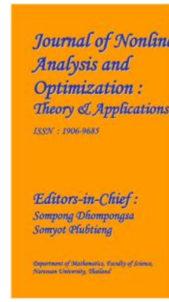
Journal of **N**onlinear **A**nalysis and **O**ptimization
Vol. 15, Issue. 1, No.15 : 2024
ISSN : **1906-9685**



Paper ID: ICRTEM24_140 **ICRTEM-2024 Conference Paper**

A REVIEW ON CHARGING MANAGEMENT OF ELECTRICAL VEHICLES

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ABSTRACT: This paper presents on managing the charging of electric vehicles (EVs) in the presence of renewable energy sources involves optimizing charging schedules to align with periods of high renewable energy generation, such as during daylight hours for solar power or windy conditions for wind power. This can help maximize the utilization of clean energy and reduce reliance on non-renewable sources during peak demand periods. Technologies like smart charging and vehicle-to-grid (V2G) systems can also play a role in this management, allowing EVs to not only consume renewable energy but also feed excess energy back into the grid when needed. Considering the increasing use of electric vehicles, the establishment of charging stations to exchange power between the grid and electric devices, and the integration of charging stations with solar power generation sources, the optimal use of electric vehicle charging stations in the power system. The results indicate that, in the presence of electric vehicles and distributed production sources, the technical performance of the network are improved.

Keywords*:** *Charging management, Energy Management Strategy electric vehicles, Distribution, planning Renewable sources.**

I. INTRODUCTION

Electrical Vehicle's produce fewer emissions compared to traditional internal combustion engine vehicles, especially when charged with electricity from renewable sources like wind or solar power. This helps combat climate change and air pollution. EVs are typically more energy-efficient than traditional vehicles because electric motors convert a higher percentage of energy from the battery into driving power, whereas internal combustion engines waste energy through heat and friction. By transitioning to EVs, societies can decrease their reliance on finite and environmentally damaging fossil fuels, promoting energy security and sustainability. Electric vehicles produce zero tailpipe emissions, thus helping to improve air quality in urban areas and reducing health issues associated with air pollution. The development and adoption of EVs drive innovation in battery technology,Electric motor efficiency, charging infrastructure, and energy storage, leading to advancements that can benefit various industries and sectors. Although EVs may have higher upfront costs, they often have lower operating and maintenance costs over their lifetime due to cheaper electricity compared to gasoline or diesel, fewer moving parts, and less frequent maintenance needs. EVs offer an opportunity to diversify energy sources for transportation, potentially reducing relianceon imported oil and creating opportunities for decentralized energy production and distribution. Overall, electric vehicles play a crucial role in transitioning to a more sustainable and environmentally friendly transportation system.

The importance of electric vehicle (EV) charging infrastructure is significant for a well-developed charging infrastructure provides EV drivers with the assurance that they can recharge their vehicles conveniently, thus alleviating concerns about running out of power while driving. Accessible charging stations encourage more people to consider EVs by making it easier for drivers to charge their vehicles at home, work, or public locations like shopping centers, restaurants, and highways. Charging infrastructure offers convenience to drivers by enabling them to charge their vehicles during their daily routines, reducing the need for long detours or planning around charging stops. A robust charging network stimulates market growth for electric vehicles by increasing consumer confidence and attracting investment from automakers, energy companies, and infrastructure developers. The expansion of EV charging infrastructure creates jobs and stimulates economic activity in manufacturing, construction, and service industries related to charging equipment installation, maintenance, and operation. A well-planned charging infrastructure powered by renewable energy sources helps reduce greenhouse gas emissions and air pollution associated with transportation, contributing to environmental sustainability and public health. Smart charging infrastructure can contribute to grid stability by managing electricity demand and integrating renewable energy sources effectively, helping to balance supply and demand fluctuations. The development of EV charging infrastructure drives innovation in charging technologies, such as faster charging speeds, wireless charging, and vehicle-to-grid (V2G) capabilities, leading to further improvements in efficiency and convenience.

