Electric Vehicles for Environmental Sustainability

Iflah Aijaz and Aijaz Ahmad

1 Introduction

Prior to actually constructing automobiles with an internal combustion engine, the automobiles, fitted with an automatic transmission, were made. In 1830–1840, the first prototypes were manufactured and were sloppy and unstable modules that operated at very low speeds [1]. Transportation, especially the burning of gasoline and diesel in cars, has played an increasingly important role as a cause of national and global air pollution since 1970. More than 95% of road vehicles is dependent on gasoline and contributes for almost 50% of petroleum consumption worldwide [2]. In the Economic Cooperation and Development, for the number of fuel vehicles, the total vehicle ownership statistics are over 450 cars per 1000 people; and in some developing countries there are even more cars per person. In countries such as the United States, this figure is also growing [3]. Fuel use has been growing steadily for the past few years. Growing volumes of automotive use, the rise of heavy duty vehicle use, and a change from private commercial vehicles to private light-duty trucks, buses, and Sport Utility Vehicles have mostly induced this [4]. The demand for diesel engines is constantly escalating internationally. In 2030, small engine diesel vehicles with sophisticated internal combustion motors are projected to win about 6% of the emerging US demand for cars and light trucks [5]. Diesel vehicles and petrol engines are the primary types of motors we have currently. There is a rising issue in fuel usage, especially gas and diesel, as more than 90% of road vehicles use gasoline and diesel engines nowadays. Every type of fuel has its

I. Aijaz (✉)
Department of Computer Science and Engineering, Jamia Hamdard, New Delhi, India

A. Ahmad
Department of Electrical Engineering, National Institute of Technology, Srinagar, India
e-mail: aijaz54@nitsri.net

P. Agarwal et al. (eds.), *Smart Technologies for Energy and Environmental Sustainability*, Green Energy and Technology,
https://doi.org/10.1007/978-3-030-80702-3_8

advantages and poor implications. Such harmful contaminants have been linked to severe illnesses. Consequences include early mortality, failure of respiration, reduced function of the lungs and heart disease [6]. Carbon Dioxide also has a strong atmospheric influence and leads to global warming. This massive rise of vehicle populations would put tremendous environmental stress in numerous ways on regional and global levels, especially triggering air pollution. Some energy sources have also been developed as the quantity of fossil fuels declines some of which are still very much in new requirement, such as methanol. These alternative energy sources can decrease reliance on fossil fuels, and certain global problems can be minimized by the use of these energy sources, including the use of electric cars without pollutants.

In the early 1990s, the concept smart city was introduced. This concept covers urban planning with recent technological advances, creativity, and modernization that have changed. The main achievement is to the adaptation of the late 1990s smart growth trend. This has encouraged increased spatial planning and the use of enhanced Wi-Fi-enabled equipment. In the modern global knowledge economy, this is vital for development. The management of public utilities and facilities used in houses, infrastructure, power and water delivery, and community security are also combined [7].

At the forefront of next-generation mobility are electric vehicles (EVs). At global panels, this so-called magical approach is widely addressed with a growing emphasis on renewable energy and use on the global level. Eventually, governments and green campaigners are trying to pin great standards on EVs with developing cities on the brink of suffocation [8]. The ability of electric cars to reduce contaminant emissions in the urban environment is a significant explanation for promoting their use in the private car market. This concern encompasses only comparatively to greenhouse gas emissions, and particularly to carbon dioxide. Evidently, given that a significant proportion of electricity is provided by fossil fuel power plants and that the effect of greenhouse gases needs to be viewed internationally, the potential reduction of the overall CO_2 released by the passenger vehicles in the urban world should be calculated [9].

