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Current status, Barriers and Opportunities of EVs in Asian countries

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Abstract: This decade Electric vehicles (EVs) have advanced and decreasing battery costs. Electric vehicles (EVs) are reducing carbon emissions of GHG and trending towards decarbonizing. It reduce dependency on fossil fuel completely decrease the ozone impact and promoting towards renewable energy. It should be noted that gasoline use vehicles are more costly than EVs i.e.it is less costly than other transport medium. Commercial vehicles for EVs require charging type infrastructure which can be easy to use, easy to access and less expensive and will definitely expected over the next 5 years. The costs for Equipment, Installation and Utility Service are fixed cost and Electricity cost is variable cost[1]. In the Automobile sector EVs are moving and within next 10 years there will be definitely shifts towards EVs. Asian Countries are on high demand and have great potential business market.

The paper provides an overview of Electric Vehicle (EVs), Current status of EVs, Opportunities of EVs and Barriers of EVs in Asian Countries along with the SWOT Analysis of EVs.It also recommends future prospects of EVs New Module. Overall, this paper encouraging the competitiveness and expansion strategies of EVs platform in 21stCentury.

Keywords: Electric Vehicles (EVs), Current Status, Opportunities, Barriers, SWOT Analysis

I. Introduction:

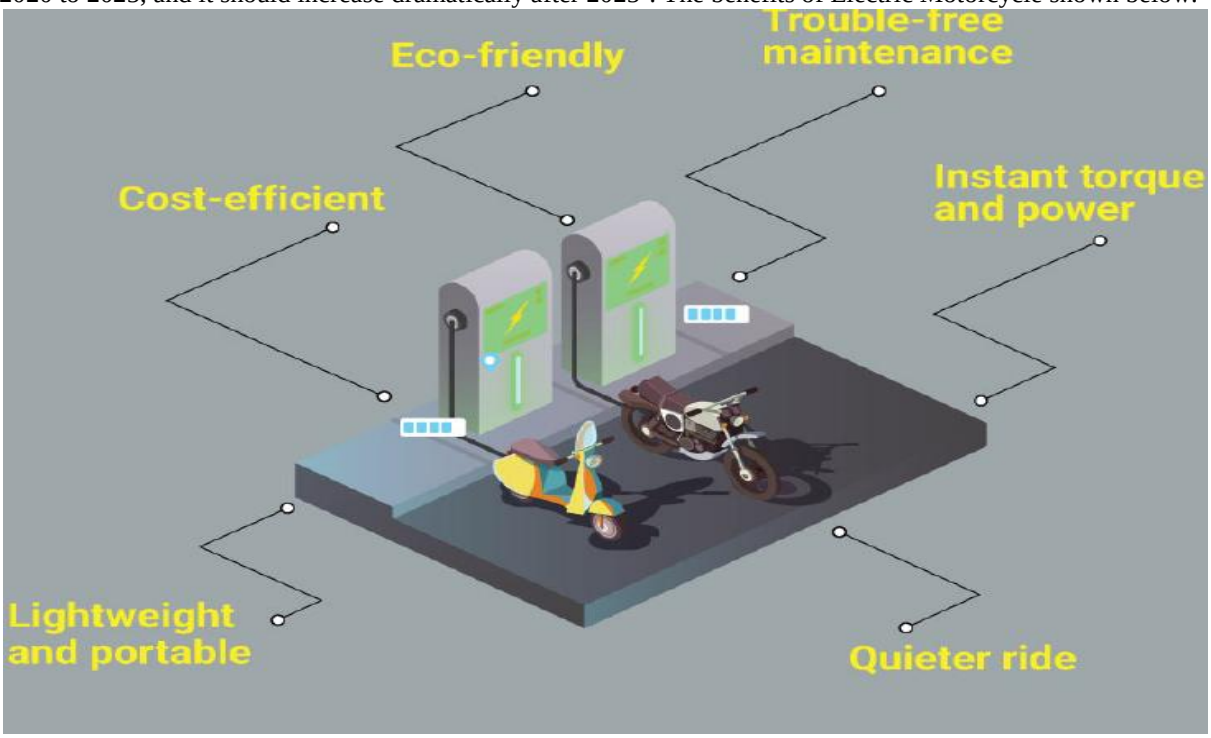
Adoption of Electric Vehicles (EVs) in Asian market with emphasis on Gap Analysis. The Asian Countries are India, Pakistan, Sri Lanka, Bangladesh and Afghanistan. Starting with an overview of emerging trend in Asian Countries relating to smog and congestion. To reduce the impact of carbon emission and to protect sustainable environment, the Asian countries are adopting toward Electric Vehicle (EV) Technology. Many of Automotive industries are implementing transformation towards EVs and some them have already started. The Sustainable Development Goals (SDG) to decreasing carbon emission along with other hazardous forms of emission which are polluting the environment i.e. SOx&NOx. The 3 A's towards SDG are Availability, Affordability & Accessibility. As an adoption of EVs will show zero per cent emissions, less noisy and reducing import dependence on oil.

