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An Analysis of the Requirement for Energy Management Systems in India for Electric Vehicles

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Abstract— Conventional fuels used in combustion engines are the main sources of carbon dioxide emissions, which affect the environment. If energy is available from renewable sources compared to conventional sources, electric vehicles (EVs) offer efficient and cost-effective solutions to the above issue. However, EVs employ batteries for energy storage, which presents a number of issues. For example, overheating produced by chemical reactions during the charging and discharging process in high temperatures can result in the battery's fatal destruction. Hence, an effective energy management system (EMS) is in need of the technology required for the accomplishment of EVs in the long term. Monitoring and optimizing electricity use is the aim of energy management, which aims to cut costs and emissions without interfering with operations. When lifetime CO2 emissions are taken into consideration, EVs will be far more environmentally friendly than regular fuel vehicles because of the incorporation of sustainable power. Distributed solar energy will help reduce the distribution and transmission losses, which will further lower the lifetime CO2 emissions and operating costs of EVs and hasten their commercial viability. This paper presents a review of energy management challenges and their necessity. EV energy management is very important as it helps to minimize EV charging costs.

Keywords- *Energy Management Systems, Electric Vehicle (EV), Environmental Pollution Control*

I. INTRODUCTION

Energy Management Systems are the primary focus of the current situation since they are crucial to making electric vehicles (EVs) more environmentally friendly, economically viable, and practical for everyday use. There are many ESS topologies that have been taken into consideration, including hybrid combination technologies like Hybrid Electric Vehicles (HEV), Plug-in HEVs (PHEV), and others [1]. These approaches rely on a variety of ESS, including batteries, fuel cells, and supercapacitors. The hybrid combination could be one of the future technologies to help EVs gain traction in modern transportation [2] Energy Storage Systems (ESS) are now facing hurdles in terms of safety, size, cost, and overall management for EV systems. Additionally, the optimal power consumption for leading-edge EV technologies is significantly impacted by the hybridization of energy storage systems (ESS) with sophisticated power electronic technologies [4]. It has long been recognised that the best way to achieve approaching outcomes in vehicle EMS development is to use systematic framework-optimized methods with useful optimization algorithms. [5]. As a result, the Energy Management System (EMS) is critical in managing a power train's overall performance.

The Engine Control Unit (ECU), Transmission Control Unit (TCU), Battery Management System (BMS), and Motor Control Unit (MCU) are the primary components (MCU). In a conventional car, with the braking and pedal pedals, the driver controls the immediate electricity supply, and in vehicles with manual gearboxes, the driver chooses which gear is occupied at any given time. As a result, there is no need for an energy management plan. How much power is delivered by each of the energy sources inside a hybrid vehicle is a further choice that needs to be made. For this reason, an energy management controller serves as a link between the driver and the component controllers in all hybrid vehicles [6]. Among the onboard sources of energy, the energy management system's task is to identify the greatest power distribution. This has already been said. The specific application will determine what is considered optimal [7]. While most strategies are created to reduce fuel consumption, optimization goals may also include decreasing pollutant emissions, extending battery life, or, in general, finding a balance between all of the aforementioned objectives [8]. The researchers presented several optimization solutions for fuel, cost, and energy management. Stochastic

Dynamic Programming was used by Fletcher (2016) to provide an optimal strategy for a low-speed campus car (SDP).

The SDP controller aims to reduce the total fuel cell operating costs by balancing fuel consumption and degradation costs [9]. Daming Zhoua presented a comparison of different ESM techniques for fuel cell hybrid electric vehicle online energy management strategies (FCHEVs). The fuel cell system's working points may be kept in an efficient energy range thanks to the extreme seeking regulator, which also lowers the amount of hydrogen needed. The primary evaluation criteria in this comparison study are the utilisation of lithium-ion batteries, variations in fuel cell system electrical output, fuel cell system efficiency, and hydrocarbon consumption. [10]. Koubaa (2017) emphasised the use of metaheuristic techniques to undertake energy management in a hybrid fuel cell/ultra-capacitor EV. The key performance requirements evaluated in this work are hydrogen consumption, processing time, and the slow dynamic nature of the fuel cell system. The rule-based integrated Particle Swarm Optimization algorithm is used for online management, and it is compared to Ant Colony Optimization and Genetic algorithms for optimal offline and online management, respectively [11].

