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# A Review on Hybrid Electric Motor Cycle

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**Abstract:** A wide range of topics related to electric two-wheelers (ETWs) and related technologies are covered in the literature study. The increasing significance of hybrid and electric automobiles as remedies for ecological predicaments in the transportation domain, stressing the necessity of tackling concerns like exorbitant battery expenses, energy usage, and charge durations. Battery-swapping charging stations are suggested as a possible remedy; nevertheless, difficulties in guaranteeing a sufficient supply of batteries are mentioned. Particular focus is placed on the particular difficulties large-sized electric two-wheelers have, which call for a different strategy than that of electric passenger cars. The possibility of various energy technologies, such as hybrid fuel cells and supercapacitors, in next-generation automobiles is examined. Research also looks at how air and noise pollution are affected by electric cars, addressing possible safety issues brought on by their low noise levels. The literature study provides significant insights into the field of electric two-wheelers by addressing a wide range of themes, including technical difficulties, energy storage methods, regulatory standards, and environmental concerns

**Keywords**: Electric two-wheelers, battery swapping, energy storage, hybrid technologies, environmental impact.

## 1. Introduction

The burgeoning interest in and advancement of hybrid and electric vehicles in the ever-changing realm of modern transportation represents a critical reaction to the grave environmental threats posed by the conventional use of fossil fuels. This study of the literature dives into a wide range of research viewpoints, examining the complex problems and creative fixes related to electric two-wheelers (ETWs). The charging stations have emerged as a viable solution to the problems related to high battery costs, energy consumption, and charging times for electric and hybrid vehicles. These issues are closely examined. This investigation goes beyond standard evaluations and investigates the vibration assemblies in large-scale electric two-wheelers critically, revealing differences from their passenger vehicle equivalents. The promise of other power sources, like batteries, hydrogen fuel cells, and hybrid combinations, as ways to reduce greenhouse gas emissions is shown by more research. The literature works through the complexities of energy storage methods, outlining potential problems and offering technological fixes, such as swapping out batteries and using metal hydrides to store hydrogen. The significance of effective, environmentally friendly transportation is emphasized through the exploration of battery monitoring, energy performance criteria, and creative power supply methods. In order to provide a comprehensive overview of the electric car landscape, the thorough assessment also takes into account economic analyses, perceptual studies, and environmental factors.

## 2. Literature Review

Bui et al. (2021) investigated though they have been experiencing issues with onboard energy storage technology, bikes powered by batteries, fuel cells, or a mix of these two or more power sources are the possible contenders for sustainable development in the future. Thus, the primary goal is to outline the current issues and technological fixes related to two-wheeler energy storage. It was discovered that switching metal hydride hydrogen storage canisters and batteries was the best course of action.

Caliwag et al. (2021) the amount of a battery's remaining usable capacity is discussed. When a battery is operated outside of its safe operating range, such as when it is continuously discharged at 0% SOC and continuously charged at 100% SOC, monitoring SOC helps avoid the negative impacts. The battery SOC needs to be measured at a consistent interval in order to be monitored. But it is impossible to quantify SOC directly.

Kammuang-Lue (2020) The high energy efficacy level (HEPS) and the minimal energy

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consumption criteria (MEPS) for electric motorcycles in Thailand were the subject of an investigation. The type approval of electric motorcycles was cited under Regulation (EU) No 168/2013. European Union Regulation No 134/2014 was followed in the measurement and testing setup of the electric energy usage.

Dwibedi et al (2020) a wider range of power for electric cars using PV panels or batteries was investigated to solve issues with the car's batteries, like rapid charging and discharging. Better acceleration, controlled regenerative braking, a longer range for driving, longer lasting power, and a lighter battery pack are some of this model's benefits. Reducing the stress on the battery during the permanent magnet-powered brushless DC motor's acceleration and braking was the aim of this endeavor. Boost converters are used to transfer power to the motor correctly at various points during the driving cycle while reducing total harmonic distortion (THD) to a larger extent.

Nayak et al. in (2023) Numerous cutting-edge energy systems have been addressed, along with special techniques to guarantee maximum longevity and efficiency, like avoiding thermal runaway reactions and minimizing electrode deterioration. Large-scale adaptations of hybrid fuel cells and supercapacitors appear possible. In order to power the future generation of vehicles, new materials and methods for synthesizing the former have also been explored.

Pardo et al. (2020). Research on electric vehicles in cities helps to lessen the pollution of the air and noise in these spaces. Nevertheless, the previously perceived benefit of these vehicles' low noise levels may now be a danger to other drivers' safety. The actual scope of this problem is debatable, though. This study examines a topic that hasn't been explored before: the opinions of seasoned drivers of electric and hybrid vehicles in professional settings. In all, 95 drivers of electric vehicles and motorcycles from various government agencies in the Spanish city of Málaga took part in the research.

