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Environmental Benefits and Challenges of Electric Vehicles

Dr. Suresh Nair*
Associate Professor in Battery Technology and Electric Mobility
Indian Institute of Technology Madras

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Abstract: *Increasing carbon emissions and the price of oil are the two biggest challenges confronting the world's main transport systems. Because they don't consume oil and don't contribute to climate change, electric cars (EVs) are becoming more popular. Although EVs have many advantages, there are still a number of operational concerns that must be resolved before they can be widely used. A number of advantages of electric vehicles are detailed in this study, including the fact that they help lower pollution levels and carbon emissions. Also covered are the problems and obstacles that have prevented their widespread use, such as the expensive infrastructure, lack of charging stations, concerns about running out of juice, and poor battery performance. Improving the charging infrastructure, adding more stations, using battery swapping procedures, and developing better battery technology to alleviate range anxiety and decrease charging times are all possible ways to tackle these difficulties. Tax credits and subsidies, as well as investments in a reliable charging infrastructure, are two ways that governments may encourage the purchase of electric vehicles. Governments and industry leaders can work together to solve these problems and increase the use of electric vehicles, which helps lower pollution levels and carbon emissions.*

Keywords: electric vehicles; smart cities; challenges; charging infrastructure

Introduction

In recent decades, the automotive sector has grown into an influential force in the R&D and international economies. Because technology is always improving, modern cars include safety measures that make everyone on the road, from passengers to pedestrians, feel more secure. The result is more cars on the road, which is great since it allows us to travel more quickly and comfortably. But there's been a price to pay for this advancement. Sulphur dioxide (SO2), nitrogen oxides (NOx), carbon monoxide (CO), and particulate matter (PM) have all experienced significant increases in urban areas. The good and bad effects of the automotive sector on our everyday lives must be recognised. Although industry has greatly improved transportation and technology, it has also played a role in the degradation of our natural environment. We must make it a top priority to discover ways to lessen the environmental impact of the car sector as we go ahead. Carbon emissions and the abundance of oil are widely

recognised as increasing threats to Earth. The transport sector is responsible for about 25% of global energy consumption and greenhouse gas emissions, making it the sector with the greatest cumulative impact on the environment. More than 70% of the emissions in this sector come from vehicles on the road. Proponents of the idea of "sustainable transportation" argue that it holds the key to reducing emissions and reducing reliance on oil. According to the Electric Power Research Institute (EPRI), extensive usage of electric cars would significantly decrease emissions of greenhouse gases, especially when compared to conventional vehicles that are more efficient. Several countries are pushing for EV promotion because of the advantages and the urgent need to address climate change and energy stability. The number of plug-in electric cars (PEVs) in use across the US has increased significantly since 2011, with over 275,000 PEVs now on the road. Europe has seen yearly sales of EVs triple since their introduction in 2010, and by 2013, there had been the sale of about 60,000 PEVs. More than 2 million EVs have been sold across Europe by September 2021. By 2025, electric cars (EVs) should have made up 20% of all new car sales in China, the nation with the highest EV growth rate. Additionally, by 2035, the Chinese government hopes to have achieved its long-term goal of having all new automobile sales in the country be "new energy" vehicles (NEVs), which encompass both fully electric and plug-in hybrid models.

Background

Smart City

In order to gather data, a "smart city" uses a network of interconnected electronic devices and sensors. By prioritising sustainability, comfort, and maintenance, smart cities use ICT to manage public resources and improve service quality. The transportation sector is going to be completely dominated by electric vehicles (EVs) in the near future. As part of a larger effort to reduce fuel emissions in the city, the whole transportation system will be powered by electricity. But additional problems with power distribution and traffic management make it impossible to guarantee that these new transport systems will work in a normal city. In light of this, a smart city can contribute to the achievement of this national objective. Since EVs are integral to many smart city initiatives, there is a tight relationship between the two. The broad adoption of electric vehicles is a key component of many smart city programmes' overarching goals of significantly reducing emissions and improving urban air quality. Electric vehicles contribute to smart city efficiency since they are less expensive to operate and require less maintenance than regular cars. Electric car uptake and integration can be aided by smart city infrastructure like charging stations and smart traffic control systems.

Electric Vehicles

An increasingly popular mode of transportation, electric vehicles (EVs) have recently garnered a lot of attention for their ability to reduce emissions of greenhouse gases and dependence on fossil fuels. Electric vehicles are powered by electric motors that take power from rechargeable batteries, rather than by petrol or diesel fuel. Predictions show that the number of people using EVs will triple between 2011 and 2030. Technological progress in battery performance and its

effects on autonomous vehicles have led to this. One of the key advantages of electric automobiles is the impact they have on the environment. Even while EV sales have been on the rise in the US and China, it's important to remember that both nations still have plenty of cars fueled by old-fashioned fossil fuels. In addition, these nations' rising energy needs have prompted them to burn more coal, the main ingredient in their carbon footprint.

Benefits of Electric Vehicles

- **Environmental Benefits**

Neither air pollution nor greenhouse gas emissions are caused by EVs since they do not release pollutants from their tailpipes. Compared to a conventional gas-powered car, EV emissions are lower even when the energy to power the vehicle is generated by fossil fuels.

- **Lower Operating Costs**

Electric vehicles have fewer operating expenses than conventional automobiles. Electricity is typically more affordable than petrol or diesel, and electric cars are easier to maintain since they have fewer moving parts. Electric motors often have a longer lifespan than internal combustion engines because of their superior durability.

- **Energy Independence**

Electric vehicles may run on renewable energy like solar or wind. A more sustainable energy future may be possible as a result of this reduction in demand for fossil fuels.

