoming very widespread. Researches have been done on the solar roadways using photovoltaic cells and solar panels. In this paper an integrated approach is discussed on how solar roads can benefit the current and future generations in multiple ways so that it will help to provide solutions in overcoming the obstacles of basic necessities including clean air, purified water secured food and clean energy, employment, national announcements/road announcements, electric charging, highway intelligence etc.

I. INTRODUCTION

Roadways are major infrastructure for connecting people and providing access and mobility. With increasing concern of global warming and the depletion of fossil fuel reserves, many are looking at sustainable energy solution to preserve the earth for the future generations. Solar energy holds the most potential to meet our energy demands. The idea is to gather the substantial solar energy which hits the surfaces but is currently not being utilized. In this way, they will have a dual purpose: modern infrastructure and smart power grid. This also opens up a whole new market for the solar industry.

II. BENEFITS

Below are the list of benefits (but not limited to) that we can obtain by using the solar roadways and this can be adapted in an integrated way to reap the vast opportunities it provides.

A. Clean Air

Emission of greenhouse gases will be greatly reduced. So no more global warming in the solar roads.



Figure - Solar Roads for clean air

B. Clean Water

Rain water harvesting beside the solar roadways will help in clean water to be provided for the surrounding communities from water tanks.

C. Food security and Immunity

Organic food cultivation and medicinal plants beside the solar roads will help in providing the communities to get good food and building immunity.



Figure - Solar Roads with organic food cultivation

D. Clean energy

We can build electric charging stations at regular distances to charge electric vehicles to foster cleaner energy. In addition, this will be used to supply energy to the households from the centralized integrated power grid, to help communities use green energy.

E. Green Employment

Overall this also helps in industrial revolutions to take it to the next level by providing decent jobs to many.

F. Intelligent highways

It pays for itself through the generation of renewable energy viz., TV, telephone, high-speed internet, intercommunication between roadway and cars to avoid collision. It is an Embedded Tracking system.



Figure – Intelligent Solar Roads

G. Illuminated Roads

The solar roadways will have LEDs and will illuminate the lanes. LEDs can be programmed to show the traffic instructions as well as national messages.



Figure - A Solar Highway

H. Snowfall Management

The embedded heating elements help the road to heat them and melt away the snow.

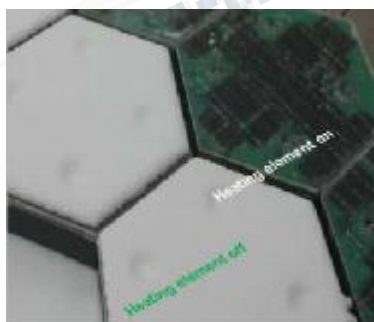


Figure - A Solar Road with embedded heating element

I. Accident prevention

The cells in the solar panel can detect if something is on the surface of the panel. It can protect wildlife and motorists.

J. Smart roadways

Solar roadways are also smart roads with electronic LED displays built-in. Warning signs with LED text to warn people about downed limbs, animals, and construction can be displayed directly on the road ahead. And they can also help with power lines and poles. A cable corridor runs underneath, housing power lines, cable lines, and fiber optics, replacing the need for telephone poles. It also serves as a transportation system for storm water, running it to treatment facilities.



Figure - A Solar Smart Highway

III. CONCLUSION

50 Billion tonnes of CO₂ e produced each year by global greenhouse gas emissions and this leads to air pollution. 2.3 Billion of world population is living in water scarce areas. And 2Billion of world population do not have access to safe, nutritious and sufficient food. These data indicate the grave insights with respect to basic necessities in life. Solar roads are a means to overcome these challenges and helps in providing solutions in multiple ways for the current and future generations to come.

Though the initial investment is more but in the long run it's a worth investment as ROI is on the higher side because of the multiple benefits listed above which needs to be seen in an integrated manner. And of course, it can be adopted in stages.

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