According to Yue Hu (2018), a deep reinforcement learning (DRL)-based EMS is made to learn to choose direct actions from situations without the use of predictions or pre-established rules [12]. In order to examine and choose the implementation of particular optimization objects and optimization targets, Xueqin Lü (2020) investigates and assesses the impact of evolutionary algorithms on different energy management systems. This study aims to contribute to the investigation of enhancing the fuel cell hybrid power system's energy utilisation efficiency and increase the lifespan of the fuel cell, as well as provide guidance for the ideal control strategy and structural design. It also offers additional suggestions for future energy management optimization. [13]. Fazhan Tao (2020) has developed an energy management method for EVs equipped with fuel cells (FC), batteries (BAT), and supercapacitors (SC), with the goal of enhancing overall performance in vehicle-to-network application architecture. [14]. A. Ponnupandian (2020) offers a power management technique for hybrid energy storage systems (HESS) like supercapacitors and SCAP batteries in electric vehicles. Because the proposed methodology executes both the random decision forest (RDF) and krill herd optimization (KHO) simultaneously, it is also known as the KTO-RDF method. The main objective is to minimise the difference between real and standard energy in the battery and SCAP [15].

By 2030, India hopes to have 5 to 8 million hybrid and electric cars on the road, as by 2030, it wants to be entirely electric. Although these goals are ambitious, we must keep in mind that the use of EVs will raise the demand for electricity as a whole and necessitate significant upgrades to the infrastructure supporting power transmission and distribution [16]. However, in order for EVs to truly qualify as green, the additional electricity needed to charge them cannot originate from thermal power plants. These difficulties will be lessened with the incorporation of renewable energy, especially in distributed form, together with supportive regulations. Energy management in EVs is very important as it helps to manage peak load and demand charges, supports long-term sustainability costs, integrates with onsite solar and storage systems, reveals energy usage and improves consumption forecasts, promotes resilience and avoids operational disruptions, and builds an electrical and sustainable electrical fleet.[16-25].

This paper has through analysis of the literature review following with discussion of review methodology starting with review approach, and review planning. In section III, deals with the present scenario and the purpose of the energy management system with various strategies. In section IV, deals with the purpose of EMS along with duck curve challenge. In section V, deals with benefits of distribution of solar for electric vehicles adoption and in section VI, deals with summary of the paper and discussion and comparison of various methods and methodologies.

II. REVIEW METHODOLOGY

A. ReviewApproch

The goals of the energy management strategies include lower emissions, improved fuel efficiency, and the preservation of battery state of charge. The fundamental objective of the EMS is to divide the available electricity to meet the demand for energy. This study takes a strategic approach to energy management. The numerous strategies that have been used and their outcomes have demonstrated the need for this. The review's structure includes seven crucial steps: choosing the proper search terms; choosing the relevant research under study; filtering and evaluating them; developing the database for analysis; deciding on the analysis criteria; and coming up with the best answers. The categorization of strategies aids in the development of research analyses that will be depicted on time periods, places, or even the relationships between solutions. By using the findings of the literature review on energy management plans, we are assisting in the dissemination of the findings. This article is essential for providing a distinct viewpoint on the energy management techniques for electric vehicles.[26-35]

B. Review Planning

The market's need for effective access to concrete solutions and to dependable sources is the driving force for this evaluation. Finding the best energy management system requires time and extensive study, two costly factors that stand between the market and the customers. Therefore, the primary customer requests for emissions reduction, action to reduce consumer happiness, simplifying the backup system, and improving comfort and derivability have been used to build the relevant classification scheme.[36-40]

III. NECESSITY OF ENERGY MANAGEMENT SYSTEMS

In the present scenario, the purpose of the energy management system is to observe and optimise the usage of electricity to a lower price and to minimise the emissions from the vehicles. In some aspects of energy management, it can be done manually, but it is most effective when aided by on-site technologies such as sensors, software, and other monitoring tools installed behind the meter [41-45]. These systems provide a level of control and automation that traditional electric metres and controls, as well as manual monitoring, cannot.