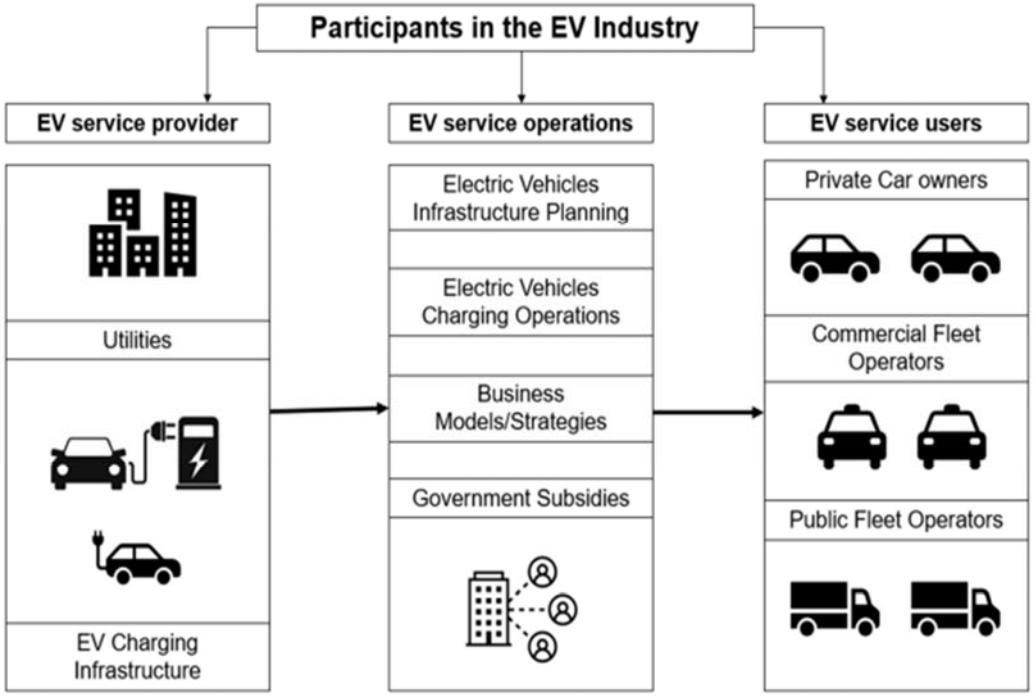

Figure. EV service operations/participants.

Environmental Benefits:

- **Reduced Greenhouse Gas Emissions:** Using renewable energy sources, such as wind or solar power, to charge an electric car reduces or eliminates emissions compared to a conventional vehicle. Greenhouse gas emissions are decreased, which contributes to the fight against climate change.
- **Improved Air Quality:** There is less pollution in metropolitan areas since EVs do not emit any pollutants from their tailpipes. By lowering the prevalence of air pollution-related respiratory diseases and other health issues, this has the potential to enhance public health outcomes.
- **Energy Efficiency:** By transforming a larger fraction of the grid's energy into usable electricity, electric motors outperform internal combustion engines. Overall, less energy is used because of this efficiency.
- **Noise Reduction:** There is less background noise in cities because to electric motors because they are less noisy than I.C. engines.
- **Promotion of Renewable Energy Integration:** When renewable energy production is high but demand is low, EVs can store the extra energy. Both the grid's stability and the incorporation of renewable energy sources are enhanced by this.

Environmental Challenges:

- **Battery Production and Recycling**: Due to resource extraction and manufacturing procedures, the creation of lithium-ion batteries—commonly found in EVs—can have environmental implications. In addition, there are concerns about the environmental sustainability of battery recycling and disposal.
- **Energy Source for Charging**: Depending on where the power for charging comes from determines the extent to which EVs help the environment. Power plants that rely on fossil fuels to generate energy could not substantially lessen the environmental effect in the long run. The use of renewable energy sources, however, makes the grid cleaner, therefore this problem becomes less of an issue.
- **Infrastructure Development**: A substantial investment in infrastructure, namely the placement of charging stations, is necessary to facilitate the broad use of electric vehicles. In the event that infrastructure development results in the loss of habitat or an increase in energy use, this might have an effect on the environment.
- **Supply Chain Impacts:** The production, transportation, and extraction of resources may all contribute to environmental impacts in the supply chains of EV components such electric motors, rare earth metals, and batteries.
- **Vehicle Weight and Efficiency**: The added mass of an electric car's battery pack reduces its overall energy efficiency and makes it harder for roadways to handle than a regular vehicle.

To maximise the beneficial impact of electric cars on the environment, it is vital to overcome the obstacles related to their manufacture, charging infrastructure, and supply chain. Despite these problems, electric vehicles provide considerable environmental advantages. The

environmental advantages of electric vehicles will be amplified in the long run when the power infrastructure is decarbonised.

Conclusion

Ultimately, EVs have great potential to promote sustainable mobility, improve air quality, and decrease emissions of greenhouse gases. Battery manufacture, energy sources for charging, infrastructure development, supply chain implications, and vehicle weight are some of the hurdles that must be overcome in order to fully realise their environmental advantages. In order for electric vehicles to fulfil their promise of reducing pollution and climate change, there must be an increase in the usage of renewable energy sources to generate electricity, an expansion of charging infrastructure, better battery technology, and sustainable practices throughout the supply chain. While electric vehicles aren't perfect, they do help us get closer to a transportation system that's better for the environment if we keep improving them and more people start using them. Electric vehicles (EVs) have the potential to have a significant impact in creating a more sustainable future by tackling these issues and making the most of their environmental advantages.

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