



Scienxt Journal of Recent Trends in Automobile Engineering & Research
Volume-2 || Issue-1 || Jan-Apr || Year-2024 || pp. 1-13

Driving towards tomorrow: exploring the evolution and challenges of hybrid electric vehicles

***¹Henry Joy, ²Dr. P Jen0 Paul**

^{*1,2}Department of Electrical and Electronics, Adi Shankara Institute of Engineering and Technology (KTU),
Kalady, India

**Corresponding Author: Henry Joy
Email: henryjoy96@gmail.com*

Abstract:

Hybrid electric vehicles (HEVs) represent a pivotal advancement in automotive technology, blending internal combustion engines with electric propulsion systems to redefine the future of transportation. This review paper comprehensively explores the intricate components, diverse types, versatile operation modes, compelling advantages, persistent difficulties, and groundbreaking innovations within the realm of HEVs. HEVs encompass various types, including full hybrids, plug-in hybrids, and mild hybrids, each offering distinct benefits in terms of efficiency, range, and environmental impact. Innovative powertrain architectures, next-generation batteries, regenerative braking systems, predictive energy management, and electrification of auxiliary systems, vehicle-to-grid integration, and advanced driver assistance systems are among the cutting-edge innovations shaping the evolution of HEV technology. However, challenges such as cost barriers, battery degradation concerns, weight constraints, maintenance requirements, infrastructure limitations, and consumer adoption hurdles persist, underscoring the need for collaborative efforts to overcome obstacles and accelerate the transition to a sustainable transportation paradigm. Through an in-depth analysis of HEV components, types, operation modes, advantages, innovations, and difficulties, this review paper provides valuable insights into the current state and future prospects of hybrid electric vehicles in the automotive industry.