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Depending on the facility, energy management systems can take a variety of forms. Many commercial and industrial systems, for example, concentrate on energy conservation through more efficient HVAC and lighting, which are typically the highest power consumers in a facility. Facility managers can use this type of system to monitor energy usage, automate system settings, and take cost-cutting measures such as turning off non-critical lighting, switching to LED lighting, or adjusting the temperature when electricity costs are high.

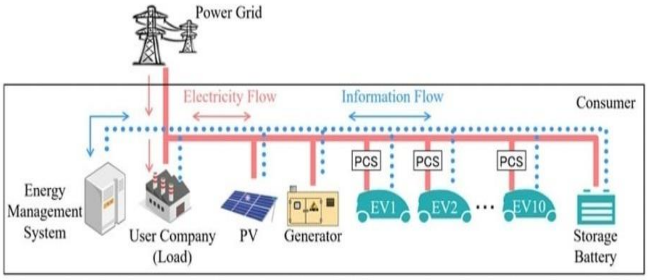

Fig-1: General Layout of Energy Management System.

In the above figure shows the basic layout of an Energy Management System with a few examples of various loads which manage the flow of electricity as well as information from the power grid to the consumer [46-50]. It shares the necessary charge to the storage devices on the consumer side.Here are several ways energy management lowers EV charging costs and helps fleet electrification succeed.

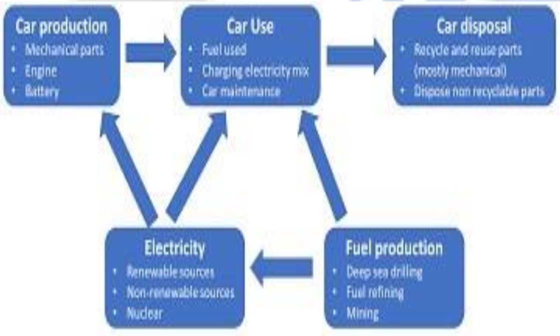

Fig-2: various ways of Energy Management.

A. *Manages Peak Load and Demand Charges*

When demand is high, power prices rise. This increase in prices may be seasonal, related to the time of day or a specific event, or both, depending on the grid operator serving your locality [51-55]. Through the use of energy management systems, you may better control your power use during these times, reducing the effect of demand charges and realizing significant cost savings.

B. *Supports Long – Term Sustainability Goals*

To develop benchmarks and set realistic targets for any organization that is just beginning their energy transformation, they must first identify their present power consumption. This process is aided by energy management systems, which produce detailed, dynamic data regarding ongoing usage [56-60]. Fleet electrification is a high-impact option for businesses with set sustainability goals to advance by getting rid of tailpipe emissions. However, it's also crucial to take into account the emissions related to power generation. The figure indicates the recent market sales, particularly in India, as the sale of electric vehicles has increased in recent years.

C. *Integrates with Onsite Solar Storage*

Advanced strategies for relying less on the grid and more on locally produced renewable energy are made possible by energy management systems. It enables us to choose to set up local solar panels to produce clean energy for EV charging. However, since on-site solar only functions when the sun is shining and has a limited amount of generation capacity due to small facility footprints, it is not viable to rely only on this source of energy.

D. *Revels Energy Usage and Improve Consumption Forecasts*

Energy management can produce extremely accurate historical usage data to produce more accurate estimates, which frequently results in more competitive rates and fewer unwelcome shocks on the monthly energy bill. In the figure, it recommends the applications used for traffic in the cities with energy management systems, which can prepare road grade, speed limits, altitude, speed, road conditions, etc. using the Global Positioning System GPS [61-65]. It also maintains the distance from one vehicle to another using sensors and GPS with this energy management system. Additionally, it allows for control over actual electricity usage in the event that it starts to spiral out of control. It enables us to quickly stop non-essential processes, schedule some operations for off-peak hours, and choose whether to use off-depot EV charging stations rather than depot-based chargers with the use of a comprehensive energy management system.

E. *Promotes Resiliency & Avoids Operational Disruptions*

Energy management helps the entire system in addition to lowering your energy costs. It helps to ensure that the grid has enough electricity capacity to prevent blackouts and service outages by using less power during times of peak demand [66-70]. Gas-powered cars may not be as dependable as EVs during a power outage. While gas pumps cannot function without electricity, EV chargers can continue to function even when the power is off as energy management technologies include battery storage or backup generators. These integrate charging systems with onsite solar or backup generators to assist in maintaining the functioning of mission-critical charging stations.

