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Design and Innovation of Hybrid Solar Vehicle

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Abstract: *This paper proposes a Hybrid Solar Vehicle system which solves the major problems of fuel and pollution. The renewable energy is vital for today's world as in near future the renewable sources that we are using are going to get exhausted. Wind power is clean and sustainable natural resources that has yet to be fully utilized in the automotive industry. Also the sun is probably the most important source of renewable energy available today. The hybrid system has been designed and installed to generate power which combines wind turbine and solar panel. The hybrid model system is renewable energy system, which helps conserve energy by reducing the use of fuel in vehicle. Hence developing a new method for the economical evaluation of Hybrid Systems for electricity production. The hybrid solar vehicle is a step in saving these renewable sources of energy. The basic principle of solar vehicle is to use energy that is stored in a battery during and after charging it from a solar panel. Power generated by renewable energy sources has recently become one of the most promising solutions for the electrification of islands and remote rural areas. But high dependency on weather conditions and the unpredictable nature of these renewable energy sources are the main drawbacks. To overcome this weakness, Solar Energy combined with wind energy. The charged batteries are used to drive the motor which serves here as an engine and moves the vehicle in reverse or forward direction. This idea, in future, may help to protect our fuels from getting extinguished.*

Keywords: Solar Panel, Converter, Battery pack, Motor, Framebody

I. INTRODUCTION

In the last years, increasing attention is being spent towards the applications of solar energy to electric and also to hybrid cars. But, while cars only fed by sun do not represent a practical alternative to cars for normal use, the concept of a hybrid electric car assisted by solar panels appears more realistic (Letendre et al.,2003; Fisher, 2009). The reasons for studying and developing a Hybrid Solar Vehicle can be summarized as follows: Fossil fuels, largely used for car propulsion, are doomed to depletion; their price tends to increase, and is subject to large and unpredictable fluctuations; The CO2 generated by the combustion processes occurring in conventional thermal engines contributes to the greenhouse effects, with dangerous and maybe dramatic effects on global warming and climatic changes; The worldwide demand for personal mobility is rapidly growing, especially in China and India; as a consequence, energy consumption and CO2 emissions related to cars and transportation are increasing; Solar energy is renewable, free and largely diffused, and Photovoltaic Panels are subject to continuous technological advances in terms of cell efficiency; their diffusion is rapidly growing, while their cost, after a continuous decrease and an inversion of the trend occurred in 2004, is continuing to decrease. Solar cars, powered only by the sun, in spite of some spectacular outcomes in competitions as World Solar Challenge, do not represent a practical alternative to conventional cars, due to limitations on maximum power, range, dimensions and costs; Hybrid Electric Vehicles (HEV) have evolved to industrial maturity, and represent now a realistic solution to important issues, such as the reduction of gaseous pollution in urban drive as well as the energy saving requirements (Guzzella and Amstutz, 1999); the degree of electrification of the fleet is expected to grow significantly in next years.

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II. PROBLEM STATEMENT

The solar power generation systems are installed through parallel connection of two or more conventional and renewable energy generation systems to each other. The hybrid power generation systems are one of the best solution methods to meet the electric energy need of mini or micro networks far distance from energy generation and distribution centers and of small settlement units. Most commonly, the wind-solar solar power generation system is used. For electric generation systems in various structures, recently, hybrid energy generation systems are realized by combining mainly the wind and the solar energy and fuel cell and soon. However, as more staff will be used for hybrid energy generation systems installed with more than one renewable energy source, the cost and installation area need will increase and structure and inspection of the system will become complicated. In this paper, a battery-supported hybrid wind-solar energy generation system with switching power flow control is presented to supply stable electrical power.

III. OBJECTIVE & ANALYSIS

1. Energy Efficiency and Fuel Reduction:

Maximize energy efficiency: HSVs aim to combine the advantages of solar power with conventional energy sources (e.g., gasoline, diesel, or electric). By harnessing solar energy, these vehicles reduce reliance on non-renewable fuels, leading to lower fuel consumption and enhanced overall energy efficiency.

Lower operating costs: Solar energy can help offset the costs of conventional fuel, reducing the overall cost of ownership for vehicle users.

2. Environmental Sustainability:

Reduction of greenhouse gas emissions: By utilizing solar energy and reducing dependence on fossil fuels, HSVs contribute to a significant reduction in CO2 emissions and other pollutants, helping mitigate climate change.

Less pollution and noise: Hybrid solar vehicles, particularly when operating on electricity, can reduce air and noise pollution compared to traditional internal combustion engine vehicles.

3. Promotion of Renewable Energy Integration:

Utilization of solar energy: One of the core objectives is to integrate solar power into everyday transportation. By using solar panels on the vehicle, HSVs reduce the demand for grid power and encourage the use of clean, renewable energy.

Energy independence: Solar-powered systems enable vehicles to partially or fully rely on locally generated renewable energy, promoting energy independence and reducing reliance on external fuel sources.

4. Extended Range and Flexibility:

Increased driving range: By combining solar energy with traditional energy storage systems (like batteries), HSVs can extend their range, especially in areas with abundant sunlight. This makes solar vehicles more practical for long-distance travel or in regions where charging infrastructure for electric vehicles may be lacking.

Hybrid system benefits: The hybrid powertrain offers flexibility in terms of energy sourcing, ensuring that the vehicle operates efficiently in various conditions, such as on cloudy days or during nighttime.