The economist magazine officially appointed the next group disruptor in the business world, that is, climate change and they have a point as the Covid-19 pandemic showed us how difficult it would be to cope with climate change [10]. It has caused economic activity to cease and the carbon dioxide emissions associated with electricity have dropped significantly. But even a substantial reduction in this year’s overall carbon dioxide production is projected to only trigger a drop of 4–7%. Nevertheless, in order to meet the target of the 2015 Paris Agreement that restricts global warming well below 2 °C, we will have to reduce our greenhouse gas emissions in the next 30 years by another 90% [11]. The European Union’s long-term plan is to become climate stable by 2050. The 2030 climate and energy system is the first step. The new goal is, as part of the European Green Deal, to reduce greenhouse gas emissions by 40% in just 10 years [12]. The European Commission recently suggested that this goal be further increased to a 55% reduction and that the Green Recovery Plan be adopted [13]. It is expected that the Green Recovery Plan will help economic growth in a more sustainable way. But halting the economy is not an alternative, so we need technological improvements to achieve these goals. Each year, a single car can easily release a few tons of carbon dioxide into the atmosphere. Road transport actually accounts for 12% of the world's overall greenhouse gas emissions, so these technological advances could also have an effect on road transport. Such improvements will provide many new problems and many new possibilities to address them and see how telematics will support management by calculation. The 2020 year will be remembered for the pandemic, but this year will also be remembered where fleet electrification has really gained traction in Europe, making it the largest EV market in the world. Europe is already on its journey to surplus China, leading the charge since 2015, with EV sales every month at record high levels [14]. Electric vehicle energy obviously needs to be brought from somewhere. The large bulk of electric energy would have to come from the power grid if battery electric cars are widely adopted, in which most energy generation currently emerges from the combustion of fossil fuels [15]. Only around 10% of the energy used throughout the grid is currently supplied by sustainable energy sources, so that majority of the electricity used to charge electric vehicles would be acquired from the from power plants that burn fossil fuels such as coal, gas, and gasoline [16]. In modern power plants, conversion efficiency for generating electricity from fossil fuels is usually around 45%, far better unlike fuel cars [8]. This must, indeed, be delivered to the customer and the average quality of propagation, together with communication over local and small voltage setups, is about 90%. This suggests that the real performance of translating the chemical fuel oil at the power plant to energy at the electronic connectors of customers is usually around 41%. This would then be transformed to electricity provided by the wheels of the car.

2 Electric Vehicles (EVs)

A vehicle that operates fully or partially on power generation is an electric vehicle. E-vehicles use an electric motor that is operated by a fuel cell or batteries, unlike traditional cars that simply operate on carbon fuels. We may also use the 'e-vehicle' and 'EV' terminology for Electric Vehicle. Generally, the expression 'electric vehicle' (EV) indicates an automobile with an electric drive (motor) power mechanism that can be inserted in to refuel the battery, supplying at least part of the vehicle's power storage room [17]. Electric vehicles would include electric vehicles, electric trains, electric trucks, electric lorries, electric aircraft, electric ships, electric scooters and motorcycles, and electric spacecraft. Sustainable attributes are the greatest benefit of having an electric vehicle. Ultimately, the wider community has awakened attention to the reality that fossil fuel-based cars are one of the world's largest main sources of rising climate change and poisonous gas emissions. This situation is going to get even worse with the growing population and commodification. As a timely response to this growing issue, electric cars have arisen. Although because of its anti-polluting functionality, the innovation has been marketed nation-wide, it does have some drawbacks that have stifled its expanded universal recognition [18]. An electric car is an ultimate platform for you to not only save your expenses, but also aim to lead to a peaceful and reliable world.

The very first formal proposal to promote electric cars was introduced in India in 2010. The cabinet approved an economic motivation for producers of electric vehicles sold in India under the Rs. 95-crore policy sanctioned by the Ministry of New and Renewable Energy (MNRE) [19]. As of November 2010, the scheme contemplated discounts of up to 20% on ex-factory vehicle costs, according to a higher limit. Conversely, in March 2012, the reimbursement system was subsequently discontinued by the MNRE. The 'National Electric Mobility Mission Plan (NEMMP) 2020' was launched by India in 2013 to create a significant change to electric vehicles and to resolve power generation stability, automotive emissions and domestic energy capability development problems. While the plan was supposed to provide grants and build e-vehicle knowledge base, the proposal remained mainly a plan. Then finance minister Arun Jaitley proposed quicker implementation and production of electric vehicles (FAME), with a potential amount of Rs 75 crore, when proposing the Union Budget for 2015–2016 in Parliament. The programme was designed with the goal of offering opportunities for cars with clean energy sources to expand their revenues to up to seven million vehicles by 2020. Transport Minister Nitin Gadkari expressed an opinion in 2017 demonstrating the intention of India to move to 100% electric cars by 2030. The car sector, moreover, has faced doubts regarding the adoption of such a project. Consequently, the government narrowed the scheme from 100 to 30%. A Rs 10,000-crore project under the FAME-II scheme was approved by the Union Cabinet in February 2019. This policy has been in effect since 1 April 2019 [20]. The key goal of the program is to facilitate rapid implementation of electric and hybrid cars by providing early opportunities for the purchase of electric vehicles, as well as by building the required charging facilities for EVs.

