



The Role Of Electric Passenger Vehicles On Environmental Sustainability Of The Automobile Industry

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Abstract

The automobile industry is one of the most important drivers of economic growth in India and one with high participation in global value chains. Even though the industry contributes nearly half of the manufacturing GDP of the country, on the other side the skyrocketing increase in sales of the automobile industry has been putting pressure on environmental sustainability, especially with reference to fossil fuel-burning vehicles. Shifting to electric vehicles is the much-discussed solution to the problem. The present study aimed to find out the effects of fossil fuel-burning vehicles and the role of electric vehicles on environmental sustainability. The study suggests that it is high time to turn to the electric vehicle era to ensure environmental sustainability and make nature fit for the coming generation.

Keywords: Passenger Vehicles, Automobile Industry, Sustainability

Introduction

Environmental sustainability is the responsible interference with the environment to conserve natural resources and ensure the quality of the environment. The notion of environmental sustainability aims to ensure that the needs of today's populations are met without compromising the potential of future generations to meet their needs. The natural environment has got a remarkable influx to rejuvenate itself and sustain its originality. Nature has its own mechanism to cure its defects but when man enters the picture and started exploring its natural resources things started changing. The application of better environmental sustainability methods is to be ensured for long-term viability as human involvement can deplete natural resources.

Public transportation is a service that has not been able to keep up with the exponential growth of cities in India. Continuous infrastructure developments and increasing road networks have forced citizens to resort to personal vehicle purchasing. In fiscal year 2021, more than 3 million passenger vehicles were produced across India. The production volume reached 4 million in the fiscal year 2018 within the segment. The majority of the produced units were sold domestically. Rising transportation requirements and dependence on petroleum as its primary energy source will continue to be major causes of greenhouse gas and pollutant emissions leading to global warming and damage to human health and the ecosystem. For these reasons, several advanced vehicle and fuel technologies are currently being developed with the aim of reducing the environmental impacts of road transport and its dependence on fossil fuels. However, these technologies enter the market incrementally and must meet performance, utility, and cost requirements to be accepted by consumers.

Statement of the problem

The burning of fossil fuels evokes the emission of greenhouse gases. Manufacturing and driving vehicles produce greenhouse gases. The process of producing petrol or diesel itself requires extracting oil from the ground, transporting it to a refinery, refining the oil into petrol, and final distribution of petroleum to the service stations. Each of these steps can produce additional greenhouse gas emissions. In 2020-21 more than three million passenger vehicles are sold in India (SIAM). A typical passenger vehicle emits about 4.6 metric tons of carbon dioxide per year. This number can vary based on a vehicle's fuel, fuel economy, and the number of miles driven per year. It may affect environmental sustainability as the right of future generations to enjoy fresh air will be interrupted. The government of India has been considerably trying to elicit the effects of fossil fuel-burning vehicles by means of Emission norms and Electric mobility through Automotive Mission Plan. There is still a remaining question on the extent of electric vehicles in ensuring environmental sustainability. Hence the present study is conducted to address the significance of environmental sustainability in the background of electric vehicles.

Objectives

1. To know the effects of fossil fuel burning vehicles to the environment in terms of emission of gases
2. To know the role of electric vehicles in ensuring environmental sustainability

Review of Literature

(Günther et al., 2015) Electric vehicles are considered the key technology in the automobile industry towards sustainable development with lesser greenhouse gas emissions, limited air pollution and new employment opportunities with adequate social impact. The study emphasizes the long-term industry supply chain framework which starts from raw material exploration to vehicle sales including the vehicle usage phase as well as reverse supply chain activities.

(US EPA, 2018)The amount of carbon dioxide (CO₂) produced from burning one gallon of fuel relies on the amount of carbon in the fuel. When the fuel is burned, more than 99% of the carbon in it is expelled as CO₂. Even diesel fuel offers more fuel efficiency than similar vehicles that use petrol, which usually gets rid of the higher carbon content of diesel fuel. Carbon content differs by fuel, and some variation within each type of fuel is normal.

(Faria et al., 2012)This paper focuses on a study of the economic and environmental balances for Electric Vehicles (EVs) against Internal Combustion Engine Vehicles(ICEV). The primary energy source includes non-renewable sources (fossil fuels and nuclear) and Renewable Energy Sources (RES). Vehicle technologies cover Battery enabled Electric Vehicle (BEV), Hybrid Electric Vehicle (HEV) and Plug-in Hybrid Electric Vehicle (PHEV). In terms of environmental implications, for the average electricity usage, BEVs have less than half of the emissions as an ICEV. Meanwhile, the ownership costs during the life cycle (about 10 y) of an EV are similar to an equivalent ICEV, despite the lower operational costs.

