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A study of Sustainable Transport: Prospects for Green Vehicle and Electric Technology in India

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Abstract: The falling cost of batteries has helped electric vehicles (EVs) make great progress over the last decade. “However, throughout the course of their useful lives, electric cars remain more expensive. To make substantial inroads into the passenger car market, electric vehicles will need more development, which is explored in this study. Distribution utilities have both a difficulty and an opportunity when it comes to dealing with the increased demand from electric vehicles. Local transformers might be overloaded by a high concentration of EV home charging during peak hours. If demand shifts to off-peak hours, utilities may need to purchase extra peak capacity. Some jurisdictions have already implemented time-of-use power pricing and smart meters to encourage off-peak charging and regulate peak consumption, respectively. It's not certain whether they'll be enough to keep up with the rising demand. While these initiatives may benefit from EVs serving as mobile energy storage units, enough incentives are not yet in place to make this technology a reality. If today's power infrastructure are going to be able to handle the increased demand from a large number of electric cars, tariff changes are going to have to be implemented.

Keywords: Electric Vehicles; Plug-In Hybrid Electric Vehicle; battery charging; batteries technology; charging modes; EV plugs

Introduction

Climate change and concerns about human dependence on fossil fuels have led to an increasing focus in many areas of the globe on producing cars that use less gasoline and more alternative (so-called clean) sources of energy for transportation. Developing and marketing electric cars has received a lot of attention since they are considered as a way to reduce our dependence on fossil fuels, particularly when the energy is supplied from renewable sources like wind, hydro, or geothermal power. A hybrid car like the wildly famous Toyota Prius is one example; these cars use a gasoline-powered generator to power an electric motor. However, authorities are increasingly focused on electric vehicles (EVs), which operate solely on electricity. Annie, the

leader of the Central Party and former Minister for Enterprise, wrote an Op-Ed piece just before the September 2014 general election, presenting Sweden as a nation where the need to establish an electric-car-friendly environment is taken seriously. Due to an increasing reliance on private cars for personal transportation and the fact that many parts of the country (including rural areas with low population density) are reliant on the automobile as their only viable mode of transportation, the following steps are suggested as a way to improve personal mobility in the near future: provide

According to this worldwide literature review, electric vehicle development and adoption are covered. A short history of electric cars is followed by an examination of the role that different financial and other incentives may play in convincing prospective purchasers to acquire electric vehicles, as well as the possible disadvantage of such initiatives. It is also important to look at how people's opinions regarding such modes of transportation have changed over time and why they continue to be resistant to the idea of switching to electric vehicles. Driving ranges, recharging stations, and the best places to put them all are also briefly discussed in our assessment. After that, we turn our focus to the notion of drive tourism and the role electric cars may play in this context. The notion is that boosting the use of electric vehicles in a specific location may serve as a model for the rest of the region's people. Even though most writers discuss the adoption of electric cars in urban situations, we will go on to explain why this technology makes sense in low density areas like the one passed by the E-14. Even as we'll see, some analysts believe that, in the long run, the issue of congestion caused by the fast increase in personal vehicle use cannot be solved by simply switching to electric vehicles in cities. Electric cars are also perpetuating the status quo, as they are geared toward using personal motorized vehicles rather than shifting to other sustainability-oriented solutions that emphasize the necessity of improving service accessibility to communities through revised land use planning and the shift toward non-car mobility like walking and cycling or collective forms of transportation. In addition, a study by the European Union shows that transportation accounts for roughly 28% of total carbon dioxide (CO2) emissions, with road transport accounting for 70% of those emissions. As a result, the governments of most industrialized nations are pushing the use of Electric Vehicles (EVs) in an effort to reduce air pollution, CO2, and other greenhouse gases. Furthermore, they encourage efficient and environmentally friendly transportation by implementing a variety of measures, including tax breaks, financial assistance with vehicle purchases, and other perks like free parking in city centers or unlimited usage of interstates. Traditional cars have the following disadvantages:

• Zero emissions: this type of vehicles neither emit tailpipe pollutants, CO2, nor nitrogen dioxide (NO2). Also, the manufacture processes tend to be more respectful with the environment, although battery manufacturing adversely affects carbon footprint.

• Simplicity: the number of Electric Vehicle (EV) engine elements is smaller, which leads to a much cheaper maintenance. The engines are simpler and more compact, they do not need a cooling circuit, and neither is necessary for incorporating gearshift, clutch, or elements that reduce the engine noise.

• Reliability: having less, and more simple, components makes this type of vehicles have fewer breakdowns. In addition, EVs do not suffer of the inherent wear and tear produced by engine explosions, vibrations, or fuel corrosion.

• Cost: the maintenance cost of the vehicle and the cost of the electricity required is much lower in comparison to maintenance and fuel costs of traditional combustion vehicles. The energy cost per kilometre is significantly lower in EVs than in traditional vehicles, as shown in .

• Comfort: traveling in EVs is more comfortable, due to the absence of vibrations or engine noise .

• Efficiency: EVs are more efficient than traditional vehicles. However, the overall well to wheel (WTW) efficiency will also depend on the power plant efficiency. For instance, total WTW efficiency of gasoline vehicles ranges from 11% to 27%, whereas diesel vehicles range from 25% to 37% . By contrast, EVs fed by a natural gas power plant show a WTW efficiency that ranges from 13% to 31%, whereas EVs fed by renewable energy show an overall efficiency up to 70%.

• Accessibility: this type of vehicle allows for access to urban areas that are not allowed to other combustion vehicles (e.g., low emissions zones). EVs do not suffer from the same traffic restrictions in large cities, especially at high peaks of contamination level. Interestingly, there was a recent OECD study that suggests that, at least in terms of Particulate Matter (PM) emissions, EVs will unfortunately not improve the air quality situation .