The reason that it will not require any gas or diesel to operate has been one of the main benefits of having an EV. Rather, a charging station is required where the car can be charged in and prepared to go. The cost of building up a charging station is very high, but it is not assured of the investment rewards of such projects. The inability of different investors to spend in charging networks continues to be a significant impediment to the development of charging ports. And furthermore, car manufacturers have not been interested in speeding up charging activities around the nation. Other than this, the level of information about the EV charging strategy of the company is very tiny. Not many people understand whether or not one has to receive a permit to set up a charging station. It is worth resolving the uncertainty around charging protocols. It would make absolutely no sense even though you buy an EV if there is no charging station in your proximity. To encourage the increased use of these automobiles, a sufficient number of charging stations must first be built. It is also costly to own an electric car. There are several fossil fuel vehicles available at varying price levels on the market. Nevertheless, hybrid cars have fewer choices to choose from, and the best ones are very costly. Also, the batteries that are used are still expensive, although it is projected that their costs will decline in the coming years.

2.1 Technical Components of Electric Car

Battery is charged by the electricity either when connected to the power grid via a charging station or during braking through kinetic energy recovery system. As its performance can now vary approximately 60–97%, squandering 3–40% of grid energy as heat, the charger is a key element. Based on the load scenario, the motor controller provides the electric motor with variable power. The electric motor transforms electricity into kinetic motion and into torque when used within a powertrain. Central engines were used in the BEV series produced till now, but hub wheel electric motors are also conceivable and will be necessary for large scale manufacturing. Traditional, extremely effective electric motors are built on permanent magnetic components, the hardest of which are alloys comprising neodymium and samarium (REE) rare earth elements. This has generated several apprehensions as REEs are limited and a few countries, mostly China, regulate their exports. Electrical engines for BEV, nevertheless, do not usually produce REE. There are a range of electric motor types, typically separated into categories of alternating current (AC) and direct current (DC). Based on personal usage, there are indeed AC and DC electric machines designed with and without magnetic materials. Traction motors without magnets are very popular in electric vehicles, as they are inexpensive.

2.2 EV Types

Electric vehicles are classified according to the degree of electricity that will be used by these vehicles as energy sources. Mainly they are classified in three categories, such as BEVs or battery electric vehicles, PHEVs or plug in hybrid electric vehicles and HEVs or hybrid electric vehicles. Among the three only BEVs are capable of charging on a level 3 DC fast charge [21].

Battery Electric Vehicles (BEV)

BEVs are more frequently called by the name EVs; these are fully electric vehicles with rechargeable batteries and no gasoline engine. High capacity battery packs are used to store electricity. The battery power is used to run the electric motor and all types of electronic devices on board. These vehicles don’t emit any kind of harmful emissions and hazardous gases which are otherwise emitted by the traditional gasoline powered vehicles. Such vehicles are charged externally and each type of charging source is classified as per the speed of charging. The main charging capacities are classified as level 1, level 2, level 3 or Dc fast charging. The level 1 charging facility uses the traditional household outlet and takes up to 8 h to charge an EV which will run almost for 75–80 miles. Level 1 charging can be usually done at home or otherwise such charges have the capability to charge most EVs on the market.

Level 2 charging requires a special type of station which will provide power at 240v. Such charging facilities are more common at workplaces or public charging stations and will consume at least 4 h to charge the battery which will run for almost 75–80 miles.

Level 3 charging or Dc fast charging is currently the fastest charging facility among the three available in market. DC fast chargers are found at dedicated EV charging stations and take up to 30 min to charge a battery which will run up to 90 miles.

Plug-in Hybrid Electric Vehicle (PHEV)

Such electric vehicles have the type of batteries which can be charged either through regenerative braking or plugging into an external source of power. The standard models of such vehicles can only go up to 1–2 miles until the gasoline engine turns on. PHEV models can run for almost 10–40 miles before gas engine is turned on.

Hybrid Electric Vehicles (HEV)

These vehicles are powered by both gasoline and electricity. The electric energy required to run the vehicle can be generated by the braking system of the vehicle, as a result help in recharging the battery of the vehicle. Such kind of braking is called regenerative braking; it is a process where electric motor of the vehicle slows down the vehicle to some extent which in turn helps it to use some of the energy which is normally converted to heat by the brakes.

3 Impact of Electric Cars on the Environment

Production of electric cars seems more appealing in current time as bringing about reduction in carbon releases and greenhouse gasses is a rising alarm all over the world. A number of researches have been conducted on the impact of such cars on environment and mostly the results have revealed that such vehicles are indeed better for environment. Such cars release less smokes through their whole lifespan in comparison to the vehicles powered by petrol and diesel. The results have been the same even after taking into consideration the manufacture process of the vehicle and the production of electricity mandatory to fuel them.

