Electric Power Generation and Distribution (ELEC5580M)

ASSIGNMENT-1

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Impact of green mobility in developing countries (India)

Abstract:

Transportation sector is one of the biggest contributors to air pollution and developing countries such as India have worst effected cities due to their large population, high density of vehicle, large percentage of energy generated by non-renewable sources and huge industrial activities. Adoption of green mobility can reduce the pollution caused by transport sector and impact the socio-economic condition of the country in a positive way. A proper framework needs to be developed by the government to ease the adoption and overcome any technical and economical difficulties in implementing green mobility in the country.

Introduction

According to World Health Organisation 97% of the most polluted cities are situated in developing countries and 90% of the top 200 are located either in India or in China. [1,2]. The research in [3] proves the correlation that higher pollution level causes chronic diseases and thus reduces the average life expectancy in polluted region.

For any developing country transport sector act as the backbone of it but transport sector in India is responsible for more than 27% of the total pollution in the country.[4] One of the potential steps to curb pollution in transport sector is by introducing green mobility.

Green mobility includes steps such as integrating different modes of transport, enhancing public transport facility, adopting cost effective alternative in power train technology such as replacing Internal combustion engine(ICE) vehicles with Electric Vehicles (EV) but most importantly changing the mindset of common people so that they help in achieving the goal of green mobility.[5]

There are multiple benefits in adopting green mobility but has a lot of challenges too. When compared to their developed counterparts, developing countries face bigger socio-economic challenges in implementing green mobility. But due to many benefits, government of India has been working towards realising green mobility in the country.

Main body.

India is the seventh largest country by size but second only to China in population due to its biggest arable land area compared to any other nation, being a developing nation with one of the fastest growing economy it has a lot of industries in different sectors creating lot of jobs, growth, opportunities and even pollution. Indian capital, New Delhi is the most polluted city in the world mainly due to the traffic.[6][7] According to ministry of statistics and programme Implementation, Government of India(F), total registered vehicle in the city in 2015 was more than 88.5 million personal vehicles[8] which is twice the total vehicles registered in the UK around the same year. But even with such huge number of vehicles, last mile connectivity is not accessible to all due to the lack of public transport, financial

constraints, high traffic congestion and hence need for adequate infrastructure is required by the government but utilising all such facilities have to be inculcated by the citizens.

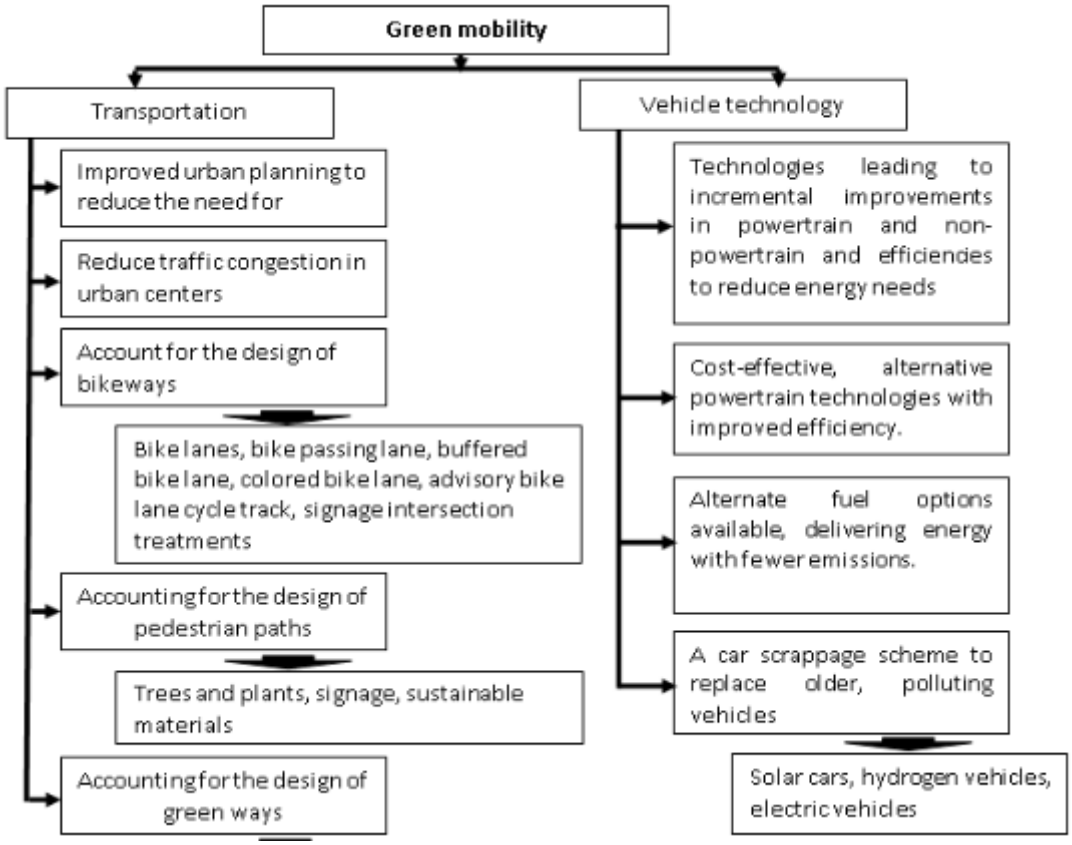


Figure 1. Overview of green mobility. [9]

