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REVIEWER'S REPORT

Manuscript No.: IJAR-58953

Title: ULTRA-FAST CHARGING TECHNOLOGIES FOR ELECTRIC VEHICLES: OPPORTUNITIES AND CHALLENGES.

Recommendation:

Accept as it is .....

Accept after minor revision.....

Accept after major revision .....

Do not accept (*Reasons below*) .....

Rating	Excel.	Good	Fair	Poor
Originality		✓		
Techn. Quality		✓		
Clarity		✓		
Significance	✓			

Reviewer Id: JPR-258

Reviewer's Comment for Publication.

The manuscript addresses a highly relevant and timely topic concerning ultra-fast charging (UFC) technologies for electric vehicles. The study provides a useful quantitative comparison of different charging-power classes (50, 150, 250, 350, and 400 kW) using 2,500 standardized Monte Carlo scenarios. The manuscript appropriately discusses the trade-offs among charging time, battery thermal response, charging efficiency, degradation stress, and grid demand. The topic is significant for researchers and practitioners working in electric vehicles, battery systems, power electronics, and charging infrastructure.

The major strength of the manuscript is its attempt to establish a standardized framework for comparing different charging-power levels while recognizing that charger nameplate power does not necessarily represent the actual power accepted by the battery. The discussion of high-voltage architectures, SiC-based power electronics, battery thermal management, lithium plating, charging infrastructure, and grid-side impacts further increases the practical relevance of the work.

However, several points should be addressed before publication:

1. **Methodology requires greater reproducibility.** The Monte Carlo model is central to the manuscript, but the probability distributions and exact mathematical formulation used for the stochastic acceptance/taper factor, temperature-response term, and degradation-stress index are not sufficiently described. The authors should provide the equations, parameter distributions, assumptions, and randomization procedure in sufficient detail so that the analysis can be independently reproduced.
2. **The distinction between modeled results and experimental evidence should be emphasized more clearly.** The reported charging times, temperatures, efficiencies, and degradation-stress values are model-derived rather than measurements from actual EV battery packs. This limitation is acknowledged, but it should be made explicit throughout the Results and Conclusion sections to prevent readers from interpreting the numerical values as experimentally validated performance.

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3. **The degradation-stress index needs stronger justification.** Since this index is newly constructed as a screening metric, the authors should explain more clearly how its components and weighting were selected and whether sensitivity analysis was performed. A comparison with experimentally measured degradation indicators would strengthen the validity of this metric.
4. **The 400/800-V modeling assumption should be clarified.** Assigning 50/150 kW systems to 400 V and 250/350/400 kW systems to 800 V is useful for standardization, but this assumption may influence current, thermal losses, and efficiency results. A sensitivity analysis using alternative voltage configurations would improve confidence in the conclusions.
5. **Statistical interpretation should be improved.** Because the 2,500 observations are simulated scenarios rather than independent experimental observations from a physical population, the manuscript should be careful not to overinterpret very small p-values. Effect sizes and engineering significance should receive greater emphasis than statistical significance alone.
6. **Some numerical statements require correction or clarification.** For example, the Results section contains incomplete text around the maximum temperature value ("36.04±3.49 at 350 kTime…"), and the statement concerning charging losses appears truncated or incorrectly formatted. These typographical and numerical presentation errors should be carefully corrected.
7. **Consistency should be maintained in reported values.** Some values differ slightly between the abstract, tables, Results, and Conclusion. The authors should verify all numerical values, units, decimal places, and rounding throughout the manuscript.
8. **The reference list requires careful checking.** Some references appear only loosely connected to the specific UFC discussion, particularly references concerning general converters, microgrids, and EV applications. The authors should ensure that every cited reference directly supports the corresponding statement. Reference formatting should also be standardized.
9. **The manuscript would benefit from improved language and proofreading.** There are several grammatical issues and awkward expressions, such as "charging acceptance," "peak battery system level of charging (SoC)," "greater that 95%," "it have a poor energy density," and other instances of inconsistent terminology. Professional English editing is recommended.
10. **The figures should provide sufficient information for independent interpretation.** Axis labels, units, legends, sample sizes, and definitions of modeled quantities should be checked carefully. Where applicable, confidence intervals or other measures of uncertainty should be explained consistently.
11. **The practical recommendation of 250–350 kW as an engineering compromise should be better supported.** This is an interesting conclusion, but it should be presented as a model-based recommendation rather than a universal optimum. Vehicle battery chemistry, pack size, thermal-management capability, grid conditions, and charging profiles can substantially change the optimal operating point.
12. **The limitations section should be expanded slightly.** In particular, the effects of battery aging, cell-to-cell variation, ambient temperature, charging-curve shape, pack configuration, and real-world charger reliability should be discussed in relation to the quantitative model.

Overall, the manuscript presents a relevant engineering problem and contains useful quantitative analysis and discussion. The conclusions are potentially valuable, particularly the observation that increasing charger rating produces diminishing charging-time benefits while increasing thermal, battery-stress, and grid-demand requirements. Nevertheless, the model assumptions and degradation-stress methodology need clearer documentation, and several presentation and consistency issues should be corrected.

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Recommendation: Accept after minor revision. The revisions requested above are important for improving scientific clarity, reproducibility, and reliability, but they do not require a fundamental restructuring of the study.