The foremost advantage of electric cars is that they make a healthy contribution in bringing about the improvement in the air quality of towns and cities. Such cars have no tailpipes and produce no carbon dioxide emissions while being driven. This in turn helps us in making our cities and towns greener and better for people to live in them. Over the course of 1 year one electric car can save up to 1.5 million grams of CO_2 which in turn is equivalent of four round-trip flights from London to Barcelona. Further electric cars can also help in reducing noise pollution more so in cities where speeds are commonly on lower side, as such cars are far more quite than the traditional vehicles and thereby forms an additional serene surrounding.

On the other side making such cars consumes a lot of energy as the emission created when such cars are in production process is usually higher than the conventional car, the main cause being manufacture of lithium ion batteries which are an essential part of electric cars. The energy used to manufacture an electric vehicle accounts for more than a third of the car's total CO_2 emissions over its lifespan, however as the technology keeps on improving and better manufacturing techniques are devised, the amount of emission will also be decreased to a great extent in the production process of such cars. At the same time the results from a number of researches have been encouraging as one such research conducted by European energy agency found out that even with emissions emitted in electricity generation of such cars it is still 17–30% lower than what a conventional car emits. The emissions from electricity generation can further be improved if low carbon electricity is used. However, as the EVs become more and more widespread battery recycling which is of concern will become more efficient and reduce the need to extract new materials as such there will be less reliance on mining and production of new batteries. Total impact of electric vehicles is more pronounced when their lifetime is put to comparison with a combustion engine powered vehicle and there seems to be no competition between the two, as EVs are responsible for lower emissions over their lifetime than the usual vehicles, hence make a huge difference to the state of environment.

Keeping existing systems into account, they are striving to address their dependence on fossil fuels and to maximize their renewable energy supply on a regular basis. Electric vehicles, irrespective of the power supply, produce significantly less pollutants over their lifespan, indicating that they are still the vehicle of the next generation. Car companies are also in agreement with the fact that such cars are way less contaminating when compared to conventional vehicles.

4 Advantages and Disadvantages

4.1 Advantages

Smooth, nearly noise—free driving experience

There aren't a lot of moving parts inside the engine in electric vehicles. They have only one moving part, in particular, which would be the electric motor. Within, the petrol engine has a multitude of spinning components. They have to continuously keep scraping and striking against each other in order to generate electricity. The vibrations formed from the interaction between these parts are heard as the engine sound and perceived as fluctuations within the car's interior. While petrol engines today produce substantially less noise relative to what they would release 7 or 8 years earlier, they do have substantial amounts of both. The only driving aspect of an electric vehicle is the motor that revolves and shuffles the wheels throughout. A very modern and almost quiet buzz is the only sound from this phase that can be observed. The same characteristic also leads to a completely noise-free driving environment as well.

Standstill explosive torque accessible-

One of the key disadvantages of the operation of the petrol engine is that it generates maximum torque only at a particular point of RPM. The torque produced by it, as a result of its nature, begins from a really low value, goes up to its absolute peak and then falls again as the RPM increases. Owing to a huge series of various parts used to transfer the torque, petrol engines often suffer output drop. Due to frictional drops, the net performance is decreased by around 20% by the time it hits the wheel. In the case of electric vehicles, right out of the box, they achieve their highest output power. That means you have standstill access to the entire torque output. When you advance into the upper RPM range due to the effect of back EMF, it just continues to decrease. Electric cars only comprise of one integral component, the transmission, between the wheels and the engine. Therefore, they achieve a very high output of torque and at the same time suffer zero output loss.

Simplest procedure for driving

In the world of vehicles, electric vehicles have the easiest driving approach. Commercial electric cars come with a gearbox consisting of only one very long gear. As diesel cars do, they also do not suffer from the issue of instability. To stop that from occurring, it essentially prevents the need to incorporate a clutch function. Because what it ultimately says is that with only the accelerator pedal, brake pedal and steering wheel you can run an electric vehicle. Regenerative braking is another truly valuable function in electric vehicles. The braking mechanism usually results in complete wastefulness of kinetic energy in normal cars that is emitted as frictional heat. Even so, in an electric car, to power the battery, the same electricity is used rather than being exposed as heat. You avoid providing it some accelerator input when you hit the brakes in an electric vehicle. The induction machine that rotates the tires is now starting to act as a tire-rotating engine. The whole circuit is flipped, and now the tires use the same rotational energy to power the batteries. Regenerative braking is configured to be so powerful and efficient in the newest batch of electric cars that you will only have to use the car's real brakes very occasionally or only in emergency.