Green mobility is a sustainable model which is compatible with the health of humans and overall health of environment alike. It includes affordable, low polluting last mile transport solution which helps in the total development of the society. [9] Apart from Environmental impact it also has major social and economic impact in the country. Modes of transportation which contributes to low green house gases and other toxic emissions play a major role in development of sustainable transportation. Green mobility includes usage of Electric vehicle, Walking, cycling and using public transport.

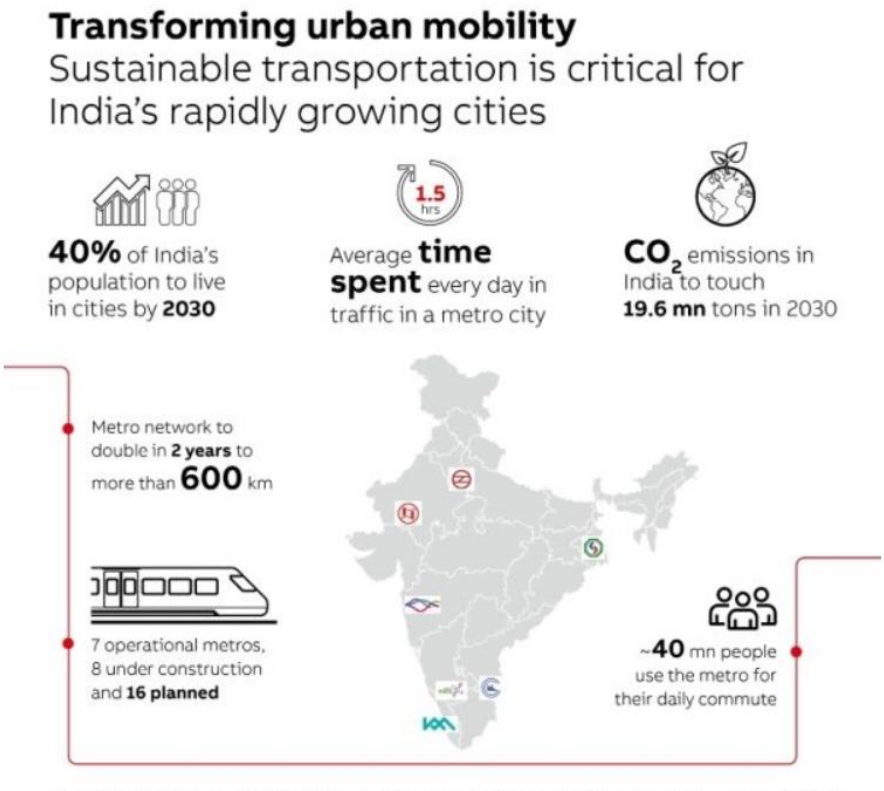
Electric Vehicles (EV) are touted as the preferred mode of transportation in the future. EVs utilises electrical energy for propulsion rather burning fossil fuels. Apart from lower air pollution EVs produces lower noise pollution. With the major breakthrough in battery technology, the range of electric vehicles is improving while the cost is decreasing.

Public transportation has a lower carbon footprint per person. According to a report by U.S department of Transportation, availing public transport can cut green house emissions up to 70% per person.[10] Public transportation includes combination of busses, trains, shared vehicles etc.

Cycling is considered the healthiest mode of transport as it is safer and doesn’t cause air or noise pollution. According to a research, in EU-27 more than 650,000 jobs have been created due to increase in cycling in the past decade. Most of these jobs employs low skilled workers hence creating jobs for local workers and growth of sales of local stores, eateries have been

observed. [11] India can benefit a lot from promoting cycling for short distances which will help in reduction of pollution, decongestion of traffic while creating more job and boosting the local economy of the area. Many companies in India have started cycle sharing services, these services extend the reach and scope of public transportation and increases adoption of public transport as well. Walking is also a healthy mode of commutation, albeit slow it is the most environmental and pocket friendly mode of reaching to destination.

Throughout the globe, scientists and lawmakers are perplexed by questions which seems quite straightforward but are challenging to answer, question such as how to develop a sustainable global transport model. A one fit solution is not possible for all nations or cities. Geography of region, economy and climate plays a major role while developing sustainable transportation and hence must be tailor-made for every single nation, in fact for each region. India being a humongous county both in size and population must come up with an indigenous model. Most Indian cities are unplanned and densely populated with some areas having narrow lanes and some with no proper roads at all. Integrating different mode of transportation is necessary to attain the last mile connectivity. People must inculcate walking, bike sharing and usage of public transport rather than using personal 2-wheeler scooters and motorbikes, such healthy habits will result in the reduction in pollution and thus decrease medical expenses as well.