[1] Henry Lee, Alex Clark, "Charging the Future: Challenges and Opportunities for Electric Vehicle Adoption", HKS Faculty Research Working Paper Series, RWP18-026, Sep 2018.

The two important Key Factors that Driving the Adoption of EVs are Environmental concerns and Cost reduction parameter. To discuss in detail are as follows. *Environmental Concern:* EVs helps to reduce pollution from exhaust emissions (i.e. zero per cent exhaust emissions). According to International Energy Agency more than 20 per cent of carbon dioxide emissions can be easily reduces by adoption of sustainability approach [2]. *Cost Reductions:* Investment in Research & Development (R&D) will definitely reducing the cost reduction, improving performance and proving better Quality. An ultimate goal of an Organization is to maximise the Profit and to minimise the Overall Requirement cost.

Although, EVs current market trends, opportunity and barriers covers the following points. EVs market is currently US$ 2.5 million expected to grow over 40% during the forecast period 2020-2030. There is an increasing consumer concerns towards EVs. The Government is regularly taking measures towards cleaner vehicles, providing government subsidies for buying EVs, Encouraging Industry Players to executing their new models. The mainbarriers to adoption of EVs in Asian countries are the higher tax rates, the lack of acharging infrastructure and the limited driving vehicles[2].

Moreover, there is serious about EVs in ASEAN (Association of Southeast Asian Nations). The biggest drivers in ASEAN EVs market are Two-wheeled and Commercial fleets vehicles. A report shows, there will be a new investment in EVs to US$6 billion by 2030. It should be noted that EVs market is likely to be slow from 2020 to 2025, and it should increase dramatically after 2025[3]. The benefits of Electric Motorcycle shown below:



Electric Vehicles (EVs) along with hybrid electric cars vehiclescan reduce carbon emissions, also SOx&NOx which are releasing into theenvironment. If proper policy formulate and implement strategy will definitely go long run to drive EVs in Asian Countries. The raw materials required for EVs batteries are Zinc, Cobalt and Manganese require sector Investment[4].

Adoption of EVs leads of Electrification of market which reduces dependence on Oil, promoting green diversification market or other availability such as Ethanol, Biodiesel and CNG. Thus emission can leads to Air quality, good health of urban population. Also, on the other hand other renewable energy sources such as wind and solar can surely be used to run EVs[5].In this Paper, we tried to focus on SWOT analyses business model[6].

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[2] Report Adoption of Electric Vehicles in Asian Market with emphasis on Gap Analysis: Masterfox Consulting Group (MCG), Dec 18, 2019.

[3] Report ASEAN Is Serious about Electric Vehicles, The ASEAN Post, 6th July 2019.

[4] Report Growing EV Industry In ASEAN, The ASEAN Post, 22 Nov 2020.

[5] Asia is poised to lead the next wave of growth in the EV industry, Investique Consulting Group, 5th January 2019.

Strengths (S)	**Weaknesses (W)**
Less Tax rate (S_1)	Crisis of Energy (W_1)
Efficient (S_2)	Commercial vehicles are not ready to shift yet (W_2)
New Technology (S_3)	Untrained manpower (W_3)
Awareness of Environment (S_4)	Less developed Infrastructure (W_4)
Opportunities (O)	**Threats (T)**
Increasing Potential Market Demand (O_1)	Less sale means less revenue generation means less profit (T_1)
Type: Renewable Energy (O_2)	Raw materials price increasing(T_2)
Platform: Digitalization (O_3)	Failure of Energy (T_3)
Less Competition (O_4)	Instability of Political network (T_4)

The Electric Vehicles (EVs) are following of four types[7]**:**

- *Battery Electric Vehicles (BEVs):* having only batteries as energy source.
- *Hybrid Electric Vehicles (HEVs):* having alternative energy sources along with electricity. It also referred to as internal combustion (IC) engine.
- *Ultra-capacitor-assisted EVs:*having a combination of capacitor and electric battery.
- *Fuel cells EVs:* having combine batteries and fuel cells.