Zero emissions and pollution

Energy is generated in a petrol car by combustion of fuel inside the motor. Carbon Dioxide, Carbon Monoxide, Sulphur Dioxide and different SPM's (Suspended Particulate Matter) are the residue produced due to this method. All of these are particularly contaminating in nature and, when inhaled does a lot of damage to the human body. They also do a lot of environmental harm at the same time. The amount of these emissions is much greater in the case of a diesel vehicle. Although emissions management equipment is being continually developed throughout time, the total elimination of the emission of toxins is yet to be achieved. On the other side, electric cars do not rely on the method of fuel combustion to generate electricity. They essentially convert a battery's electric energy to spin a motor that rotates the wheels in turn. They thus create zero amounts of any contaminant gas or gaseous pollutants and operate on 100% renewable energy efficiently.

Battery Life and Cost

Batteries are an essential element of an electric car. Most batteries for electric cars are lithium batteries, and their prices are decreasing each year. A lithium-ion battery cell's maximum power should be sufficient for 300–500 cycles. Up to 10 years, a decent battery might last. The value of these batteries is predicted to reduce even further with the improvement of technology.

Low Maintenance

There is no need to rehydrate the engines, nothing similar to the gasoline engine or a number of repair activities that are normally connected with a gas engine. Electric vehicles operate on electrically driven motors.

4.2 Disadvantages

While the promising data has become quite evident, there are also some drawbacks that each person wants to rethink before agreeing to make their next major investment in an electric vehicle. Those explanations are-

Recharge Points

There are also electric fueling facilities in the planning process. Not a couple of areas you drive to on a constant schedule may have electric fueling stations for your car, which ensures that it might be more difficult to locate a charging station if you are on a road drive or wish to see relatives in a rural or suburban area and run out of charge. Maybe you may be trapped where you have been. Nevertheless, once charging points are much more common, ensure you have a map of the charging station where you reside and where you go regularly, so that when you will need, you can recharge your new EV.

Electricity isn't free

If you don't properly give it some thought, electric vehicles can even be an issue for your energy bill. If your investigation into the electric car you intend to buy has not been completed, so you might be proposing an imprudent venture. Electric cars often need a large fee to function effectively, and each month can impact negatively on your energy bill.

Short Driving Range and Speed

Electric cars are constrained by distance and velocity. Many of these vehicles are about 50–100 miles in length and have to be powered up again. As of today, you really can't use them for long trips, but in the meantime that is predicted to progress.

Longer Recharge Time

Although charging the gasoline-powered vehicle requires a couple of minutes, an electric car takes around 4–6 h and occasionally even a day to get charged up. Consequently, as the resources necessary to refill these is very significant, you need dedicated power stations. Therefore, certain individuals are turned off by the expenditure in time and required preparation. There are a few packages that can drastically cut on the charging time. But it is going to be an extra investment.

Minimal Amount of Pollution

Electric cars are not 100% emission-free either; they indirectly generate a slight level of pollutants. Renewable energy sources do not inherently produce the batteries and electricity required for charging. Many authorities do not have measures to enable you to purchase an electric vehicle to save costs. Only because there are a lot of variables don't mean they have got to be daunting. Doing a fair amount of study into multiple versions, and perhaps even combinations, will help you change on with a correct judgment. That being said, an electric vehicle will save our fragile world.

Higher number of options

Today's electric car demand is rising, with no signs of stopping. The fact, though, is that there are limited options for customizing and choosing your EV's designs. At the same time, typical cars have a huge array of customization available. This is bound to improve over time, so it is continuing to be a downside for several individuals.