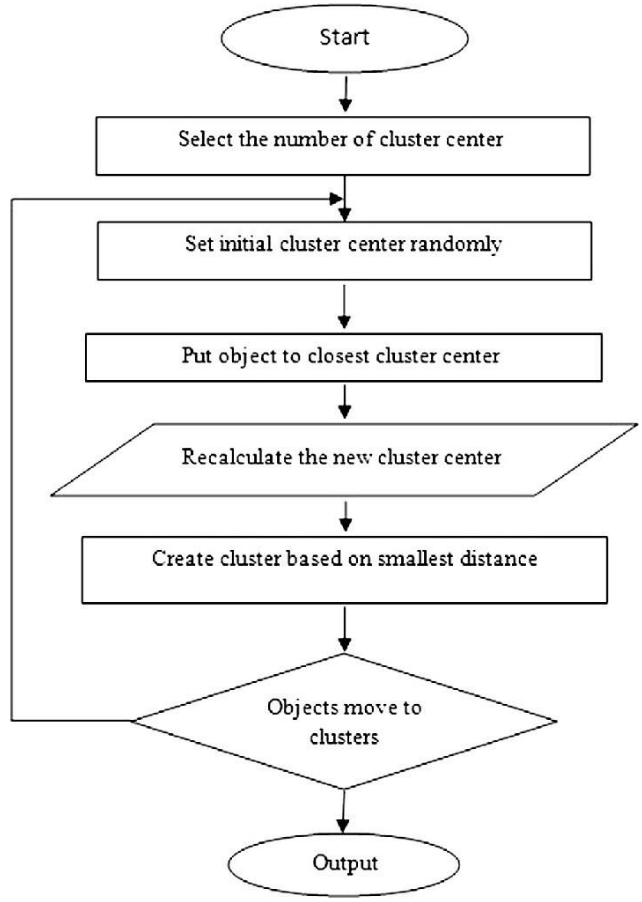


Figure: K-means cluster algorithm

Many algorithms like MPSO, K-means are proposed to solve the DEP problems considering DG and energy storage sources. But the uncertainties (charging stations, charging time, Driving range, initial costs) are not mentioned. The capacity of the line in distribution network has improved to make the better charging of vehicles. The overall investment and current operating costs are minimized in distribution networks in presence of DG. There was an implementation of various methods of planning of charging equipment corresponding to different charging methods. The geo-graphical area must suite the location of installation of the charging station and must have a suitable service radius to create a EV model for charging. The operation mode of centralized charging and one-way distribution is introduced in this review paper. The Solid State Transformer (SST) is used for energy management strategy. The energy management improved by scenario based optimization method. The grid connected hybrid vehicle charging strategies has also proposed

II. LITERATURE SURVEY

In recent years, different models have been presented to model different types of electric vehicles (charging or discharging vehicles in houses or charging stations in electric parking lots). In this part, a part of these articles has been reviewed according to the proposed objective functions, the limitations of the problem, the way of modeling the vehicles, and the studied system. In reference [1], a modified particle swarm algorithm (MPSO) is introduced to solve the DEP problem considering DG and electrical energy storage sources. The proposed model optimally selects the total investment and operation costs of DG and distribution network, but this reference does not mention uncertainties. The authors of reference [2] have put a dynamic model for developing distribution networks to determine DG's location, time, and capacity, as well as the schedule for increasing the capacity of existing lines in the distribution network. However, the investment and current operating costs in Distribution networks in the presence of DG have not been considered. Also, the DGEP problem has been solved by combining the genetic algorithm and optimal load distribution (OPF) in reference [11]. Accordingly, the reference [3] has proposed a hybrid method to solve the DGEP problem with the ability to reduce the peak load of scattered productions. In reference [4], the uncertainty of wind power generator productions is also considered in more accurate modeling. Rail probabilitydistribution functions have been used to model the wind speed uncertainty created after the discretization of probabilistic scenarios. Also, the problem of DGEP has been considered in references [5-10], with the approach of minimizing the total investment and current operating costs in distribution networksin the presence of DG. In [12], charging station locations and measurements have been studied from 3 aspects. (1) Quality and profitability, (2) car traffic patterns, (3) land acquisition cost by the government. The planning of charging equipment has been done in 3 stages, and the optimized model of charging stations has been selected according to different charging methods [13]. In [14], a method is presented according to each charging station's geographical factors and service radius (which fully considers the effects of the battery on the power grid) to create a model of EV charging stations considering DG. In [15], the operation mode of "centralized charging and one-way distribution" is introduced, in which the model of the centralized charging station is built to determine its location and capacity in terms of the capacity of transmission lines and the price of land. Although all the abovereferences, for location, measuring, and determining the impact of vehicles on the distribution network, only consider EVs as loads. These articles did not reflect the main characteristics of EVs as loads and power sources. In another reference, considering EV charging capability, various sample plans of the grid-connected EV have been analyzed [16-29]. On the other hand, different structures for EMS using differentoptimization algorithms and different configurations for smart micro grids have been presented in references, some of which aim to optimize the performance of each resource in the micro grid system to minimize interest costs. It is a system vector. Many types of research have been done in this field; among the most recent research, we can refer to the article [30], in which solid-state transformer (SST) is used for the energy management strategy for solid-state transformers for smart electric vehicle solar charging station (SPVCS). Also, the energy management section in charging stations has been improved using the scenario-based optimization method. Also, the solid-state transformer is selected for PV and storage Integration. Among the advantages of this method are things like SST enables the control of the electric power passage and the flexible connection of distributed production sources to the network, as well as the distribution of power, which is important for the safe and stable operation of the network. It is also mentioned. Correspondingly, grid-connected hybrid electric vehicle (PHEV) charging strategies have been proposed in reference [31-36] by presenting a fast energy management algorithm for grid-connected charging parks in industrial/commercial locations. The presentation of an adaptive fuzzy strategy for the energy management of hybrid vehicles has been discussed, and one advantage of this method is the adaptability of the control plan in an energy management system due to the existence of numerous factors affecting the performance of the vehicle and the existence of parametric uncertainties, which are very important.