II. Literature Review:

According to the Report of Masterfox Consulting Group (2019), highlighted Sustainability approach towards adoption of EVs in Asian countries, performance parameters, quality improvement and cost cutting on EVS. ASEAN (2019), Investment in a new model of EVs, sales forecasting and future trend. ASEAN (2020), EVs formulating Strategy and implementing approach in a long run in Asian countries along with investment in EVs battery materials. Investique Consulting Group (2019), declared that there will be an Electrification market called diversified market leads to adoption of EVs, less dependence on Oil and less carbon emissions along with other hazardous pollution caused due to fossil fuels. Henry lee (2018), focused on future EVs opportunities and challenges and its adoption. Md. NazmulHasanSuman (2020), How EVs SWOT analysis done in Bangladesh and the Business Strategy for implementation of New EV Module. On the Other hand, Draft Report of India Smart Grid Forum highlighted infrastructure development for EVs and Electric Road Transport in member states.SonaliGoel (2021), find important challenges ad future trend of EVs in India and vehicle to grid concept. RafiqAsghar (2021), focuses on EVs adaption in Pakistan current trend, barriers and future opportunities. Geotab report (2021), addressing barriers of EVs adaption in Afghanistan. Jayasinghe (2018), address impact of EVs on Sri Lankan power sector. Md. Raju Ahmed (2019), important challenges for EVs adaption in Bangladesh. Janardan Prasad Kesari (2019), mention opportunities of EVs in India.

III. Research Methodology:

The paper followed the current status, barriers and opportunities of EVs in all Asian countries i.e. India, Sri Lanka, Pakistan, Afghanistan and Bangladesh.

1.1. India[8]:

1.1.1. Current Status:

- In India, the electric vehicle market is still booming. Electric car sales have been stagnant at 2000 units per year for the past two years. However, there is a goal of selling 100 percent electric vehicles by 2030, with a compound annual growth rate of 28.12 percent since 2020.
- A survey was conducted out in the city of Ludhiana, which revealed that 36% of the current automobile owners of two-wheelers were also excited about switching to an electric vehicle.
- The state government of Telengana is likewise pushing the usage of electric vehicles, announcing that EV owners would not have to pay any road taxes. The Telengana State Electricity Regulatory Commission (TSERC) established a charging fee for electric vehicles of INR 6 in 2018. In addition, the TSERC set the service rate for the whole state at INR 6.04/kWh.

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[6] ***Md. NazmulHasanSuman, Fuad Ahmed Chyon, and Md. SazolAhmmed, Business strategy in Bangladesh—Electric vehicle SWOT-AHP analysis: Case study", International Journal of Engineering Business Management, Vol (12), pg.no 1–10, 2020.***

[7] ***Draft Report: INDIA SMART GRID FORUM, "Study on Infrastructure and Enabling Environment for Road Electric Transport in SAARC Member States", Submitted to: SAARC Energy Centre (SEC).***

[8]***SonaliGoel ,Renu Sharma and Akshay Kumar Rathore, "A review on barrier and challenges of electric vehicle in India and vehicle to grid optimisation", Transportation Engineering, Vol. 4 (2021) 100057.***

- In addition, the Hyderabad metro train system has partnered with Power Grid Corporation of India Ltd to provide electric vehicle charging stations at metro stations.
- The New Delhi government received authority last year to build 131 public charging stations around the city. A private company called Magenta Power is also working to provide EV charging infrastructure on the Mumbai-Pune route.

1.1.2. Barriers:

Barriers to EV adoption in India may be tackled from a variety of angles, including technical issues, market issues, and a lack of infrastructure.

