

## ENVIRONMENTAL IMPACT OF EMERGING ELECTRIC VEHICLE TECHNOLOGY

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**Abstract:** With the burgeoning development, the existing technology in transportation is possessing threat to the environment in some way or the other. To mitigate this threat and damage, electric vehicles are developed which are comparatively less harmful. The problems faced by today's automobile sector is not only its contribution to the air pollution and the rise in global warming, which indeed has a proportional effect on the ecosystem but also the shortage of the fossil fuel. Electric vehicles provide us with a more sustainable solution for these problem by restricting the tail pipe emission, which lowers the level of air pollution; as it runs on the electricity. However, depending on current electric vehicle technology would be myopic, since there are some long term effects of electric vehicle like, the pollution caused during the production and disposal of the battery, which can cause a hindrance in our goal of sustainable development. Only when new technologies are formulated to over come these problems we can call electric vehicle a complete sustainable idea.

**Keywords:** Sustainable development, air pollution, global warming, battery production, electric vehicle.

### 1) Introduction

The worldwide population is growing day by day, which requires the improvement of the state at a fast rate. In any developing country, transportation acts as a primary resource. The automobile form a majority part of the transportation. In major cities across the world, motorbikes and car accounts to more than 70% of the vehicle population. Increase in mobility calls for increase of motorization, development of new infrastructure for transportation, increased noise and traffic, which has indeed caused negative effect on the humans and its surroundings. In the need of development we have engendered various new problems like pollution, depletion of natural resources etc, which lead to a new chain of problem. To mitigate the effects of these problem it is important to come up with an alternative solution.

The main idea is to look for a more sustainable solution which will help us stem the current problems and will lead us to greener development, to emphasize more on the traffic safety, keep a check in the pollution and to be as much economical as possible. In order to cater the needs, all the countries started looking for a better alternative strategies and improved

technologies. Reducing the use of oil, petrol and other common fuels was one of the ideas, which indeed gave rise to the electric vehicle technology. This technology is now adopted all across the globe including India. Electric vehicle gives us an apt solution to mitigate the problems of air pollution, emission of green house gases, increase of global warming and depletion of the fuel which is mainly petroleum [1].

## 2) Sustainable Development

Sustainable development itself is a broad terms which can be implied in all the aspects of life. Any answer formulated preserving in thoughts the environmental aspect, financial aspect and the social significance is a sustainable answer. The ideal or the primary meaning would be, “Sustainable development is the idea that human societies must live and meet their needs without compromising the ability of future generations to meet their own needs” [2].

In recent years, sustainable development is been seen in the transportation sector of the world, which is directly related to most of the negative impacts on the environment, economy and the social impact. The electric vehicles developed are the framework of the massive shift in the era. The shift from internal combustion engine to electric motor can be seen as sustainable shift which is a sign of development of the nation.

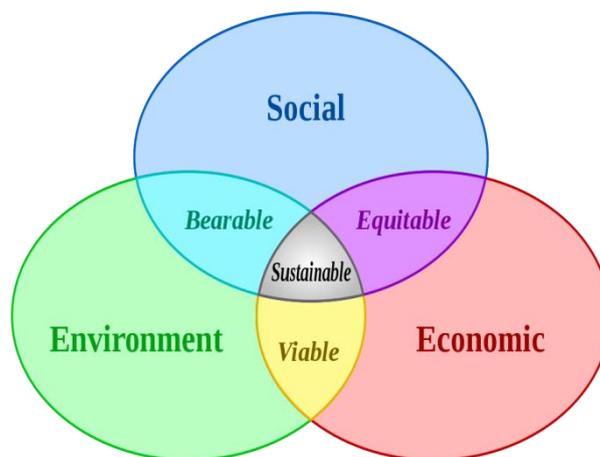


Figure above show the meaning of sustainability

To prove that this shift is sustainable and reliable for the future growth and development we need to look at several parameters such as its long term effects, short term impact, the economic shift, its effects on the environment and the acceptance by general public etc. Mainly if it answers the recently faced environmental problems or not, is based on which we can classify this shift as fruitful and beneficial for further use.

