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Present and Future Scenario in Electrical Vehicles

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ABSTRACT: As the demand of fuel increasing day by day but we have limited resources of fossil fuel found on earth and it will be continuously decreasing and it depicts completely approx. Up to 100 to 200 years, and we are using this fossil fuels in many ways like regeneration of electricity, recreation, industrial area are included easily and efficiently. This will also use in transportation sector it gives an immense effect on our environment thus we have to find another way of transportation that drives our vehicle. We have an alternative to face this problem by daily life. Adopting electrical vehicles as their transportation in daily life. This paper explains that, in present and future scenario of electrical vehicles that have no pollution, EV is best for environment, reduced maintenance bills running costs are lowered. Some EVs Have Short Ranges for Driving Charging Can Take a Lot of Time Charging Stations aren't Available Everywhere. If a person lives in a large city where many people use electricity, electrical vehicles are good option to choose due to its affordability.

Keywords: electrical vehicle, hybrid electrical vehicle, motor

INTRODUCTION: An electric vehicle is one that is powered entirely or partially by electricity. Unlike traditional vehicles, which rely solely on fossil fuels, e-vehicles employ an electric motor driven by a fuel cell or batteries. The phrases 'e-vehicle' and 'EV' can also be used. The word is used to describe both BEVs and PHEVs in most contexts, including this article. The initials BEV and PHEV stand for battery electric vehicles and plug-in hybrid electric vehicles, respectively.
"A vehicle that is propelled by one or more electric motors." Wheels or propellers propelled by rotary motors, or linear motors in the case of tracked vehicles, generate motion depending on the type of vehicle." "Electric vehicles include electric automobiles, trains, trucks, and lorries, as well as electric aero planes, boats, motorbikes and scooters and spacecraft."

TYPES OF EV: --
BEV: A battery electric vehicle runs exclusively on electricity. It gets the electricity from on-board batteries. To charge the car's batteries you will need to plug it into a charging station using an EV charging cable.

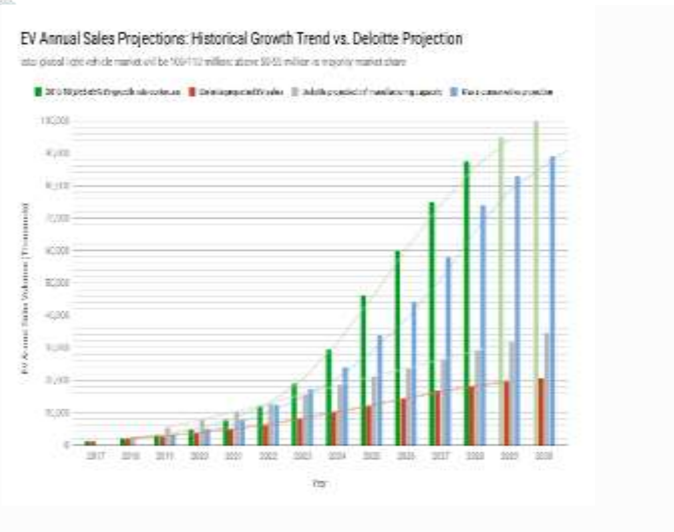

Fig – 1 Flow chart for annual sales of EV's

This will then recharge the battery for your next journey. BEVs have no gasoline or diesel engine. They also have a longer electric driving range than a plug-in hybrid electric vehicle. When you drive a BEV, the vehicle does not produce tailpipe pollution, i.e., There are no exhaust emissions in the room. In fact, it lacks a tailpipe entirely (exhaust pipe). Even if the car itself does not contaminate the environment, the electricity generated by it does. If the electricity is generated by solar, wind, or hydroelectricity, there is no pollution. Solar power, often known as solar energy, is the process of capturing the Sun's energy and converting it to electricity. Wind power harnesses the energy contained in moving air and turns it to electricity. "Because battery electric cars do not use gasoline or diesel, they are significantly less expensive to fuel than traditional automobiles," the Union of Concerned Scientists noted of using electricity rather than fossil fuels.

PHEV: A car that uses both electricity and fuel is known as a plug-in hybrid electric vehicle. Its electric motor drives the automobile for a portion of the journey before the combustion engine (a gasoline-powered engine) kicks in. If the trip isn't too long, it might merely utilize power. A PHEV isn't the same as a hybrid electric car (HEV). While moving, the HEV charges its own batteries with the petrol engine. Unlike a PHEV, you don't have to plug it in. "These automobiles can be hooked into the national grid via a cable, much like an electric car." This will charge the car's batteries, allowing for some electric-only range (generally between 20 and 40 miles) and typically lowering the amount of gasoline consumed on longer trips.