- Market
- Vehicle servicing
- High capital cost
- Consumer perception
- Raw materials for batteries
- Technical
- Battery lifespan/efficiency
- Driving range of electric vehicle

1.1.3. Opportunities:

According to studies conducted by the International Energy Agency (IEA), the worldwide fleet of electric cars has grown from 5,000 in 2008 to over two million in 2016. This is due to basic factors such as rising environmental concerns, lower battery cost, and more charging infrastructure availability. All of this has prompted experts to expect fast increase in EV use over the next decade, with growth projections ranging from 27% to 33% for the present year to 2030.

Although India still has a long way to go in terms of achieving its electric vehicle goals, it is clear that electric vehicles present a significant growth opportunity. The central government created the National Mission Plan for Electric Mobility (NEMMP) 2020 in 2013 to encourage the production of hybrid and electric cars in India, with the goal of producing seven million electric cars by 2020. Furthermore, the government has chosen to fund up to 60% of R&D expenditures for the development of low-cost indigenous electric technologies, while global automobile companies spend extensively in energy technology R&D.

1.2. Pakistan[9]:

1.2.1. Current Status:

- Pakistan's main automotive manufacturers are interested in producing EV models with a wide range of pricing that target consumers of all income categories.
- The Rahmat group will first create electric buses to enter the transportation industry, and then a manufacturing factory will be built at the complex to create electric automobiles and twowheelers in the second phase.

1.2.2. Barriers:

- In Pakistan, the electric vehicle sector has significant obstacles. The main issue is that most automobile customers are unaware of the benefits of electric automobiles versus gasoline-powered automobiles.
- Electricity shortages and a lack of charging infrastructure are the primary reasons.
- The charging time required by electric cars, as well as the driving range they provide, are regarded negative characteristics that deter local people from purchasing EVs.

1.2.3. Opportunities:

In the 2018–19 budgets, the government announced 16 percent customs duty exemptions for charging stations for electric cars. In addition, the government decreased the customs charge on electric car kits from 50% to 10%. Pakistan's federal cabinet passed the country's first-ever national Electric Vehicles (EV) policy on November 5, 2019, in an effort to combat climate change and provide cheap transportation. By 2030, the government plans to convert 30% of all vehicles, mostly automobiles and rickshaws, to electric vehicles in the first phase. According to the strategy, 200,000 automobiles and 600,000 motorcycles and rickshaws will be converted to electric vehicles in the next five years.

1.3. Afghanistan[10]:

1.3.1. Current Status:

The current status of EVs in Afghanistan not in peak level as compare to other Asian countries, but it likely to grow in coming decades as the Afghanistan government target to convert fuel vehicles to Electric vehicles may be till 2030 or 2040. Because of less tax rate, less charging cost, less carbon emissions and many other factors.

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[9] ***RafiqAsghar, Faisal Rehman, ZahidUllah, AffaqQamar, KaleemUllah, Kashif Iqbal, Ali Aman and Agha Ali Nawaz, "Electric vehicles and key adaptation challenges and prospects in Pakistan: A comprehensive review", Journal of Cleaner Production, 278 (2021) 123375.***

[10] ***Report: Addressing the barriers to EV adoption, Geotab, Published on January 6, 2021.***

1.3.2. Barriers:

- Consumer education
- Range anxiety: the fear of running out of electricity
- Public charging station ease-of use
- Initial capital cost of electric vehicles
- Access to charging stations in multi-unit residential

1.3.3. Opportunities:

Electric vehicle adoption is expected to continue to rise, with predictions estimating that by 2040, EVs will account for 57 percent of all new passenger vehicle sales. Buying an electric vehicle is now more affordable for a larger segment of the population. In 2019, the electric car market grew even more, e.g. Tesla Cyber truck, Ford F-150, The Ford Mustang Mach-E.

1.4. Sri Lanka[11]:

1.4.1. Current Status:

TheSri Lankan governmentis promoting an increase in the percentage of electric vehicles (EVs) in their transportation sector, mostly owing to environmental degradation and rising oil prices. The number of electric vehicles is rapidly increasing, with estimates that they would account for 2-3 percent of total vehicle stock by 2030.