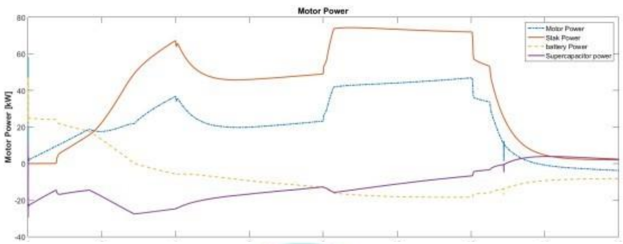
III. COMPARATIVE ANALYSIS

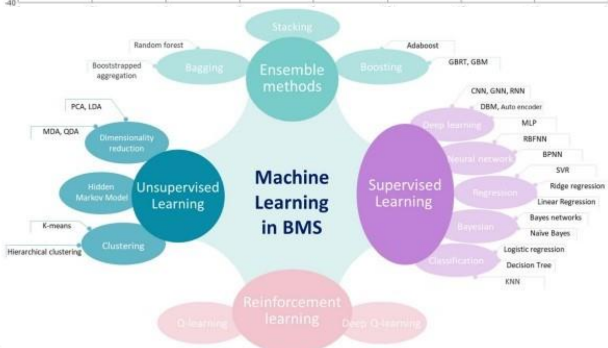
Referring to the article [1], we can find that the robust cubic smoothing spline method for producing IC curves is superior to typical alters that require tuning on window size, usually by trial and error. By cross validation, the robust cubic smoothing spline method for producing IC curves is superior to typical lters that require tuning on window size, usually by trial and error. These methods, which extract features to obtain health indicators for state estimation, have a prediction error of basically less than 5% for health prediction at the cell level. Focuses more on the recent developments in this field. Modeling and state estimations are given considering multiple domains, including battery electrical, thermal, aging, and further coupled domains. The innovative theory for data mining that might be promoted in the future is still being introduced to provide a probable advanced research direction. This paper presents the cutting-edge battery management technologies for achieving satisfactory safety and a long service life for EV applications.

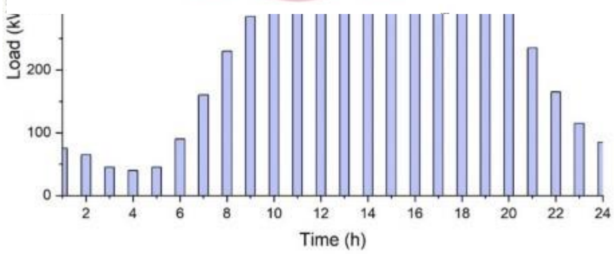
The main purpose of this study [2] was to investigate the dynamic behavior of the proposed power train during traction, braking, and operating modes. The results of the three references of motor line currents correspond to the flux control block computed. EMS by showing that the fuel cell system stabilized the battery. Were illustrated by comparing curves with and without the super capacitor.