5. Reduction of Carbon Footprint:

Lower lifecycle emissions: Hybrid solar vehicles reduce the environmental footprint throughout their lifecycle, from production through to operation. Using renewable energy for propulsion helps in cutting down the carbon emissions associated with transportation.

6. Technological Innovation and Research:

Advancement of solar technology: HSVs drive the development of more efficient solar panels, batteries, and energy management systems, contributing to advancements in solar energy technologies.

Electric vehicle and hybrid innovation: Hybrid solar vehicles help refine the integration of solar energy with electric powertrains, contributing to innovation in hybrid vehicle technology.

7. Public Awareness and Adoption of Clean Transportation:

Increased adoption of electric vehicles (EVs): Hybrid solar vehicles can help promote the adoption of electric and hybrid vehicles, particularly in markets where consumers are concerned about range anxiety or charging infrastructure limitations.

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Public demonstration of solar potential: These vehicles serve as a visible example of how solar energy can be integrated into everyday life, encouraging individuals, businesses, and governments to invest in renewable energy solutions.

Reduce Environmental Impact

One of the primary objectives is to **minimize carbon emissions** and **reduce dependence on fossil fuels**. By integrating solar panels to harness energy from the sun, solar hybrid vehicles contribute to:

Lower greenhouse gas emissions.

Reduced air pollution, especially in urban areas.

Mitigation of climate change impacts.

This aligns with global goals for cleaner and greener mobility.

Improve Energy Efficiency

Traditional internal combustion engine (ICE) vehicles convert only about 20–30% of the fuel's energy into motion. In contrast, hybrid vehicles using solar power can improve overall energy efficiency by:

Using solar energy to assist propulsion or recharge batteries.

Reducing load on the engine or main electric battery.

Operating more efficiently in low-speed and idle conditions.

Reduce Operational Costs

Though initial investment in solar hybrid technology may be higher, **long-term cost benefits** include:

Reduced fuel or electricity costs by supplementing with solar power.

Lower maintenance costs due to fewer moving parts in electric systems.

Decreased reliance on external charging infrastructure.

Extend Driving Range

Solar panels can **charge auxiliary batteries or support propulsion**, especially in sunny regions, leading to:

Increased vehicle range, particularly for electric hybrid vehicles.

Improved performance in remote or off-grid areas where charging stations are unavailable.

Enhance Energy Independence

Solar hybrid vehicles **reduce dependence on centralized energy sources** and fossil fuels. This is particularly valuable in:

Remote or rural regions.

Countries with limited oil resources.

Situations involving frequent fuel price fluctuations or supply instability.

Promote Renewable Energy Integration

The project promotes **research and development in solar energy applications** and encourages adoption of clean technologies:

Drives innovation in solar panel efficiency, lightweight materials, and energy management systems.

Supports integration of renewable sources in automotive and transportation sectors.

Educational and Awareness Goals

Solar hybrid vehicle projects often serve as platforms for:

Educating the public and engineering students about sustainable energy.

Demonstrating practical applications of renewable energy.

Raising awareness of environmental issues and sustainable mobility.

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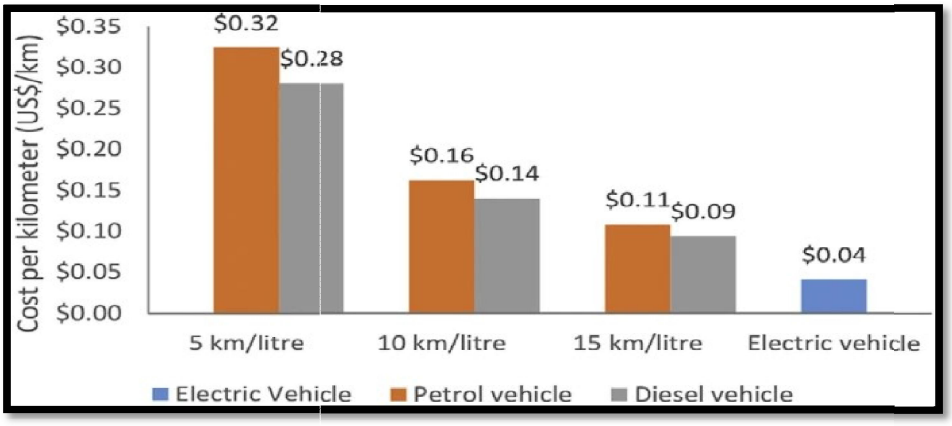

A comparison of cost per KM Electric Vehicle, Petrol Vehicle, Diesel Vehicle.

IV. CONCLUSION

The integration of photovoltaic panels in hybrid vehicles is becoming more feasible, due to the increasing fleet electrification, to the increase in fuel costs, to the advances in terms of PV panel technology, and to the reduction in their cost. Hybrid Solar Vehicles may therefore represent a valuable solution to face both energy saving and environmental issues. Of course, these vehicles cannot represent a universal solution, since the best balance between benefits and costs would depend on mission profile: in particular, significant reductions in fuel consumption and emissions can be obtained during typical use in urban conditions during working days. Moreover, the integration with solar energy would also contribute to reduce battery recharging time, a critical issue for Plug-in vehicles, and to add value for Vehicle to Grid applications.

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