1.4.2. Barriers:

- Limited charging infrastructure.
- Besides high charging time.
- Less availability of the spare parts for EVscomparing with other general vehicle.
- Replacement of batteries from time to time is also the hectic problem.
- Awareness of EVs among the consumers is also not that much effective.
- The poor road and traffic conditions
- Lack of incentives and support from the government

1.4.3. Opportunities:

The manufacture of EVs and battery will lead to the increase in employment. The availability of low cost labor will eventually benefit the investors to make a huge investment for the manufacturing of EVs.The improvement in battery technology will be the emerging opportunity there. Development of the renewable energy resources for charging the batteries is another upcoming opportunity. The adoption of EV's will ultimately lead to the reduction on the dependency of oil. Thus there will be the reduction of the fuel prices. Greater opportunities for the research and development of EV's are seen as an emerging opportunity with the lot of Government investment in that sector.

1.5. Bangladesh[12]:

1.5.1. Current Status:

- Bangladesh has more than 0.5 million electric vehicles (EVs), which consume 450 MW of electricity daily from the national grid.
- Electric vehicles such as auto rickshawsand electric bikes are currently used in Bangladesh.
- For travel of 70-100 km, an electric auto rickshawconsumes 8-11 kWh each day.
- Electric bikes, on the other hand, need 1-2 kWh each 30-50 km.
- The battery in this auto rickshaw takes 6-8 hours to fully charge.
- The battery in an electric bike takes 3-5 hours.

1.5.2. Barriers:

In Bangladesh, there are no accurate data on the EV. As a result, the government is unable to take appropriate action in this matter. There are several sorts of elements related with the adoption of electric vehicles i.e. Inadequate EV charging stations (EVCS), battery technology, lack of power supply, excessive charging costs, pollution, and so on. Some serious challenges faced by the country are as follows:

- Shortage of power supply/load shedding
- Lack of charging stations
- Battery charging affects power quality issues
- High charging cost and time
- Battery life time, maintenance and technology/material used
- Low EV speed

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[11] D.H.G.A.E. Jayasinghe, RandikaWijekoon and JanakaEkanayake, "Impact of electric vehicles on the operation of the Sri Lankan power system", Ceylon Journal of Science 47(4) 2018: 363-372.

[12] Md. Raju Ahmed and Ashish Kumar Karmaker, "Challenges for Electric Vehicle Adoption in Bangladesh", International Conference on Electrical, Computer and Communication Engineering (ECCE), 7-9, February, 2019.

- Frequent accident
- Lack of government support
- Non-licensed vehicle
- Quality of road

1.5.3. Opportunities:

The opportunity of EVs in Bangladesh is very less as the research shows comparing with other Asian countries as discussed in this paper. As there are always a pros and cons while formulating and implementing any new module structure. Bangladesh government lacking to form a policy relating to renewable energy sources. The new trend of EVs will sure solve the problem of various factors such as unemployment, carbon emissions, tax rate etc. Overall, initially there is a less opportunity of EVs but with proper SWOT analysis strategy the Bangladesh government can implement EVs on road i.e. in the coming decade 2030.

2. Result& Discussion:

2.1. India[13]:

Our research leads us to three key conclusions concerning the future of electric vehicle adoption in India. Because of governmental contracts, India might attain a volume of electric vehicle sales of more than 1.6 million cars. With the acquisition of four-wheeled cars for government offices, three-wheeled vehicles and buses for public transportation is likely to be a key driver of development in the coming years. The following should be the customer composition and deciding variables for each category:

- *4-wheelers:* 30,000 cars should be purchased under public contracts until 2023.
- *2-wheelers:* The category will be privately owned and funded, and will be defined shift from low-speed to high-speed vehicles. E.g. Hero, Ampere, TVS etc.
- *3-Wheelers:* Electric rickshaws are the fastest-growing category and company like Mahindra have already released there model.

2.2. Pakistan[14]:

While EVs are seen as the future of transportation, their use has made it simpler to modify vehicles and their connected components, such as the power system. The charging network and battery technology have also been enhanced, reducing charging time and increasing EV technology efficiency. As a result, a rising number of suppliers, state agencies, stakeholders, and city planners concur that EV modifications will undoubtedly improve business and consumer results. The following are some of the prospects linked with EV modifications for Pakistan.

- Economic development opportunity
  - Increased employment prospects
  - Enhanced living standard
  - Reduce fossil fuels dependency
- Environmental sustainability opportunity
- Industrial development opportunity

2.3. Afghanistan[15]:

In terms of customer happiness and revenue generation, electric utility providers stand to benefit greatly from pushing electric car adoption in Afghanistan. These adoptions will directly supporting sustainable energy. Transportation, sustainability, demand management, demand response, and distributed energy resource innovation are all areas where progressive utilities are leading the way.