5 Market Penetration of Electric Vehicles

A wide range of factors will rely on the introduction of electric vehicles. This concerns battery performance and prices, proximity to and reliability of the distribution system, the type of business model introduced to provide the customer with stable batteries and energy, the adoption of different models of cars by the consumer and possible inferred driving behaviors. Such heterogeneity and interconnections between these variables make it highly challenging and impractical for any demand forecast to identify a single electric vehicle penetration scenario. On the above-mentioned elements, many sets of predictions can be made, resulting in numerous projections about the brand recognition of electric cars. It is essential to recognize research in various literatures of which the assessment of consumer expansion is very positive. With regard to charging infrastructure, considering the developments already proposed in different countries, it is anticipated that access to charging facilities will grow significantly. At least, current charging opportunities are now or will be expanded in a very short term, often at home, where parking lots operate. The implementation of charging infrastructure by network destinations to the grid at home and in other places (especially workplaces) helps to provide more car buyers with a wide variety of car choices that can satisfy their needs, not just traditional vehicles, but also electric vehicles. The design of batteries continues to be the driving force of the second order and leads to making electric vehicles more powerful and cost-effective in trying to adapt favorably with their traditional counterparts. The predicted developments in these two perspectives clarify that BEV sales shares continue restricted until 2020 in both situations (0.5–3%). On the opposite, as soon as they are commercially available, PHEVs are easily infiltrated. This stems from the fact that higher limits for BEVs are the battery and charging amenities. The electric car market has grown rapidly since 2008. This market growth is largely attributed to the more widespread use of engineering by automakers, as well as a dramatic reduction in prices. Thanks to the increasing outcry about the environmental harm that greenhouse gas emissions do, the credibility of electric vehicles has also improved. Global warming is already being addressed, but more people all over the world are gradually treating it as a real concern. Some have indicated that as quickly as they are produced, chemical emissions are washing away the forests and oceans. Even so, in January 2017, the United States Environmental Protection Agency released a study revealing this prerogative to be unfounded. Some people oppose claiming that global warming is an ordinary global phenomenon, and the EPA (2017) acknowledges that the process that holds Earth at a sustainable degree is global warming. The excess of pollution that triggered the temperature rise of 1.5° Fahrenheit over the last century, however, is a grave threat [22]. This rise in pollution is credited to increased electricity, population and transportation production and use. From 1990 to 2012, just 22 years ago, greenhouse gas emissions rose globally by 41%. If the rise in carbon persists at this accelerated rate, much higher spikes in temperatures and the more dangerous effects of global climate change will have to be tackled in the near future. The United States probably accounts 4.5% of the global population, but consumes 19.2% of the world's energy; it's the world's second-largest user of energy, well behind China. Efforts have been made by several smaller countries to minimize their pollution and generate electricity by clean energies, but even though 100% of the energy generated was green, the effect would be much smaller than if major energy users had decreased a large proportion of their emissions. The US transport industry accounts for 28% of the nation's greenhouse gas emissions, which implies there is a massive possibility to reduce tailpipe emissions and more electric cars being used. Fully-electric vehicle (FEV) emissions will be evaluated to show that FEVs will substantially decrease greenhouse gas emissions by taking into consideration emissions from oil generation.

The ability of electric vehicles to reduce pollution concentrations in urban areas can be demonstrated as a significant justification for promoting their use in the private car market. Just a portion of this solution applies to greenhouse gases and carbon emissions in particular. Considering that fossil fuels produce a large portion of energy and that the impact of greenhouse gases must be assessed globally, the possible decrease (if any) in the total CO_2 emitted by the car fleet in the metropolitan environment must be measured. To be prepared to do this, it is obvious that an evaluation of the development of the electric automotive sector and its rise in a metropolitan area is needed.

6 Challenges in Introducing Electric Vehicle Fleets

A range of influences can hinder or reduce the introduction of electric cars on a broader level. They can be categorized into factors affecting the appeal of the EV for prospective investors and consequently, the experiential learning of EV consumers, and, on the other hand, the industry's financial incentive in investing in the growth, processing, sales and recharging of EVs. Companies need to provide a mobility systems integration plan that offers insight into preparation, timing, and delivery coupled with data modeling to optimize performance for both customers and EV providers in order to efficiently handle electric fleet vehicles where charging specifications reflect equipment effectiveness [23]. Among several other factors, the priority of the client would be calculated by:

- Purchase price or cost of the lease
- Complete Ownership Expense
- Offers to the market (brands, models, trim levels etc.)
- Experience Driving
- Comfort of re-charging
- Perception of Security
- EV familiarity
- The industry's economic interest would be limited by:
- Possible business size of EV and its volatility.
- Margin on Profit
- Needs for Investment
- Threats from production
- Objection to Danger.

Most analysts believe that, as opposed to older vehicles, technical costs, especially battery costs, render today's EVs unviable for the mass market, even when overall expense of possession is considered. In past years, the problems that EV implementation faces are becoming more manageable, but they are still substantial. The cost of maintenance of BEVs (Battery Electric Vehicles) in the development cycle has dropped significantly; further drops in integrated battery costs below $300 per kWh could lead in the next 5–7 years to substantive comparison with ICEs (Internal Combustion Engines) [1]. Once this main hurdle can be resolved, learning results can be resolved and future encroachment in expertise will pave the way to realistic longer repayment periods for sensible consumers. The cost-effective, reliable implementation of electric vehicles is much more critical for sustainable growth of EV control [24]. Standalone commercial review of various charging options shows that, where available, residential Level 2 charging can be the best choice for most charging needs of an EV owner, and that prices (typically for rapid charging) can minimize the estimated price. The residual value of the vehicle is a significant consideration for the TCO. The total price of EVs is greatly impacted by the batteries' predicted longevity and lifespan. In order to reduce similar consumer issues, adequate warranty programs may help. The higher purchasing prices will stay a blocking influence in the long run, as many commercial consumers do not usually conduct a TCO estimate but rely mostly on the appraised value during their buying decision [25]. In contrast to outmoded cars, the travel range limits of fully electric vehicles are a vital aspect. While this aspect does not perform the topmost part for most automobile consumers today in the cities and suburbs setting, it may discourage prospective buyers from preferring an EV if they are unable to negotiate with existing traditional automobile models [24]. One way of solving this detrimental feature of today's EVs could be rapid charging or battery switching. It is not anticipated that other driving elements such as reduced speed and other traditional features of EV driving can cause substantial adoption challenges for EVs, particularly in the urban and regional environment [26]. Because power transmission networks are widespread, especially in urban and suburban areas, the key problems arise with the actual set-up of recharge locations and the development of uniform recharge frameworks, procedures for communicating between vehicles and grids, as well as processed data and sustainability strategy. To allow accurate EV re-charging for the EV customer, all these issues need to be properly handled. Suitable re-charging options need to be sought in the urban setting for urban residents who have no chance of re-charging their EV at home [27]. The experience of the wider populace with this modern battery technology may be a problem until a wider rollout of EVs is achieved. By concerted publicity and advertising strategies, awareness can be strengthened until a large group of EVs is on the street and brand awareness subsequently improves public interest [28].