F. *Energy Management Strategy Classification*

In the literature, a number of families of home energy techniques have been suggested. The energy conservation issue is generally addressed using rule-based and model-based optimization techniques. They rely on a set of rules to decide the value of the command to apply at any particular time rather than using explicit reduction or improvement. The capacity of rule-based techniques to be deployed in real-time is listed in table 2 as both an advantage and a disadvantage. Typically, heuristics, or the understanding of globally optimal solutions

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produced by mathematical models via optimization algorithms, are used to construct rules [30-71].

TABLE I. BENEFITS AND DRAWBACKS OF THE CHOSEN TECHNIQUES

Methods	***Advantages***	***Disadvantages***	***References***
Novel hierarchical EMS	Reduces the use of hydrogen and performance degradation	Limited study.	[45], [63]
Optimal sizing methodology	Cost effectiveness, An increase in durability, A reduction in hydrogen consumption of 6.14%, A reduction in fuel cell start-stop durations of 21.7% on average to delay fuel cell ageing, and computation times of less than 0.447 seconds at each step.	Real-time application is required.	[67], [68]
Salp swarm algorithm (SSA)	Reduces hydrogen consumption, Reduces hydrogen use; slows down fuel cell Performance deterioration; Improves power performance with an acceleration time of 8.9 seconds (0e50 km/h); Increases overall mileage. continued 286.7 km; High power output efficiency; Improvements to the vehicle's powertrain's economy; Improvements to the vehicle's economic growth and produce maximum, as well as improvements to the design and performance optimization of energy cell urban logistics trucks.	To enhance the performance of a fuel cell extended-range vehicle, a better control technique should be developed.	[37], [45], [60]
Dynamic process coordination control algorithm Mathematical model topology	The elapsed time decreases by 97.46%; - The fuel efficiency greatly increases by 23.37%. Controller for EMPC; Lower hardware prices for microprocessors; The prediction horizon gets longer. optimal power flux distribution; increased fuel efficiency;	The MPC-based control technique consumes more time. model topology in mathematics	[41], [52], [66]
Advanced optimization algorithms	Reduces the need for hydrogen, the deterioration of battery life, maintenance costs, and oxygen. Reduces maintenance costs, battery life deterioration, hydrogen consumption, oxygen starvation, and battery degradation. Improves car efficiency;	Economical and social concerns arise.	[34] ,[44]
Two-phase interleaved hybrid-mode boost converter	Increases battery capacity, enhances performance, minimizes ripple current, and enhances power quality for vehicles.	The presented strategy progressively affects the vehicle characteristics.	[58], [71], [40]

In model-based optimization procedures, the ideal actuator set-points are determined by minimizing a cost function over a predetermined and predetermined driving cycle, which results in an overall ideal solution. Figuring out the minimal value of the minimization problem based on knowledge of anticipated driving data results in a non-causal solution [40–45]. Model-based optimization methods of control are not suitable for practical implementation and do not lend themselves to direct practical application, but because of their previewing nature and high computational power, they are an important design tool. In fact, they are used as a benchmark solution to evaluate the effectiveness of other control systems or to build rules for online implementation. Analysis techniques and quantitative or non-numerical approaches are both categories of model-based optimization techniques.

Numerical optimization techniques like stochastic dynamic programming, simulated annealing, genetic algorithms, and dynamic programming take into consideration the complete driving cycle. On the other hand, analytical optimization algorithms make use of an analytical design problem to arrive at the solution in a shuttered integral equation, or at the very least, they offer a proposed and studied that facilitates numerical results more quickly than with primarily numerical approaches. The most crucial of these techniques is the minimal principle of Pontryagin [50-55]. The corresponding consumption minimization strategy falls under this category as well. This method entails minimizing suitably defined instantaneous objective functions at each iteration of the optimization horizon. The global cost function is minimized (ideally) if the simultaneous cost function, which is comparable to the instantaneous comparable fuel consumption, is properly defined. In addition to historical and current driving situations, other model-based solutions, such as a receding-horizon optimization strategy, take information about potential future driving conditions into account.