(Luthra et al., 2009)This study emphasises the importance of sustainable purchasing. Social responsibility has been reported as the most important variable to adopt sustainable purchasing. ‘Economic benefits’; ‘Environmental benefits’ and ‘Social benefits’ have been found as the most dependent and desired result of the present study.

Automobile Industry in India

The automobile industry in India has been identified as one of the key sectors of the Indian economy (Luthra et al., 2014a). The automobile industry in India was the fifth largest in the world in 2020. The automobile industry has hundreds of suppliers and thousands of spare parts units. The Indian automobile industry has shown tremendous growth in the last few years. The domination of the middle class is reflected in the fact that about 80% of the vehicles sold in the country are two-wheelers; cars and MUVs account for only about 13% of the sales.

Automobile Industry Composition in India

Table 01: Domestic market share for 2020-21

Passenger vehicles	15
Commercial vehicles	3
Three wheelers	1
Two-wheelers	81
Grand total	100

Source: Society for Indian Automobile Manufactures

The two-wheelers and passenger vehicles dominate the Indian Automobile Sector

Table 02:Automobile Domestic Sales trends(Numbers)

Category	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
Passenger Vehicles	2,789,208	3,047,582	3,288,581	3,377,389	2,773,519	2,711,457
Commercial Vehicles	685,704	714,082	856,916	10,07,311	717,593	568,559
Three Wheelers	538,208	511,879	635,698	7,01,005	637,065	216197
Two Wheelers	16,455,851	17,589,738	20,200,117	21,179,847	17,416,432	15,119,387
Quadricycle	0	0	0	627	942	-12
Grand Total	20,468,971	21,863,281	24,981,312	26,266,179	21,545,551	18,615,588

Source: Society for Indian Automobile Manufactures

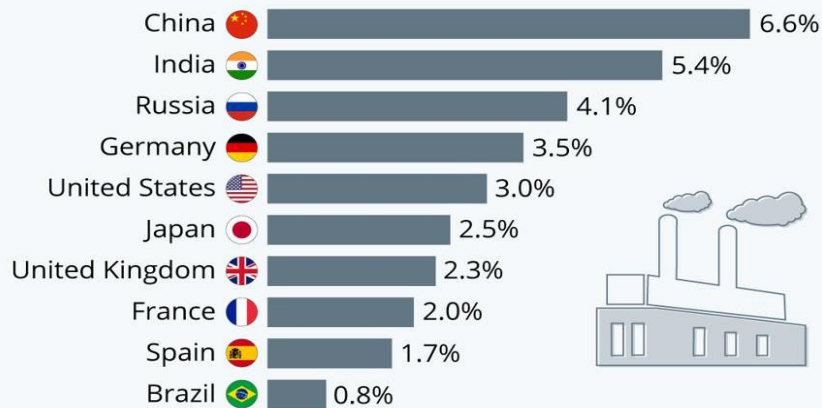
It is clear from the above table that till 2018 automobile industry experienced a positive trend in sales, but later on it started deteriorating. But still, the amount of gases emitted by these vehicle populations may add insult to injury to our natural environment.

The problems of fossil fuels on the environment

Petrol and diesel are both made from oil a black gloopy substance formed from the fossilized remains of animal and plant life that lived and died under our oceans hundreds of millions of years ago. Oil contains compounds of carbon and when it is burned in a car's engine along with being an energy source, it produces carbon dioxide, the most abundant greenhouse gas in our planet's atmosphere. The concentration of carbon dioxide in our planet's atmosphere has been increasing rapidly in recent years and now stands at over 400 parts per million, while in 1800 it was just below 283 PPM. The increased level of carbon dioxide in our atmosphere brought about by the increased burning of fossil fuels is now agreed by almost all climate scientists to be the cause of rapidly accelerating climate change and rising global average temperature.

But what's also now becoming much clearer is that diesel cars, which in the 2000s were hailed as more environment friendly than their petrol counterparts because they produce less CO₂, also produce more oxides of nitrogen. These include nitrous oxide or laughing gas which is almost 300 times more powerful greenhouse gas than CO₂, which is the major pollutant and forms the brownish-coloured component of smog and nitric oxide which readily oxidises in the atmosphere to become nitrogen dioxide.