7 Conclusion

More than 80% of Europe's population is concentrated in cities. It's a mystery that they need to retain their mobility while still protecting their health and the environment. Several overarching European initiatives in the energy and transport industries are seeking to shift the tension between mobility and the environment.

In the urban world, the electrification of public transport, as well as our approximately thorough dependence in fossil fuels will probably minimize CO_2 emissions (and other pollutants) on the streets of our cities. This is focused on the much better proficiency of rechargeable engines comparison to ICEs, and also the strength to de-carbonize the transport energy sequence and, in specific, well-to-tank paths. BEVs are much more attractive from a CO_2 Well-to-Wheel emission factor of standpoint, and as an intermediate level, PHEVs are a fair alternative. The world is increasingly urbanizing, and creativity is hitting new levels as well. However, we do have a good potential to achieve our target [22].

However, the high cost penalty associated with BEVs and PHEVs would continue to be a concern until 2030, when learning consequences should have lowered the cost forfeit to a degree that would ensure the BEV's reasonable payback periods of less than 6 years and a level equal to the PHEV's other hybrid cost penalties. If replacement rates for parts or insurance rates are advanced and appear to be sophisticated than traditional vehicles, it will be a long time before a modest norm for TCO is reached. As such, a cohesive overall fiscal and regulatory structure would be important both to support the most energy-efficient infrastructure choices and to protect public budgets in line with new revenues from fuel use. In addition, the experience of the general population with this emerging propulsion system must be discussed in order to achieve a greater rollout of EVs. By dedicated publicity and advertising strategies, familiarity can be strengthened until a serious figure of EVs is on the road and a confirmed technology benefit further improves community interest [29].

As a final point, a cautionary note: encouraging the use of electric vehicles just wouldn't, say, result in the implementation of a green transportation infrastructure. It will also help to minimize the environmental footprint of road transport, but it is just one aspect of long-term development. To pursue the sustainability framework in a genuine way, necessary steps to reduce the use of personal transportation (private cars) in place of communal public transportation are unquestionably necessary. This involves moving the decision-making perspective from the point of view of sustainable transport to one of sustainable mobility [30, 31].

References

1. Petrillo, A., Mellino, S., De Felice, F., & Scudo, I. (2018). Design of a sustainable electric pedal-assisted bike: A life cycle assessment application in Italy. In *New frontiers on life cycle assessment-theory and application*. IntechOpen.
2. Woodcock, J., Banister, D., Edwards, P., Prentice, A. M., & Roberts, I. (2007). Energy and transport. *The Lancet, 370*(9592), 1078–1088.
3. Moriarty, P., & Honnery, D. (2008). The prospects for global green car mobility. *Journal of Cleaner Production, 16*(16), 1717–1726.
4. Martin, G. T. (2019). *Sustainability prospects for autonomous vehicles: Environmental, social, and urban*. Routledge.
5. Boden, T. A., Marland, G., & Andres, R. J. (2009). *Global, regional, and national fossil-fuel CO2 emissions*. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, US Department of Energy.
6. Karavalakis, G., Hilari, D., Givalou, L., Karonis, D., & Stournas, S. (2011). Storage stability and ageing effect of biodiesel blends treated with different antioxidants. *Energy, 36*(1), 369–374.
7. Telang, S., Chel, A., Nemade, A., & Kaushik, G. (2021). Intelligent transport system for a Smart City. In S. C. Tamane, N. Dey, & A. E. Hassanien (Eds.), *Security and privacy applications for Smart City development. Studies in systems, decision and control* (Vol. 308). Springer. https://doi.org/10.1007/978-3-030-53149-2_9
8. Shanthi.rajan (2019). Are electric vehicles really green if they don't use clean energy? Retrieved from https://inc42.com/features/are-electric-vehicles-really-green-if-they-dont-use-clean-energy/
9. Bebkiewicz, K., Chłopek, Z., Sar, H., & Szczepański, K. (2021). Comparison of pollutant emission associated with the operation of passenger cars with internal combustion engines and passenger cars with electric motors. *International Journal of Energy and Environmental Engineering*, *12*(2), 215–228.