Sneha Angeline (2020) and other people discussed Electrification is a good way to build an environmentally friendly and energy-efficient transportation system. Electric car impacts on the environment are thought to be a serious concern. Both the locomotive business and the electrical sector benefit from the trustworthy technology provided by electric vehicles. A eco vehicle provides grid-supporting additional services and helps to provide an alternate generator for domestic usage.

Carranza et al (2022) ICE cars (ICEVs) and BEVs, or were contrasted, and the longevity of motorbike use in Spanish cities was examined. The environmental costs connected with each vehicle type are taken into account when doing a fiscal evaluation of the overall expenses of ownership. For both motorcycles, a thorough inventory is created which comprises a list of every necessary component and two different kinds of BEV batteries. The third alternative is to perform a threshold analysis on the factors with the highest influence.

Goussian et al. (2019) assessed a number of energy storage technologies' practicality, concentrating on a passive hybrid designs for electric motorcycles. The hybridization under investigation is based on a passive concurrent architecture that connects lithium-ion capacitance and potassium titanium nickel 18650-type cells to supply the motorcycle's powertrain. Based on the application of Ns/Np cell sizing maps to sensitive hybrid architecture, the structure of the apathetic hybrid system for storing energy is entirely handled using battery packs with lithium-ion and lithium-ion capacitors.

Macias et al. (2021) investigated When it comes to power supply systems, electric recreational vehicles are different from the high-performing light-duty electric vehicles of today. Recreational vehicles must ensure the high demanded power while adhering to the restricted dimension criteria

Weber et al. (2019) examined data from dynamometric examinations of internal combustion and electric motorbikes. They found that the average energy performance of liquid-fueled engines was 15.32%, but electric vehicles performed three times better, with an efficiency of 47.06%. This finding spurred a more thorough evaluation that took into account the Brazilian energetic matrix and expanded the energy chain using a bottom-up methodology and the Primary Energy Factor (PEF).

Chung et al. (2019) e-CVT, which may function in input-split or output-split style while in hybrid drive or offer dual-motor drove when in pure electrically powered mode, was studied by the author along with other full hybrid electric vehicles (HEVs). This powertrain consists of one motor, one motors, and one generator. It also has two single-way clutches, a regulated clutch, and a unique mechanical link between the two global gearsets.

Jiang et al. (2020). A fuel cell, a super capacitor pack, and two related power converters are all combined in this investigated hybrid power source. Experiments are used to carefully calibrate the system model. This makes it possible to meaningfully identify the different methods' parameters. Utilizing a motorbike certification driving cycle, the model data is calculated.

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Bastida-Molina (2020) el at, Since they produce no emissions when in motion, electric vehicles (EVs) seem to be an environmentally friendly answer for the transportation industry. However, this method may be gravely jeopardized by the carbon intensity (CI) of the energy sources used in the system of generating power. Therefore, by introducing EVs, this study offers a mechanism to confirm the sector's sustainability. It compares the emissions produced by two fleets using the "Well-to-Wheel" tool: one is based on internal combustion engine vehicles (ICEVs).

## 3. Results and Discussion

Taken taken as one, the studies and articles under consideration show how electric bicycles (ETWs) are evolving, along with the challenges and innovations that go along with them. Electric and hydrogen-powered cars are viewed by the transportation sector as essential solutions to environmental problems; yet, they face difficulties because of their expensive batteries, high energy consumption, and long charging periods. Battery-swapping stations are a solution that need enough kinds of battery and charging slots.

Several studies look on the problems and technological fixes surrounding energy storage systems for 2-wheeled vehicles Battery state-of-charge maintenance is crucial for preventing adverse effects, necessitating periodic periods for testing. likewise, regulatory framework-compliant minimum requirements for energy performance are proposed for electric motorcycles.

Among the advances are studies into the usability of different battery charging systems for electric automobiles, extended range power source models combining solar cells and batteries, and wavelet-based power control systems for integrated energy storage. The integration of contemporary technologies including lithium-ion capacitors, fuel cells, and super caps is being researched for enhanced efficiency and performance.

## 4. Conclusions

The following were the conclusions drawn from the results of the TCLP and Netherlands tank leaching tests:

(a) The leaching of metals was comparatively high in the TCLP test compared to that of the Netherlands tank leaching test.
(b) The crushing of particles increases the surface area of particles, resulting in increased chances of getting in contact with the leaching solution.
(c) TCLP test results do not depend on the distribution of metals in the inner portions of the brick, whereas the Netherlands tank leaching test has a significant impact on the distribution of metals in the brick.
(d) The crushing of particles has a more significant impact on the leaching of metals than the contact period with the leaching solution.
(e) TCLP test results are more appropriate to the actual field conditions arising during the service life of materials.

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