IV. NECESSITY OF ENERGY MANAGEMENT SYSTEMS

A. *Green-house Emissions*

Eliminating emissions from the roadway is the main objective of the transition to EVs. If this keeps up, we'll just be moving road emissions to these power stations' outlying areas, which would actually increase world emissions. This study includes EVs from two Zero Emission Mobility (OEM)s: an Indian OEM (with 8 km/kWh) and a worldwide OEM (with 4.7 km/kWh). The lifetime CO2 emissions of EVs were found to be higher than those of a base-model petrol hatchback, as illustrated in Figure 3.

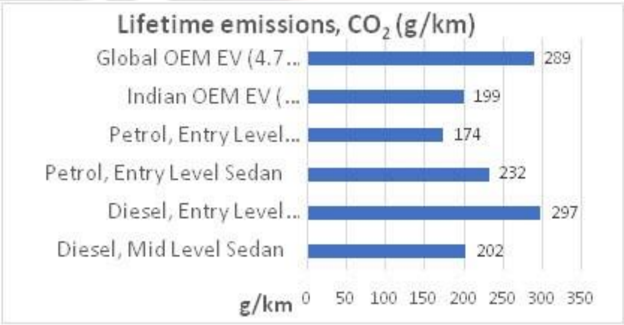

Fig-3: Comparison of EV emissions and Conventional Vehicles

Currently, the average CO2 emission from EV charging is 0.711 kg/kWh, making EVs more polluting than equivalent fuel-powered vehiclesThe CO2 emissions from these plants are expected to drop by 18% (to 0.599 kg/kWh) and 37% (to 0.662kg/kWh) for the corresponding years If we reach the 242 GW renewables integrated objectives by 2037, EVs will be significantly less carbon-intensive From the figure it is clear the rate of growth in the electric vehicles has been in top notch, also it is expected to be completely electric vehicles around near future like in the year 2030.

B. Duck Curve Challenges

Although incorporating more and more renewables into the electricity mix is beneficial in terms of lowering greenhouse gas emissions, it poses practical difficulties in matching supply and demand. The overall expected electricity demand for India for a typical day in the years 2021–23 is depicted in Figure 4. The demand for electricity typically increases at around 7 AM, remains largely unchanged, then rises once again at about 8 PM to reach its peak at about 9 PM. Since solar only produces electricity between sunrise and dusk, the need for conventional energy sources (thermal, nuclear, and hydro) decreases throughout the day as we incorporate more solar PV into the overall energy mix.

This "net demand" curve, seen in Figure 4, is often referred to as the "Duck Curve," and it makes it difficult to integrate renewable energy into the grid. A significant problem is the overnight rapid ramp-up of energy production facilities to assure supply-demand balancing. Base load producing plants will run continuously, but intermediary and peak load producing plants will only be operational for a portion of the day. The rapid ramp-up and ramp-down of electric generation plants is expensive and inefficient. Therefore, any means of lowering the "net demand" curve's peaks and valleys will help with the grid operator integration of growing volumes of sustainable power.

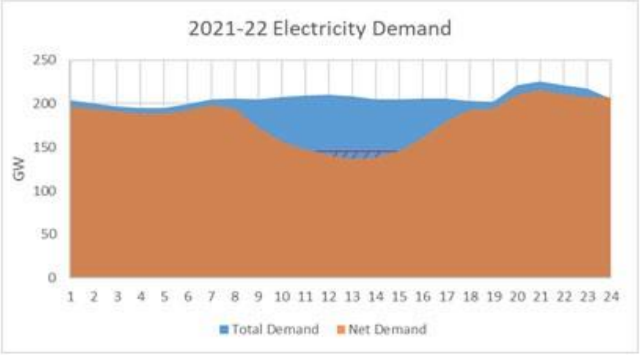

Fig-4: ‘Total Demand’ and ‘Net Demand’ in 2021-22.

Due to the fact that technology is constantly evolving and has both benefits and drawbacks, there will always be a gap. As attempts are being created to make base load power facilities more reactive and while "energy storage" options are being introduced, the entrance of EVs will offer a chance for this curve to be condensed. This will fundamentally alter how well the net elasticity of supply is created. ToD (Time of Day) pricing must encourage EV users to recharge electric vehicles overnight, when consumption is low and renewable electricity production is at its peak (9 AM to 3 PM). It is predicted that 1% of the world's electricity needs will come from EVs by 2025. Imagine a hypothetical scenario where all EVs are only charged for four to five hours around noon (as shaded in Figure 5).

