e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
( Peer-Reviewed, Open Access, Fully Refereed International Journal )
Volume:05/Issue:10/October-2023 Impact Factor- 7.868 www.irjmets.com

# BATTERY SELECTION FOR ELECTRIC VEHICLE

**P. Govinda Rao[*1], P. Murali[*2], V.V.S Ganesh[*3], U. Sainadh[*4], S. Hemanth[*5], Dr. P. Ramana[*6], Dr. V. Manoj[*7]**

[*1,2,3,4,5,6,7]Department Of Electrical And Electronics Engineering, GMRIT, Rajam, 532127, Andhra Pradesh, India.

## ABSTRACT

The selection of the best battery technology is essential to the success and general acceptance of EVs. Determining important elements including energy density, power output, charging time, cycle life, cost, safety, and environmental impact is critical when choosing a battery for an electric vehicle (EV). The suitability of several battery technologies, including lithium-ion, nickel-metal hydride, solid-state, and others, for use in electric cars is assessed. This project gives a broad overview of the significance of battery selection for EVs while taking into account different battery types and their benefits and drawbacks. In order to assist in choosing the best battery for electric vehicles, the study also examines two well-known decision-making techniques, PROMETHEE 2 (Preference Ranking Organization Method for Enrichment Evaluations) and FAHP (Fuzzy Analytic Hierarchy Process). The PROMETHEE 2 method and FAHP ranking approach are used to speed up the battery selection process. With the help of PROMETHEE 2 multi-criteria decision-making framework and FAHP, we may evaluate battery solutions based on how crucial they are to fulfilling particular EV needs. Both approaches provide useful information about the best battery technology for electric vehicles, taking into account a number of factors.

**Keywords:** EV, Battery, Lithium, MCDM, FAHP, PROMETHEE 2.

## I. INTRODUCTION

The Electric vehicles (EVs) are essential in solving many of the world's most important problems today. They play a crucial role in halting climate change, to start. Since the transportation industry contributes significantly to greenhouse gas emissions, EVs provide a cleaner option because they have no exhaust emissions. By switching to electric vehicles, governments may drastically cut their carbon footprints and work toward achieving their climate goals, so reducing the potentially disastrous effects of global warming. Second, EVs improve the quality of the air in cities. Vehicles with conventional internal combustion engines generate dangerous pollutants that are bad for public health. The absence of exhaust emissions from EVs reduces air pollution and its associated health problems, making the environment better. Additionally, by utilizing a variety of energy sources, electric vehicles help to ensure energy security. Electric vehicles (EVs) rely heavily on their batteries, which are crucial to both their performance and environmental impact. First, batteries act as a storage device for energy, providing the electric motor of an EV with power. The vehicle's range directly affects consumer acceptance and usage and is a key determinant of battery capacity. Second, batteries allow EVs to have zero tailpipe emissions, which makes a significant difference in the fight against climate change and air pollution. The battery's capacity to offer a clean and effective energy source free from the pollution produced by internal combustion engines is essential to this environmentally favourable feature. Additionally, improvements in battery technology are essential to enhancing the infrastructure for charging EVs, making them more useful and practical for daily usage. EVs don't emit any exhaust, which reduces air pollution and its associated health problems, making the world a cleaner and more habitable place for everyone. Furthermore, by varying the sources of energy used for transportation, electric vehicles help to ensure energy security. Electricity can be produced from a variety of renewable sources, such as solar, wind, and hydro power, as opposed to fossil fuels, which lessens reliance on unstable oil markets and improves energy resilience. Last but not least, the EV sector fosters technological advancement and job prospects. Research and development in the fields of battery technology, charging infrastructure, and vehicle design affect a wide range of businesses in addition to the automotive one. Additionally, the rising demand for EVs encourages job growth in infrastructure development, maintenance, and manufacturing.

## II. LITERATURE SURVEY

Tummala Siva Lova Venkata Ayyarao,et al.,[1]This paper presents a novel bio-inspired Salp Swarm Algorithm (SSA) for sensorless speed control of Brushless DC (BLDC) motors. It employs an Extended Kalman Filter to estimate the motor's nonlinear dynamics, using PID control with SSA-tuned parameters to achieve optimal transient performance. Experimental validation demonstrates the method's effectiveness, even at low speeds.

Vasupalli Manoj,et al.,[2]This paper combines AHP and PROMETHEE methods to select the optimal site for wind energy projects in India, considering seven criteria. Through a case study of six wind projects, the analysis identifies the Muppandal wind farm in Kanya kumari as the best location for a wind power project.

Vasupalli Manoj,et al.,[3]This research focuses on enhancing the cost-effectiveness of solar panels within photovoltaic systems, crucial for harnessing solar energy. It employs VIKOR and TOPSIS techniques, combined with AHP, for selecting the most suitable solar cells. A comprehensive case study involving six types of solar panels demonstrates the effectiveness of these methods in decision-making for PV arrays.