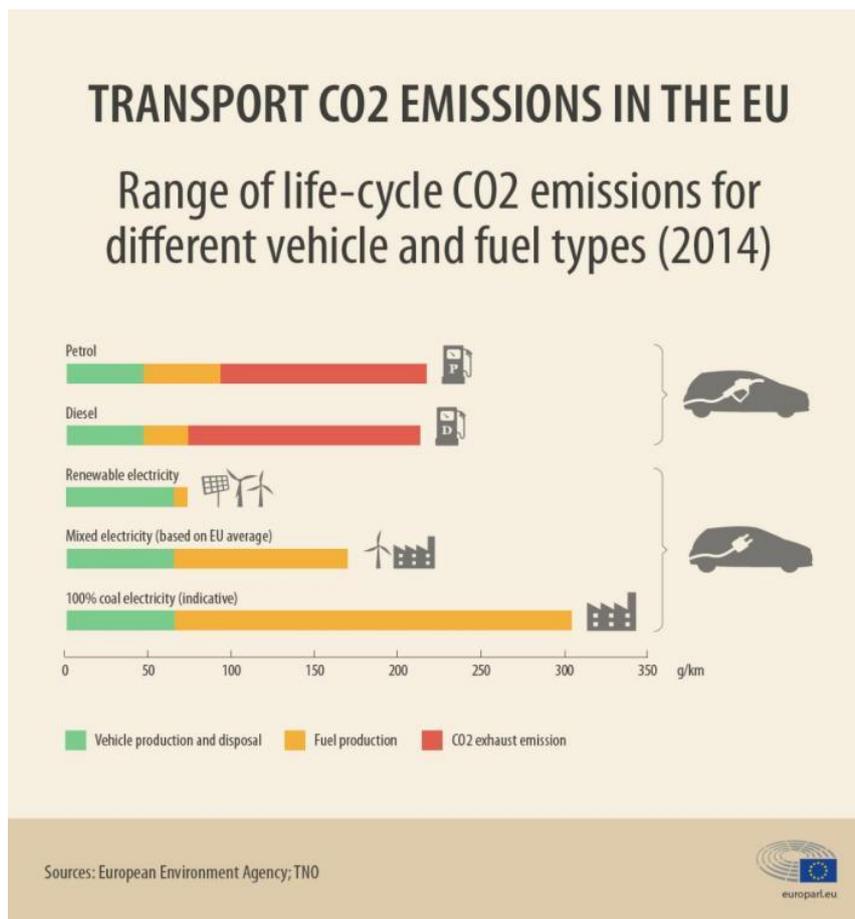
### 3) Need for electric vehicles

#### 3.1) Effects of IC motor

According to WHO “Air pollutants kills a predicted seven million human beings globally each year”. WHO records suggests that nine out of 10 human beings breathe air that exceeds WHO guiding principle limits containing excessive stages of pollution, with low- and middle-income nations stricken by the best exposures [3].