10. The great disrupter. (n.d.). https://www.economist.com/special-report/2020/09/17/the-great-disrupter
11. The Paris Agreement. (n.d.). https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement
12. The 2030 climate and energy framework. (2019, December 06). https://www.consilium.europa.eu/en/policies/climate-change/2030-climate-and-energy-framework/
13. Press corner. (n.d.). https://ec.europa.eu/commission/presscorner/detail/en/ip_20_940
14. Kakoulaki, G., Kougias, I., Taylor, N., Dolci, F., Moya, J., & Jäger-Waldau, A. (2021). Green hydrogen in Europe–A regional assessment: Substituting existing production with electrolysis powered by renewables. *Energy Conversion and Management, 228*, 113649.
15. Srivastav, A. (2021). The challenges of energy supply. In *Energy dynamics and climate mitigation* (pp. 77–120). Springer.
16. Gayathri, M. N. (2021). A smart bidirectional power interface between smart grid and electric vehicle. In *Intelligent paradigms for smart grid and renewable energy systems* (pp. 103–137). Springer.
17. Wolbertus, R., Kroesen, M., van den Hoed, R., & Chorus, C. G. (2018). Policy effects on charging behaviour of electric vehicle owners and on purchase intentions of prospective owners: Natural and stated choice experiments. *Transportation Research Part D: Transport and Environment, 62*, 283–297.
18. Paulin, A. (2018). *Smart city governance*. Elsevier.
19. Mohanty, P., & Kotak, Y. (2017). Electric vehicles: Status and roadmap for India. In *Electric vehicles: Prospects and challenges* (pp. 387–414). Elsevier.
20. Khurana, A., Kumar, V. R., & Sidhpuria, M. (2020). A study on the adoption of electric vehicles in India: The mediating role of attitude. *Vision*, *24*(1), 23–34.
21. Berckmans, G., Messagie, M., Smekens, J., Omar, N., Vanhaverbeke, L., & Van Mierlo, J. (2017). Cost projection of state of the art lithium-ion batteries for electric vehicles up to 2030. *Energies, 10*(9), 1314.
22. Agarwal, P., & Alam, A. (2018). Use of ICT for sustainable transportation. *Proceedings of International Conference on Future Environment and Energy, 150*(1), 1–7.
23. Blumm, M. C., & Wood, M. C. (2017). No ordinary lawsuit: Climate change, due process, and the public trust doctrine. *American University Law Review, 67*, 1.
24. Kley, F., Lerch, C., & Dallinger, D. (2011). New business models for electric cars—A holistic approach. *Energy Policy, 39*(6), 3392–3403.
25. Dodds, P. E., Staffell, I., Hawkes, A. D., Li, F., Grünewald, P., McDowall, W., & Ekins, P. (2015). Hydrogen and fuel cell technologies for heating: A review. *International Journal of Hydrogen Energy, 40*(5), 2065–2083.
26. Legatt, M. E. (2017). *An experimental and analytical method for assessing the integration of electric vehicles into the bulk power system.* Doctoral dissertation.
27. Nyström, S., & Bergstedt, E. (2018). *Possibilities of batteries in the distribution system as substitute for a cable reinforcements while maintaining reliable electricity distribution.* Master's thesis.
28. Policy Options for Electric Vehicle Charging Infrastructure in C40 Cities. (n.d.). Retrieved from https://www.innovations.harvard.edu/policy-options-electric-vehicle-charging-infrastructure-c40-cities
29. Heffner, R. R., Kurani, K. S., & Turrentine, T. S. (2007). Symbolism in California's early market for hybrid electric vehicles. *Transportation Research Part D: Transport and Environment, 12*(6), 396–413.
30. Agarwal, P., Chopra, K., Kashif, M., & Kumari, V. (2018). Implementing ALPR for detection of traffic violations: A step towards sustainability. *Proceedia: Computer Science, 132*, 738–743. ISSN: 1877-0509.
31. Agarwal, P., Hassan, S. I., Mustafa, S. K., & Ahmad, J. (2020). An effective diagnostic model for personalized healthcare using deep learning techniques. In *Applications of deep learning and big IoT on personalized healthcare services* (pp. 70–88). IGI Global.