

## Review of Strategies for Hybrid Energy Storage Management System in Electric Vehicle Application

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**Abstract :** Electric Vehicles (EV) appear to be gaining increasing patronage as a feasible alternative to Internal Combustion Engine Vehicles (ICEVs) for having low emission and high operation efficiency. The EV energy storage systems are required to handle high energy and power density capacity constrained by limited space, operating temperature, weight and cost. The choice of strategies for energy storage evaluation, monitoring and control remains a challenging task. This paper presents review of various energy storage technologies and recent researches in battery evaluation techniques used in EV applications. It also underscores strategies for the hybrid energy storage management and control schemes for the improvement of EV stability and reliability. The study reveals that despite the advances recorded in battery technologies there is still no cell which possess both the optimum power and energy densities among other requirements, for EV application. However combination of two or more energy storages as hybrid and allowing the advantageous attributes from each device to be utilized is a promising solution. The review also reveals that State-of-Charge (SoC) is the most crucial method for battery estimation. The conventional method of SoC measurement is however questioned in the literature and adaptive algorithms that include all model of disturbances are being proposed. The review further suggests that heuristic-based approach is commonly adopted in the development of strategies for hybrid energy storage system management. The alternative approach which is optimization-based is found to be more accurate but is memory and computational intensive and as such not recommended in most real-time applications.

**Keywords :** battery state estimation, hybrid electric vehicle, hybrid energy storage, state of charge, state of health

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