Transportation involves the combustion of fossil fuels to provide strength translated into motion. Pollution is produced from incomplete carbon reactions, non burned hydrocarbons or different factors gift within-side the gasoline or air for the duration of combustion. These strategies produce pollution of numerous species, along with carbon monoxide, soot, numerous gaseous and liquid vapour hydrocarbons, oxides of sulphur and nitrogen, sulphate and nitrate particulates, ash and lead. These primary pollution can, in turn, react in the surroundings to shape ozone, secondary particulates, and different damaging secondary pollution. Combustion additionally produces carbon dioxide, the number one greenhouse gas. Transportation accounts for approximately 21 percent of greenhouse gas emissions global; it is projected that this share will upward thrust notably for sure areas inclusive of Europe and Latin America. The International Energy Agency (IEA) has seen that transport area emissions of carbon dioxide (CO<sub>2</sub>) has grow by over ninety percent between 1990 and 2020. Methane and nitrous oxide (N<sub>2</sub>O) also are of concern for the environment, since both of these gases are currently a huge part of the greenhouse gases or we can call them as major contributors of the greenhouse gas, however due to the fact that certain technology can be followed into considerable use for local pollutant emissions (particularly NO<sub>x</sub> control technology and natural gas fuel systems) may limit the emissions of those green house gases in the nature [4]. According to the international council of clean transport, the majority of vehicle emissions related health impacts occur in the top global transport market like India, China, the European Union (EU) and the United States (US). In 2015, more than 70 per cent of the total air pollution associated deaths in the world occurred in these four countries with the highest numbers being in China and India.

The study, which analyzed the health impacts of air pollution caused by vehicular emissions in the period 2010-2015 found that premature deaths caused by pollution from vehicle exhaust increased from over 3.6 lakhs (3,61,000) in 2010 to over 3.8 lakhs (3,85,000) in 2015 which is almost an increase of 6.6 per cent over just five years. These deaths, however, increased by 26 per cent in India and China [5].



### 3.2) Impact of electric vehicles

Electric cars (or electric vehicles, EVs) have different environmental impacts compared to conventional internal combustion engine vehicles (ICEVs). While factors in their manufacturing can set off similar, much less or alternative environmental impacts, some models produce very little tailpipe emissions, and a few have the ability to lessen dependence on petroleum and greenhouse gas emissions, relying at the source of electricity used to charge them, and health effects from air pollution. The adoption of this technology has seen a sharp rise with time, because it gives us a benefit against the pollution problem [6].

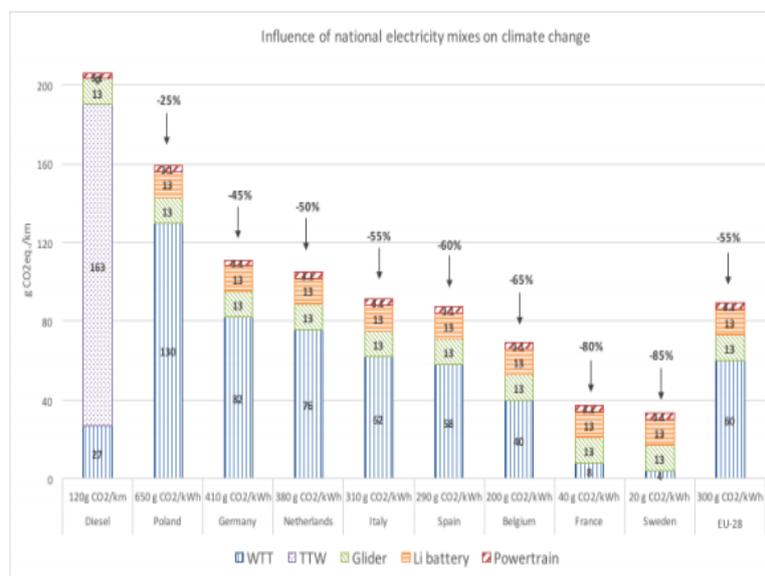


Figure represents CO<sub>2</sub> emission comparison between IC and EV.

In developing countries like India, the growth of electric vehicles have boosted by a significant level. Electric vehicles sales, excluding e-rickshaws, in India grew by 20 per cent at 1.56 lakh units in 2019-20 driven by two-wheeler, according to Society of Manufacturers of Electric Vehicles [7].

Electric vehicle works on electric power generated in the lithium ion battery, it does not require any fossil fuel to power up the vehicle. Hence, lowering the pollution and the carbon footprint on the environment, which further reduces the risk of health disease and the number of deaths related to the air pollution. The electric vehicle promotes a greener way and the adoption of the EV is going to result in the reduction of the global warming and help keep the climate change in control.