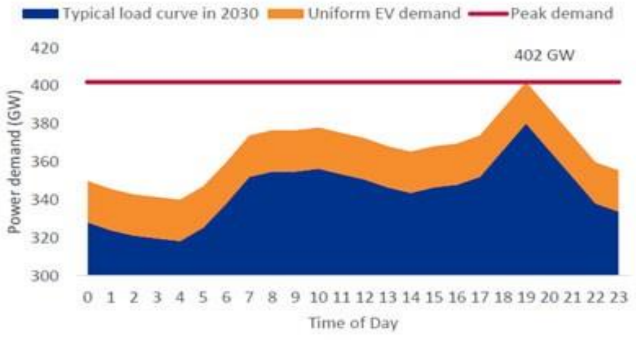

Fig-5: 'Total Demand' profile projected for a typical day in 2030 with a constant EV load.

The lowest load for the day will rise as a result, while the peak load will decrease by less than 1%. The forecasting that the electricity consumption for recharging EVs could account for up to 8% of all electricity demand by 2030, increasing the peak load from 330 GW to 412 GW under the presumption that Charging stations occur continuously during the day, and won't have much of an impact in 2021–2022, but will by then (Figure 6).

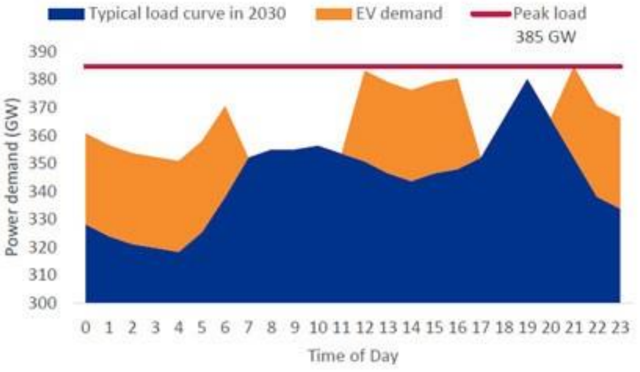

Fig-6: 'Total Demand' profile projected for an average day in 2030 under the ToD tariff regime for EV charging.

However, by implementing ToD rates and encouraging this peak consumption demand can be reduced to 355 GW4 by charging off-peak hours (Figure-6), saving substantial construction expenditures that would otherwise be needed for electricity distribution expansions.

V. BENEFITS OF DISTRIBUTED SOLAR FOR EV ADOPTION

In addition to increasing the proportion of renewable energy sources in India's power generation mix, distributed solar also offers a number of benefits that make EVs more environmentally and commercially viable. Prior to anything else, it's important to understand that losses associated with electric power transmission in 2021–2022 were 21.65 %, and losses in 2022–2073 are predicted. These losses raise both the price of the power needed to charge the vehicles as well as the lifetime g/km CO2 emissions of EVs. Because decentralised energy may reduce power outages during both transmission and distribution, the overall cost of ownership analysis demonstrates that EVs will become more environmentally friendly and financially successful sooner (energy is generated close to the point of consumption, therefore reducing losses). The second benefit of distributed energy is that it will reduce the capital expenditure needed to upgrade the transmission and distribution (T&D) infrastructure. Both the end user and the DISCOMs care about this.[70]

An EV can be categorised based on its technological capabilities by taking into account factors like its driving range, battery charging time, and maximum load capacity. The customer is upset by two crucial characteristics: the charge time and the driving range. The capacity of the battery and the types of batteries used are the key determinants of charging time. For each charge, the driving range could range from 20 km to 400 km. Likewise, some EVs' top speeds are more than 160 km/h and may be reached with charging times of less than 8 hours. Due to recent substantial advancements in EVs, interest in hybrid electric vehicles is rising in developing nations like India. Future advancements are anticipated to significantly alter the EV market as manufacturers strive to cut production costs.