. Figure 2. depicts the need of transforming the transportation sector in India.[12]

By 2025 India plans to ban the sale of sub 150cc category of 2-wheeler ICE vehicles and 3-wheel ride sharing vehicles which will be the first major step towards transition into greener transportation. Public buses, subways and other means of transportation has to be improved. India has one of the biggest rail networks in the world. According to the Rail ministry railway carries about 23 million people daily.[13] Even with so many passengers

making daily commutation availability of tickets doesn't meet the demand. To reduce the emissions from railways Government of India has started the project to electrify the whole railway network which will decrease the carbon footprint and reduce the total operating cost. [14]. According to studies it is observed that an electric train cuts the carbon emission by 25% compared to a train running on fossil fuel.

During recent corona virus pandemic, it has been observed that most of the migrant blue-collar workers got stuck in just a handful of cities and majority of these workers belonged to just 3 of the 30 states present. This shows a bigger challenge which is caused by lack of jobs in 100s of average cities in India, since most companies are located in less than 10 major cities, the population due to migrating people in these cities keeps on growing, causing depletion of resources and making existing infrastructure inadequate. Such trend is apparent in most developing nation with huge population. The result is an outward expansion of cities leaving little to no scope for development of required infrastructure such as broader roads, new subway routes and required charging station. The only viable solution is to establish a network of public transport. According to a study done in Berlin on a busy route with fully occupied bus CO2 emission per 100 passenger mile is about 14 pounds compared to 89 pounds of CO2 in a personal car.[15] The use of personal vehicle releases more than 6 times CO2 for a similar distance furthermore the space required by cars is extremely large in comparison to any other public transport which causes is the major cause of traffic congestion.

Economic impact.

Adoption of EVs in India is hindered by the lack of required infrastructure, GOI's roadmap for EV adoption will employ millions of people for development of infrastructure. The economic slump and loss of job due to the covid-19 pandemic can be negated by fast tracking the pending projects related to the infrastructure development of EVs. According to projections, India will have more than 80 million EVs by 2030 and 8 million public charging stations. Employment will also be created in the R&D sector for research dedicated to battery storage, battery management and power electronics. According to a research, India will be saving around $36 billion annually on fuel consumption by improving the vehicle's fuel efficiency.[16] To boost the investment and development of charging infrastructure power ministry under government of India has allowed sale of electricity as service. [17]

Challenge

The biggest challenge in developing infrastructure is due to high initial investment in the infrastructure hence the adoption of EVs in India has been limited, apart from lack of infrastructure, lack of knowledge about EV, limited range and high initial investment associated with procurement of an EV or HEV are also the major blockade in adoption of EVs in the country.

Since, India generates more than 60% of nation's electrical energy through burning fossil fuel added with the fact of country's high transmission losses of about 20% [18] any benefit with lower emissions due to electric vehicles are negated whereas developed countries such as Germany, Canada, U.K, etc, which generates most of their power through renewable sources lowers their vehicular emissions by adopting EVs. According to a study in [19] a positive impact in reduction of CO2 emission in China is only observed if the charging of

EVs are done overnight using slow charging method, in case of fast charging during the day time when energy demand is already high, the fast charging method proves to be counterproductive since the major proportion of energy is generated through coal fired power plant. To tackle this problem, developing countries including India which generate power through non renewable sources must come up with a framework of giving incentive to people to slow charge their vehicle at nonpeak hours. But even when utilising fast changing, EVs have one major benefit over ICE vehicle, in case of an EV scientists have observed in the shift of pollution centre. ICE causes pollution inside a city while the pollution due to EVs is concentrated at the generating station. This reason is enough for adoption of electric vehicle which will result in healthier environment inside a city and its surrounding areas and thus decrease the health-related ailments in humans.

Furthermore, adoption of EV also changes the daily load curve. A research by McKinsey shows that by 2030 the total increase in load due to EV in Germany will only be 4% of total demand but the load curve will be affected.[20] According to GOI's NITI AYOG, the energy demand in India will double by 2040.[21] By 2030 India has to increase electricity generation by 640 TWh just to power the EV's, to fulfil the energy demand, India plans to install solar plants and setup new hydro power plants. Major challenges will only occur in urban areas with high population density and high adoption of EV's. These areas will become hotspots and will be challenging for distribution centre. But the overall benefit of EV's overshadows some demerits.

Conclusion.

India being a highly populated country needs to adopt new sustainable transportation system to reduce the high pollution in the Indian cities. Government has to improve the infrastructure present in the country and come up with incentives to encourage people to adopt green mobility. Adaption of green mobility will also improve the socio-economic condition as well as the health of citizen. Indian government must set up proper framework and plans to mitigate any technical or other problems related to adoption of green mobility. The overall advantages associated with implementing green mobility in both developed and developing nations can overshadow any cons therefore Green Mobility will have a net positive impact throughout the world.

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