Furthermore, Tax rates that reflect tailpipe CO<sub>2</sub> emissions can be conducive to increased electric vehicle uptake. Fiscal incentives at the vehicle purchase, as well as complementary measures are pivotal to attract consumers and businesses to choose the electric option. Local governments are key in proposing and implementing measures to enhance the value proposition of electric vehicles. The use of local low- and zero-emission zones can steer car purchase decisions far beyond just those zones and may influence the relative resale value of internal combustion engines and electric power vehicle.

The vast majority of car markets offer some form of subsidy or tax reduction for the purchase of an individual or company electric car as well as support schemes for deploying charging infrastructure, which contributes towards the growth of electrical vehicles.

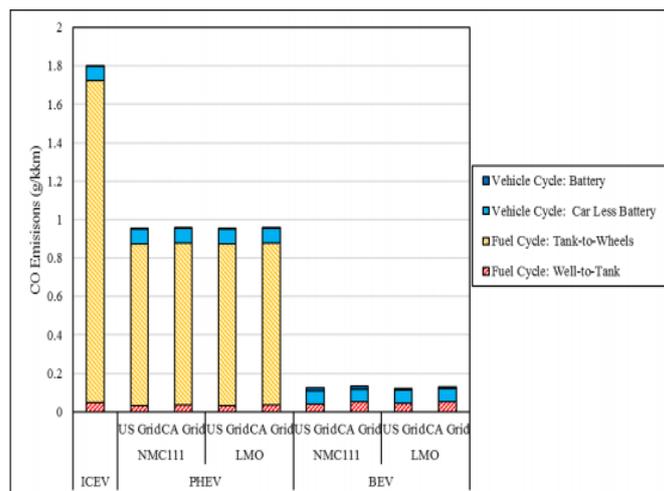


Figure represents CO emission comparison between IC and EV.

#### 4) long term effects of electric vehicles

Electric vehicles although seem promising in eradicating the current problem of fossil fuel and air pollution; is not the best possible answer or the change we are looking for to save the environment, until we analyze and work on modifying the current technology to prevent the burgeoning of the new problems anticipated from the emerging shift from IC motor to electric vehicles.

##### 4.1) Manufacturing of electric vehicle

The manufacturing of electrical cars emits about 15% more dangerous pollution than the manufacturing of the IC engine. The cycle of making a vehicle starts with raw materials being extracted, refined, transported and manufactured into numerous additives in an effort to be assembled to produce the automobile itself. The manufacturing process is very similar in both, conventional and electric powered vehicles. Nevertheless, at the end of the manufacturing system, electric powered vehicles are the ones producing extra carbon emissions, according to the Union of Concerned Scientists. For a bigger electric vehicle with a bigger battery, that gap could develop to 68%. The international council of clean transportation also supports the subsequent end primarily based totally on eleven research posted among 2011 and 2017. the Union of Concerned Scientists stated that the electricity used in the battery manufacturing was the single largest factor in explaining the emissions gap, because of this that using cleaner sources of energy would be the most impactful way to lessen the emissions that come from the manufacturing system [8,9].

The emissions from production of glider and power train are extrapolated from the average weight of the vehicles in each category, which is calculated based on the Sprit monitor data (i.e. the average weight from Sprit monitor of the top vehicle models in each category). Based

on the study 21 -which relies on average European electricity- we have used the value of 4.8 tCO<sub>2</sub> released per kilogram of vehicle produced (battery excluded) in 2020, and 2.9 tCO<sub>2</sub>/kg in 2030 (reduction in line with the average 'greening' of the EU electricity grid). Finally, because the conventional power train is much heavier and work intensive than the electric power train, we estimate based on a Ricardo study<sup>22</sup> that the production of electric cars (excluding the battery) is about 10.7% less carbon intensive than for conventional equivalents [12].