Ayyarao SLV Tummala,et al.,[4]This paper explores the potential of high-altitude wind energy systems in bridging the energy gap with renewable sources. It highlights the need for increased focus on this area, addressing paradigms, generator selection, control, transmission, feasibility, installation, and control methods, offering a comprehensive review of this promising yet challenging field.

M. Venkatesh,et al.,[5]This paper addresses microgrid stability by integrating wind, electric vehicles, and diesel generators but faces challenges due to variable wind energy. To mitigate frequency deviations, a PID controller is optimized using the Dragonfly optimization algorithm, focusing on steady-state and transient performance improvement. Comparative analysis with PSO tuning demonstrates the superior performance of the Dragonfly-optimized microgrid.

Marzetti, S.et al.,[6] Interested in environmentally friendly electric cars (EVs) is sparked by rising environmental consciousness and depleting fossil fuel sources. The TOPSIS approach is used in this study to evaluate six electric vehicle batteries based on voltage, energy density, power density, temperature range, cycle life, and cost. The results show that Li-ion is the best performing battery type.

M. Liaqat, Z.et al.,[7] Electric vehicles (EVs) are gaining popularity due to their eco-friendliness because conventional vehicles release considerable amounts of greenhouse emissions. Due to their cost-effectiveness and technical merits, hybrid sodium-nickel chloride batteries (SNCB) and super capacitors (SC) are preferred in this study above lithium-ion batteries (LIB) and hydrogen fuel cells (HFC) as viable EV storage choices.

## III. RESULTS AND DISCUSSION

**FAHP:**

This method gives accurate weights when compared to all the other MCDM methods. The relative relevance of each criterion, which is quantitatively represented in the form of weights allocated to each of the criteria as listed in Table 1, is determined by pairwise comparisons between the assigned criteria.

**Table 1**: FAHP weights

| Parameter | Weights |
|---|---|
| Cost | 0.22 |
| Weight | 0.25 |
| SOC voltage | 0.35 |
| life cycles | 0.18 |

**PROMETHEE 2:**

The resultant rankings of the different batteries are obtained using weights, which are obtained from the FAHP weight method combined with the preference function from the PROMETHEE 2 ranking method, the results are shown in table 2.

**Table 2**: PROMETHEE 2 ranks

| Alternatives | Ranks |
|---|---|
| Lithium Iron Phosphate | 2 |
| Lithium Titanate | 4 |
| Lithium Ion | 1 |
| Lithium Manganese Oxide | 3 |
| Lithium Cobalt Oxide | 5 |

## IV. CONCLUSION

The ranks which are obtained from the PROMETHEE 2 method concludes that, lithium-ion battery has high preference when compared to all other batteries for electric vehicle as follows second important battery is lithium-iron phosphate. Lithium Manganese Oxide and Lithium Titanate are coming under the 3rd and 4th place in PROMETHEE 2 ranking method respectively. The last but not least Lithium Cobalt Oxide, which is more effectively used in last quarter of 20th century.

## V. REFERENCES

[1] D. Potnuru, T. S. L. V. Ayyarao, L. V. S. Kumar, Y. V. P. Kumar, D. J. Pradeep, and C. P. Reddy, "Salp swarm algorithm based optimal speed control for electric vehicles," International Journal of Power Electronics and Drive Systems, vol. 13, no. 2, pp. 755–763, Jun. 2022, doi: 10.11591/ijpeds.v13.i2.pp755-763.

[2] V. Manoj, A. Swathi, and V. T. Rao, "A PROMETHEE based multi criteria decision making analysis for selection of optimum site location for wind energy project," in IOP Conference Series: Materials Science and Engineering, IOP Publishing Ltd, Jan. 2021. doi: 10.1088/1757-899X/1033/1/012035.

[3] V. Manoj, R. Pilla, and V. N. Pudi, "Sustainability Performance Evaluation of Solar Panels Using Multi Criteria Decision Making Techniques," J Phys Conf Ser, vol. 2570, no. 1, p. 012014, Aug. 2023, doi: 10.1088/1742-6596/2570/1/012014.

[4] A. Slv Tummala, "A Review and Aspects of High Altitude Wind Power Generation." [Online]. Available: https://www.researchgate.net/publication/321473577

[5] M. Venkatesh and G. Sudheer, "OPTIMAL LOAD FREQUENCY REGULATION OF MICRO-GRID USING DRAGONFLY ALGORITHM," International Research Journal of Engineering and Technology, 2017, [Online]. Available: www.irjet.net

[6] A. Yıldız, "Evaluation of the performance of batteries used in electric vehicles using TOPSIS method," 2021. [Online]. Available: www.journaleras.com

[7] M. Liaqat, Y. Y. Ghadi, M. Adnan, and M. R. Fazal, "Multicriteria Evaluation of Portable Energy Storage Technologies for Electric Vehicles," IEEE Access, vol. 10. Institute of Electrical and Electronics Engineers Inc., pp. 64890–64903, 2022. doi: 10.1109/ACCESS.2022.3183105.