New rules to control pollutants in emissions have led to cleaner, more efficient engines. But as the emissions scandal of 2015 showed in some cases new and supposedly greener cars are only cleaner when undergoing test conditions. A wider analysis of vehicle emissions has shown that many cars from your range of manufacture exceed emissions limits by a large and when being real life rather than under test conditions.

Figure 01: The Economic Burden of Air Pollution

Sources: Greenpeace, Center for Research on Energy and Clean Air

The figure above shows the economic cost of fossil fuels as a share of GDP in 2018. It clearly states that India spent 5.4% of its GDP to carry the burden of air pollution. It is found that the burning of gas coal and oil leads to three times as many deaths as road traffic accidents around the world while the global economic cost amounted to 2.9 trillion dollars in 2018 or 3.3 per cent of global GDP. An estimated 4.5 million people died in 2018 due to exposure to air pollution by PM 2.5 pollution was responsible for 1.8 billion days of work absence, four million new cases of child asthma and two million pre-term births.

Hence it makes sense to look for alternatives to petrol- and diesel-powered vehicles. And fortunately, alternatives already exist in the form of all-electric and electric-petrol hybrid vehicles. About one in 200 of the new cars sold today are fully electric. It is predicted that by 2030, this will have increased dramatically to around one in 12.

Electric vehicles and environmental sustainability

Promoting electric mobility, as seen in the case of India's National Electric Mobility Mission Plan and the FAME scheme, can have significant positive impacts on environmental sustainability, particularly in terms of air quality and greenhouse gas emissions. Here are some key ways electric vehicles (EVs) contribute to environmental sustainability:

1. **Reduced Air Pollution:** As mentioned in the provided text, electric vehicles produce no tailpipe emissions, which means they do not release harmful pollutants like carbon dioxide (CO₂), nitrogen oxides (NO_x), particulate matter (PM), and volatile organic compounds (VOCs) that contribute to air pollution and smog formation. By transitioning to electric cars, countries can significantly improve air quality in urban areas, reducing health risks associated with poor air quality and respiratory diseases.
2. **Lower Greenhouse Gas Emissions:** Electric vehicles help reduce greenhouse gas emissions, particularly CO₂, which is a major contributor to climate change. Since electric cars do not burn fossil fuels, their

operation produces zero direct CO₂ emissions. The environmental benefits are even more significant if the electricity used to charge the vehicles comes from renewable sources like solar, wind, or hydropower.

3. **Energy Efficiency:** Electric vehicles are generally more energy-efficient than internal combustion engine (ICE) vehicles. Traditional gasoline or diesel-powered vehicles waste a significant amount of energy as heat during combustion and through mechanical losses. In contrast, electric vehicles convert a higher percentage of the energy from the grid into usable power to propel the vehicle, making them more energy-efficient overall.
4. **Sustainable Manufacturing:** Electric vehicles can be manufactured using recyclable materials, reducing the environmental impact associated with the production and disposal of vehicle components. The adoption of sustainable manufacturing practices further supports the overall environmental sustainability of the electric vehicle industry.
5. **Potential for Grid Integration and Energy Storage:** Electric vehicles have the potential to serve as a distributed energy resource, with their batteries acting as energy storage devices. During periods of peak electricity demand, EVs can be used to discharge power back into the grid, reducing stress on power generation facilities. This integration promotes better management of energy resources and encourages the use of renewable energy.
6. **Noise Reduction:** Electric vehicles are quieter than traditional internal combustion engine vehicles. This reduction in noise pollution can benefit both urban environments and natural habitats.
7. **Local Economic Benefits:** Encouraging the adoption of electric vehicles can stimulate the growth of the domestic electric vehicle industry, generating new jobs and economic opportunities. It can also reduce a country's dependence on imported fossil fuels, enhancing energy security and fuel sovereignty.

Conclusion

The electrification of the transportation system would be a promising solution, both in terms of greenhouse gas emissions reduction and decreasing the dependence on fossil fuels in the transportation sector. The use of an EV instead of a fossil fuel-burning vehicle typically avoids the use of approximately 600–900 liters of fuel per year per vehicle. The paper suggests that electric mobility is increasingly beneficial, both from an environmental and economic point of view when compared to conventional combustion mobility.

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