2.4. Sri Lanka[16]:

The following two scenarios were developed in order to define the EV predictions:

- Business as usual (2020 – 2025):

The Department of Motor Traffic in Sri Lanka provided prepared plan phase till 2020 i.e. participation in the Nationally Determined Contributions (NDCs) of the Conference of the Parties to the United Nations Framework Convention on Climate Change's 21st session to allow the nation to prepare for the full-scale implementation.

- Long-term plan (2025 – 2030):

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[13] ***Janardan Prasad Kesari, Yash Sharma and ChahatGoel, "Opportunities and Scope for Electric Vehicles in India", SSRG International Journal of Mechanical Engineering (SSRG-IJME): Volume 6 Issue 5–May 2019.***

[14] ***RafiqAsghar, Faisal Rehman, ZahidUllah, AffaqQamar, KaleemUllah, Kashif Iqbal, Ali Aman and Agha Ali Nawaz, "Electric vehicles and key adaptation challenges and prospects in Pakistan: A comprehensive review", Journal of Cleaner Production, 278 (2021) 123375.***

[15] ***Report: Addressing the barriers to EV adoption, Geotab, Published on January 6, 2021.***

[16] ***D.H.G.A.E. Jayasinghe, RandikaWijekoon and JanakaEkanayake, "Impact of electric vehicles on the operation of the Sri Lankan power system", Ceylon Journal of Science 47(4) 2018: 363-372.***

By 2030, Nationally Determined Contributions (NDCs) will reduce GHG emissions in the transportation sector by 10% compared to 2010 levels. To meet our NDC, we need to cut emissions by 500 tones, which amount to replacing 40,000 gasoline or diesel automobiles with electric vehicles by 2030. As a result, it was believed in this scenario that the government would provide tax reductions to encourage the use of electric vehicles

2.5. Bangladesh[17]:

The EV adoption in Bangladesh has resulted i.e. positive and negative impacts. The positive impacts include, the low GHG emission, the low operating and manufacturing cost, it reduce the country's dependency on foreign oil imports. There are various weakness i.e. negative impacts in the adoption of EV'S which are as follows, limited and low speed range of vehicle, it requires high charging time, there are still less awareness among the consumers, lack of government support, lack of charging stations, poor road and traffic conditions giving rise to frequent accidents. However amidst these negative impacts there are still abundant opportunities for EV's in Bangladesh which includes high employment opportunities, availability of low cost labor, improvement in battery technology, greater opportunities for R&D, rising awareness on environment sustainability.

IV. Conclusion:

The advantages of reduced pollution and the cheapest means of transportation make the EV market more appealing to customers. However, for a variety of reasons, EVs were unable to meet market demand. In this study, these concerns are shown in the context of Asian countries. As is well known, the number of transport trucks is growing every day. As a result, vehicle emissions are rapidly growing. If the popularity of electric vehicles (EVs) in the transportation business is not sufficiently established, pollution levels will skyrocket. This report provides a high-level review of current EV development and discusses numerous significant hurdles and adaptation possibilities. The advancement of the vehicle industry is linked to the advancement of technology and government policy. So, overall, EVs are the future of road transportation and all the Asian countries are focusing on the practical implementation of EVs.

Future Scope:

- Electric Vehicles (EVs) require charging stations i.e. expanding charging infrastructure in various locations.
- The government should emphasize this vehicle as an environmentally beneficial, cost-effective means of transportation and also no tax on EVs.
- Charging stations should be located in a convenient location where public transportation is accessible and well-known.
- As a result, to reduced GHG emissions from EVs, renewable-based charging stations are required to increase long-term EV adoption.
- For better performance and safe driving management, government institutions should give training facilities to EV drivers.
- Governments of various nations may be able to provide training and workshop facilities for this purpose.
- In addition, the road quality, particularly in rural regions, should be upgraded.
- To improve technology, the government should support the establishment of new research centers.

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[17] ***Md. Raju Ahmed and Ashish Kumar Karmaker, "Challenges for Electric Vehicle Adoption in Bangladesh", International Conference on Electrical, Computer and Communication Engineering (ECCE), 7-9, February, 2019.***