TABLE II. DIFFERENCES BETWEEN ELECTRIC VEHICLES VS HYBRID VEHICLE

Parameters	**Hybrid Vehicles**	**Electric Vehicles**	**Reference**
Air Pollution	Low	Medium	[45], [15]
Cost	Medium	High	[30-35]
Energy Use	High	Low	[46-50]
Voltage	Medium	High	[55]
Equipped Charging facility in India	High	Low	[67]
Powered by	Electricity and combustion engines vehicles	Electric Engine	[20], [42]

For a case study The office has about 60 people working here, and our peak load is 13 kW. A 25 kVA step-down transformer is available. However, because of the 15 kWp solar power plant placed on our office rooftop, we can easily support the changeover to EVs by about 10% of our staff without updating the transformer. Considering the strain that EV charging will put on the improved distribution transformer's greater capacity and the related capital costs, be aware that this problem will only get worse. All the vehicles connected to the charging network must divide the available power evenly. This load on the transmission and distribution networks needs to also be addressed with technological improvements like networked charging infrastructure. Thirdly, some EV OEMs may decide to use battery-swapping technology in their cars. The upfront cost of buying an EV will be lower, and charging times for EVs will be faster with battery swapping. Distributed solar farms can be built on cheap land to charge batteries and supply clean, affordable electricity for EVs. Battery swapping also presents a great opportunity to leverage energy storage as a method for smoothing the overall electricity demand by charging the batteries during the day and releasing the power into the grid at peak hours. Last but not least, the majority of EVs (EVs) in the world are charged overnight at homes, with offices coming in second. Although overnight recharging is very advantageous for the grid, there is also a fantastic chance to make the most of the sunlight hours and charge your cars while you are at home on a solar rooftop or photovoltaic carport. It will be, without a doubt, the most efficient and low-emission method of charging electric vehicles.

A. Overview of Government Policies

The federal government and several state governments have already introduced a number of policies to encourage the use of EVs. Here is a quick summary of them: With deployment beginning in April 2015, the FAME India initiative (Faster Acceptance and Manufacturing of Hybrid and EVs) was created to assist the growth of the market and the manufacturing ecosystem. The program's four main components are technology research, electricity to the people, pilot projects, and charging points. Every tactic is developed to aid in the advancement of the electric car. Each strategy employs a unique set of setups and algorithms to achieve the predetermined goal. Every identified aim in Table 3 is followed by the energy management tactic that made it better. The offered solutions are the most suitable for the bulk of the objectives, which were confirmed by experimental findings.

TABLE III. PURPOSE OF VEHICLE EFFICIENCY

Purpose	**Strategy**	**Reference**
Increase vehicle efficiency	Management approach utilizing dSpace	[33]
	Modified algorithm for transmission monitoring	[70]
	Pontryagin's Minimum Principles;	[71],[16]
	sophisticated control techniques;	[69],[65]
	Multiple overlapping charge controller	[19]
	Long-Range Electric Vehicles	[28],[36]
	Advanced optimization for an inter Power converter algorithms	[12],[39]

The goal of the Karnataka EVs and Energy Storage Policy is to facilitate the manufacturing of energy storage and charging equipment while attracting investment totaling Rs. 31,000 crores throughout the period of 2017 to 2022. The 2018 EV Policy was adopted by the Maharashtra government, paving the way for the production of 500,000 EVs over the following five years. The legislation also offers different financial incentives to EV owners and owners of the infrastructure necessary to build charging stations across the state. The state of Uttar Pradesh seeks to boost the production of solar cells in order to provide clean energy, in addition to EV batteries and charging equipment, through its 2018 EVs Manufacturing Policy. The governments of some states in India have also implemented such measures to encourage EV demand and draw manufacturing investments to their respective states [10-71].

VI. CONCLUSION

Regarding the adoption of EVs and incorporation of renewable energy sources into the nation's overall energy mix, India has all the appropriate intents and goals in place. But it's important to realize that these objectives are complementary and work for hand in hand. When lifetime CO2 emissions are taken into consideration, the use of renewable energy will make EVs significantly greener than conventional gasoline vehicles. Distributed solar power will help to reduce distribution and transmission losses, which will also reduce the lifetime CO2 emissions and operating costs of EVs and speed up their economic potential. Additionally, distributed solar will reduce the CAPEX needed to upgrade the transmission and distribution infrastructure as a result of increased demand for EV charging. Growing EV use in combination with the proper Time of Day (ToD) tariff structure would present a chance to reduce the load requirements, even just a little, and promote the use of additional renewable energy sources in the complete power mix.

VII. CONFLICTS OF INTEREST:

The authors declare that they have no conflicts of interest.

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