Vehicle Type	Electric Vehicle (EV)	Gasoline-Powered (Internal Combustion)	Plug-in Hybrid (PHEV)	Hybrid (HV)
Energy Source	Electric only	Gasoline only	Main: Electric Sub: Gasoline	Main: Gasoline Sub: Electric
Propulsion Mechanism	Motors	Engine	Combination of motor + engine	
CO2 Emissions	None	Yes	Yes	Yes
Fuel Facility Locations	Charging stations	Gas stations	Gas stations; chargers	Gas stations
Tax Liability	Low	High	Low	Low
Cruising Distance	Short	Long	Long	Long

Fig. 2 Shows the performance of various Electric Vehicles

TYPES OF BATTERIES USED IN EV's: --

A cobalt-free lithium-ion battery: University of Texas researchers have produced a lithium-ion battery with a cobalt-free cathode. Instead, it shifted to a nickel-based alloy with a high nickel content (89%) and

manganese and aluminum as the other elements. "Cobalt is the least abundant and most expensive component in battery cathodes," said Arumugam Man thiram, director of the Texas Materials Institute and professor at the Walker Department of Mechanical Engineering. "And we're doing everything we can to get rid of it." With this technique, the team claims to have solved typical difficulties, ensuring good battery life and an even dispersion of ions.

SVOLT unveils cobalt free batteries for EVs: While the benefits of electric vehicles in terms of lowering emissions are universally acknowledged, there is still debate about the batteries, notably the use of metals like cobalt. SVOLT, based in Changzhou, China, has announced the production of cobalt-free batteries for the electric vehicle industry. Aside from lowering rare earth metals, the company claims that they have a higher energy density, which might lead to electric car ranges of up to 800 kilometers (500 miles), as well as increased battery life and safety. We don't know where these batteries will be sold, but the company has verified that it is collaborating with a major European manufacturer.

A step closer to lithium-ion batteries using a silicon anode: Researchers at the University of Eastern Finland found a way to make a hybrid anode utilizing mesoporous silicon microparticles and carbon nanotubes to solve the problem of unstable silicon in lithium-ion batteries. The ultimate goal is to employ silicon instead of graphite as the anode in batteries, which has 10 times the capacity. The battery's performance is improved by using this hybrid material, and the silicon is manufactured sustainably from barley husk ash.

IBM's battery is sourced from sea water and out-performs lithium-ion: IBM Research claims to have found a novel battery chemistry that is free of heavy metals such as nickel and cobalt and could outperform lithium-ion batteries. This chemistry has never been employed in a battery before, according to IBM Research, and the components may be harvested from seawater. The battery's performance is promising, with IBM Research claiming that it can outperform lithium-ion in a variety of ways, including lower manufacturing costs, faster charging times, and higher power and energy densities. All of this is possible in a battery with low electrolyte flammability. These benefits, according to IBM Research, will make its new battery technology ideal for electric vehicles, and the company is collaborating with Mercedes-Benz and others to turn the technology into a commercially viable battery.

Panasonic battery management system: While lithium-ion batteries are everywhere and growing in use cases, the management of those batteries, including determining when those batteries have reached the end of their life is difficult. Panasonic, working with Professor Masahiro Fukuoka of Resuming University, has come up with a new battery management technology that will make it a lot of easier monitor batteries and determine the residual value of lithium-ion in them. Panasonic says that its new technology can be easily applied with a change to the battery management system, which will make it easier to monitor and evaluate batteries with multiple stacked cells, the sort of thing you might find in an electric car. Panasonic claims that this method will aid in the drive toward sustainability by allowing for improved management of lithium-ion battery reuse and recycling.

Sand battery gives three times more battery life: This new lithium-ion battery employs silicon to provide three times the performance of current graphite-based lithium-ion batteries. The battery is still lithium-ion, like the one in your smartphone, but the anodes are made of silicon rather than graphite. For a long time, scientists at the University of California, Riverside have been interested in micro silicon, but it degrades too quickly and is difficult to create in big quantities. Sand can be filtered, pulverized, and ground with salt and magnesium before being burned to eliminate oxygen to produce pure silicon. This batter is porous and three-dimensional, which aids performance and, presumably, batter life. We first became aware of this research in 2014, and it is finally coming to fruition. Salinan is a battery technology startup that is bringing this approach to market, and it has received significant funding from Daimler and BMW. The company claims that its solution can be dropped into existing lithium-ion battery manufacturing, allowing for scalable deployment, with a performance gain of 20% now and 40% in the near future.