#### 4.2) Battery production and recycling

The raw materials required for the production of a battery are gathered by mining, Increasing mining activities to match the rising call for battery raw materials will have detrimental impacts, if not undertaken responsibly. Cobalt extraction, for instance, is a acknowledged culprit. Small-scale mines in the Democratic Republic of Congo (DRC) are notorious for human rights violations. As per the UNCTAD document, those mines employ as many as 40,000 kids in risky conditions. Further, callous dealing with of substances and wastes at cobalt mines has the capacity of contaminating water resources. Moreover, there's additionally a possibility of different poisonous metals occurring in cobalt reserves and care desires to be taken to include them all through mechanical excavation. Extraction of lithium comes with its very own set of challenges.

For instance, in Chile, lithium mining from underground brine wells has not only pushed out the local communities however has additionally caused environmental degradation through impacting the surrounding soil and water resources [10].

The carbon footprint generated all through the manufacturing is likewise pretty excessive which results in the boom in the green house gases. This modern day evidence indicates that the carbon impact of manufacturing of batteries ranges from 61 to 106kgCO<sub>2e</sub>/kWh according to the 2019 updated study from IVL Sweden<sup>11</sup>. Their previous estimate - from 2017 - ranged from 150 to 200 kgCO<sub>2e</sub>/kWh and relied on scarce data from small scale production, with some dating back to 2010 [11].

While most EV components are lots similar to the ones of traditional vehicles, the large distinction is the battery. While conventional lead-acid batteries are broadly recycled, the same can not be stated for the lithium-ion versions used in electric powered vehicles. EV batteries are large and heavier than those in everyday vehicles and are made from numerous hundred individual lithium-ion cells, all of which need dismantling. They include risky substances, and feature an inconvenient tendency to blow up if disassembled incorrectly.

Currently, globally, it is very difficult to get targeted figures for how many of lithium-ion batteries are recycled, however the cost every person fees is set 5%. The disposal of these batteries is another big issue because if not treated correctly, it will be hazardous to the nature and all the living being. Recycling is one of the alternatives developed to mitigate the e-waste, but these plants are only affordable to and economically powerful country.

In 2017, a report made through IVL Swedish Environmental Research Institute additionally calculated that the CO<sub>2</sub> emissions of lithium-ion batteries (found in many electric powered vehicles today) are in the order of one hundred fifty–two hundred pounds of carbon dioxide equivalents per kilowatt-hour battery. Half of the CO<sub>2</sub> emissions (50%) comes from cell manufacturing, while mining and refining contributes most effective a small a part of the CO<sub>2</sub> emissions. In practice, emissions in the order of one hundred fifty–two hundred pounds of carbon dioxide equivalents in step with kilowatt-hour method that an electric powered vehicle with a 100kWh battery will therefore have emitted 15–20 tons of carbon dioxide even before the automobile ignition is turned on. However, Popular Mechanics calculates that even supposing the 15–20 heaps estimate is correct, it might most effective take 2.4 years of driving for the electrical vehicle with a 100kWh battery to recover the greenhouse emissions from the battery manufacturing. Furthermore, other studies suggest a 100kWh battery could generate approximately 6-6.4 tons of CO<sub>2</sub> emissions, so drastically much less than what the IVL study claims [13].

## **5) Conclusion**

Although our views regarding the electric vehicles might differ or are in complete mutual opposition but the growth of the electric vehicles in the future is realistic. Looking at the current situation, the development of an alternative fuel is quite necessary and electric vehicles do have potential to replace the conventional IC motor vehicle. This drastic shift from IC engine to electric vehicle is estimated to be at its peak by 2050 according the European council. However, we can not simply ignore the threat possessed by the EV in the long run, therefore it calls for a betterment in the current technology and detailed research to mitigate the long term effects and the threat of electric vehicle. Not only by utilizing the current technology but it is also necessary to create such conditions in which despite the many shortcomings prevailing advantages of using electric vehicles, we can make a cogent decision and bring about a sustainable solution.

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