This study [3] is analyzed using linear programming in MATLAB to achieve the best outcome. These cases differ with respect to the components and parameters that are used in them. Comparing the cases with a reference or base case is important for micro grid analysis and planning. The effects of incorporating PV systems, ESS and EVs are studied in a distribution network of a university campus. The study proposes the application of an optimal EMS to the system, considering the future connections of the proposed DERs.

Reference	[1]	[2]	[3]
Software	BTMS, VEMS	Matlab, Python, Modelica	GridAB-D, CYME, Homer pro
Components	Sensors, battery pack, cooling and heating systems	Sensors, BMS,Super capacitors management system, power electronics, vehicle control unit	Microgrid management system,EM Grid integration and Interconnection







Algorithms	SoC, SoH, thermal management, charging and discharging control, cell balancing	Rule-based control, Optimization based control, Fuzzy logic, Neural network, Machine Learning	Linear programming, Non-linear programming, Dynamic programming, Metaheuristic, Heuristic, Reinforcement
Objective	1.optimising performance 2. Enhancing Battery life. 3. Ensuring safety. 4. Improving user experience	1.optimizing energy Efficiency. 2.improving component lifespan. 3.Ensuring system reliability 4.Enhancing vehicle performance	1.Cost minimization 2.Energy efficiency 3.Grid reliability and stability 4.Peak load management 5.Resilience and adaptability

Table: Comparison of three methods

IV. OUTCOMES

Proliferation of electric vehicles (EVs) effectively reducesour dependence on fossil fuels, and its spread in all countries will occur shortly. Next-generation distribution networks should consider EVs' charging demand and discharge capacity to promote the useful development of EVs and their charging equipment in the power grid. Distribution network development planning is a traditional large-scale optimization problem that determines how the equipment will be deployed over several years to feed the increasing load. The objective function of the DEP problem is modeled as a cost function, which includes the cost of upgrading or replacing equipment and constructing or increasing the capacity of substations over diverse periods. The main purpose of network development planning is to create a reliable service with high reliability and cost-effectiveness for electricity consumers so that the quality of voltage and power within the allowable range is guaranteed. Distributed generation sources can be modeled as power quality (PQ) or PV in the problem or accurately as sections

Such as wind farms, photovoltaic systems, or other power plants. In addition to renewable sources and DGs, the effects of energy storage and electric vehicles on DEP problems have been modeled.

Figure: The characteristics of machine learning-dependentalgorithms involved in BMS applications

Figure: Motor, FC, battery, and super capacitor powers

Figure: Daily average load profile

V. CONCLUSION

The review presented in this paper proposes a model for the optimal use of electric vehicle charging stations in the power system, considering the presence of renewable resources and the integration of charging stations with solar power generation sources. The article addresses the challenge of cost reduction in the presence of an intelligent environment and aims to create a platform suitable for predicting vehicle behavior and optimizing their presence in the power network. The article presents a comprehensive model for radial distribution network development planning in two scenarios, considering the effects of electric vehicles and distributed Production sources. The DEP problem is dynamically expressed in 5 steps, and the radial limitation is considered for the distribution feeders, which are linked to each other using the maneuvering keys of the distribution feeders. The article shows that the technical characteristics of the network have improved in the presence of electric vehicles and distributed production sources. Similarly, the use of distributed generation reduces equipment costs and undistributed energy in the system. However, 10,000 EVs, considered an uncontrolled load, have caused an increase in undistributed energy and the cost of equipment required for network development by approximately 5%. The article emphasizes the importance of planning and considering fast-charging stations, as not considering this difference can lead to loss of capital and incorrect planning. The article presents several innovative approaches, including clustering methods, multivariate probability distribution functions, and modeling the charging and discharging of electric vehicles with renewable resources. The article also discusses various keywords and concepts related to energy management, electric vehicles, planning, distribution, and uncertainty modeling.

VI. FUTURE SCOPE

The future scope is really exciting, with the increase in useof electric vehicles, there will be a growing demand for efficient and convenient charging. This opens up opportunities for innovation in smart charging stations, advanced battery technologies, and intelligent charging management systems. Another aspect of future charging management is the improvement of battery technologies. Overall, the future of charging management for electric vehicles looks promising.

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