

Design and Performance Analysis of a Solar Powered Hybrid Rickshaw for Commercial Use in Pakistan

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Abstract: The energy sector of Pakistan is not well developed and it is also inadequately managed. Due to this fact currently the country is facing severe energy crisis and large share of the energy sources are consumed by automobiles. In order to contribute in solving energy crisis problem, there is a need to increase awareness of using alternate fuel for automobiles and also to propose an alternate solution for conventional rickshaw which is the most famous mean of transport for local public in Pakistan. The main issue with conventional rickshaw is high fuel cost, high noise pollution, high maintenance cost, less mileage and high smoke pollution. The solar powered hybrid rickshaw (S-rickshaw) product is designed and fabricated to overcome these issues. The product efficiency is enhanced to make it feasible as compared to fuel prices and cartridge battery system is introduced to enhance its availability. The concept of solar charging stations for Karachi, Pakistan is proposed to make the product commercially viable. The four prototypes for passenger type rickshaws and one prototype for cargo loading type are fabricated to check the results. The performance of solar powered hybrid rickshaw is tested through average speed analysis test i.e., 40 km h^{-1} , mileage per charge i.e., $40 \text{ km charge}^{-1}$, charging time for batteries is 8 h, tyre load index is 71 and stopping distance at maximum speed of 50 km h^{-1} is 14 m. The breakeven time period of S-rickshaw is higher than the E-rickshaw because of higher initial investment but this is compensated by lower operational cost per year. As resultant the user get higher annual savings from the product. Annual saving difference for S-rickshaw will be US \$468 higher than E-rickshaw and US \$1350 higher than the conventional rickshaw (C-rickshaw).

Keywords: Renewable energy, solar hybrid, solar rickshaw, solar powered vehicle, smoke pollution

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