There will be a significant role for electric vehicles in Smart cities in the future, along with shared mobility, public transit, and other modes of transportation. As a result, more work must be done to make charging easier and batteries last longer. The biggest issue of EVs is their limited range of operation.. Researchers, on the other hand, are attempting to develop battery technology in order to boost driving range while also reducing charging time, weight, and cost. Electric vehicles' prospects will be shaped by a combination of these variables. A detailed assessment of the most essential components of EV technologies, charging techniques, and

research carried out by various research teams and laboratories is presented in this study. highlights the important points of the article. As a whole, we've gained the following knowledge and made the following contributions: the necessity for our study is shown by our review of current studies in this field, which focuses on a number of areas that have not previously been addressed, as well as the most recent works published in the literature. II) We look at the existing and future state of the electric vehicle industry in several regions throughout the globe, This paper examines the various types of EV charging standards and the connectors that are defined by them in detail. It also examines the most relevant works related to Battery Management Systems (BMSs), thermal management, and power electronics. Finally, it discusses what is needed for future EV charging infrastructure.

Review of literature

(Soman et al. 2020) studied India's Electric Vehicle Transition Can Electric Mobility Support India's Sustainable Economic Recovery discovered this and Electric vehicles (EVs) are one of several possible paths to economic recovery and long-term prosperity when the COVID-19 epidemic is ended. This route offers enormous opportunity for investment and quick market expansion. Changes in oil imports, value-addition, employment, public finances, market size for EV components, and environmental advantages from decreased local air pollution and greenhouse gas (GHG) emissions are among the economic impacts of the 30 per cent EV transition in 2030. We look at the vehicle stock in 2030 under two different scenarios: business as usual (BAU) and a scenario in which 30% of vehicles are electric. Mode-share and 30 per cent EV sales in 2030 will have a wide variety of impacts on the industry, economy and environment if we examine three alternative mobility paradigms: I high public transportation, (ii) high private car, and (iii) high shared mobility The following summarizes the most important aspects of our research and the steps we propose.

(Ioannides and Wall-Reinius 2015) studied Review of international literature on electric vehicles and ideas for further research discovered this and People across the globe are becoming more concerned about global climate change and our over-reliance on fossil fuels for transportation, which has led to an increase in the development of automobiles that use less gasoline and depend instead on alternative (or clean) energy sources. Developing and marketing electric cars has received a lot of attention since they are considered as a way to reduce our dependence on fossil fuels, particularly when the energy is supplied from renewable sources like wind, hydro, or geothermal power. A hybrid car like the wildly famous Toyota Prius is one example; these cars use a gasoline-powered generator to power an electric motor.

However, authorities are increasingly focused on electric vehicles (EVs), which operate solely on electricity.

(Brazil 2017) studied Charging the Future: Challenges and Opportunities for Electric Vehicle Adoption battery prices have decreased dramatically over the last decade, which has led to an increase in the number of electric vehicles (EVs). However, throughout the course of their useful lives, electric cars remain more expensive. In order for electric cars to become a large part of the passenger vehicle fleet, this article examines the further advancements that will be required.

(Sanguesa et al. 2021) studied A Review on Electric Vehicles: Technologies and Challenges Researchers observed that the price of electric vehicles (EVs) has decreased, as well as climate and environmental consciousness. These developments in EV battery technology, charging techniques, and new research difficulties and open prospects are all examined in this report. In further detail, an examination of the current state of the global electric vehicle market and its prospects for the future is undertaken. The battery is a critical component of electric vehicles, and this article provides an in-depth look at the various battery technologies, including lead-acid and lithium-ion. Furthermore, we take a look at the various standards for charging electric vehicles, as well as recommendations for power control and battery energy management. Finally, we summarize our findings by outlining our expectations for the near future of this discipline and the areas of study that remain accessible to the academic and industrial sectors alike.

Conclusions

For the purposes of this paper, we examined the various types of electric vehicles (EVs), the technology used to power them, the advantages they offer over conventional internal combustion engine vehicles (ICEVs), sales trends over the past few years, and charging options and potential future developments. In addition, we outlined the most pressing research issues and prospects. The autonomy of an electric vehicle is directly related to the quality of its batteries. According to these characteristics, we examined a variety of batteries. Our presentation also included a look at upcoming technologies, such as graphene, which is predicted to be able to store more power and charge more quickly in the future. Electric vehicles may potentially benefit from this technology, allowing them to go longer distances before needing recharging. Faster and more powerful charging methods and improved wireless charging technologies will be made possible by the development of larger batteries with greater storage capacity. Another factor that might help the widespread usage of electric cars is the

development of a universal connection. Electric vehicles will play a significant role in future Smart Cities, and it will be particularly necessary to have a variety of charging systems that can adjust to the demands of users. Future BMS should take into account the new situations offered by modern batteries and the needs of Smart Cities. An enormous market development potential is provided by the increasing use of electric vehicles. It's estimated that in 2030, the market for high-value-add components, including batteries, electric powertrains, and charging infrastructure, would total over INR 2.1 lakh crore (USD 27.8 billion). In a policy-friendly context, these activities form a portion of the EV supply chain that might offer considerable stimulation for new investments. An additional 1.2 lakh jobs are predicted to be created by 2030 as a result of the increased production and use of power. It's not too ambitious to target 30% EV sales by 2030 with only e-2Ws and e-3Ws, which will be cost-competitive in terms of both initial purchase price and total cost of ownership by then". As a result, we believe that India's EV strategy should aim for a far larger percentage of EV adoption.

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