Solid state lithium-ion: Solid-state batteries have always provided stability at the expense of electrolyte transfers. Toyota scientists published a paper on their testing of a solid-state battery with supplied superionic conductors. All of this translates to a better battery. As a result, the battery can run at super capacitor levels and charge or discharge completely in under seven minutes, making it suitable for automobiles. Because it is solid state, it is significantly more reliable and secure than existing batteries. The solid-state unit should also be able to operate in temperatures as low as minus 30 degrees Celsius and as high as one hundred degrees Celsius. The electrolyte materials are still difficult to work with, so don't expect to see these in automobiles anytime soon, but it's a step toward safer, faster-charging batteries. This means that these batteries will not only be safer due to the absence of flammable electrolyte, but they will also last longer, charge faster, have a five-fold higher density, be less expensive to manufacture, and be smaller than present offers. Prieto wants to start by putting its batteries in little devices like wearable. The batteries, however, can be up scaled, so we may see them in phones and even cars in the future.

Transparent solar charger: Alcatel demonstrated a phone with a transparent solar panel over the screen that allows customers to charge their phones simply by placing them in the sunlight. Although it is unlikely to be commercially accessible for some time, the business hopes that it will help solve the problem of never having enough battery power on a regular basis. The phone, like traditional solar panels, will work in direct sunshine as well as standard lighting.

Aluminum-air battery gives 1,100 mile drive on a charge: On a single battery charge, an automobile was able to go 1,100 miles. The secret to this long range is a sort of battery called aluminum-air, which fills its cathode with oxygen from the air. This makes it far lighter than liquid-filled lithium-ion batteries, allowing the car to travel further.

Twenty times faster charge, Rayden dual carbon battery: Rayden dual carbon is a novel battery technology that Power Japan Plus has already revealed. It will not only last longer and charge faster than lithium, but it can also be manufactured in the same factories that produce lithium batteries. The batteries are made of carbon materials, making them more environmentally friendly and sustainable than current alternatives. The batteries will also charge twenty times faster than lithium ion batteries. They'll also be more robust, lasting up to 3,000 charge cycles, as well as safer, with a lower risk of fire or explosion.

Sodium-ion batteries: Scientists in Japan are developing new forms of batteries that do not require lithium, such as the battery in your smartphone. These new batteries will be up to seven times more efficient than current batteries because they will employ sodium, one of the most common materials on the planet, rather than the rare lithium. Since the 1980s, scientists have been researching sodium-ion batteries as a cheaper alternative to lithium batteries. Batteries may be created substantially cheaper by employing salt, the sixth most common element on the earth. In the next five to ten years, commercialization of the batteries for smartphones, vehicles, and other devices is projected to commence.

Understanding Electric Car Batteries

	Lithium Ion	Nickel-Metal	Lead-Acid	Ultracapacitors
Easy Access / Inexpensive	✓	✗	✓	✗
Energy Efficient	✓	✓	✓	✓
Temp. Performance	✓	✗	✗	✓
Weight	✓	✓	✓	✓
Life Cycle	✓	✗	✓	✗

Fig. 3 Comparison chart for battery performance

Above table is showing the battery performance for electric vehicle application. In this, we see that Lithium ion battery performance is satisfactory in all aspects of EV's.

TYPE OF TRACTION SYSTEM IN EV's:

Electric Motors: The electric motor can be found almost anywhere. In the age of the electric automobile, wind turbines, and solar tracking systems, this is even more true. Electric motors account for more than 60% of all electricity consumed by industry. In tens of millions of homes, air conditioning, refrigerators, and washers and dryers constitute huge electricity loads. As a result, electric motor technology is a serious concern. Efficiency gains of a few percentage points can result in significant reductions in electric power use. This is why the Department of Energy invests so much effort and money into maximizing the efficiency of electric motors. The choices are somewhat limited. There's wire, iron, and a few other things. There are only two magnetic fields in the universe. As a result, there aren't many simple ways to increase efficiency if a simple material swap isn't possible. The issue is mostly one of economics. Exotic materials are available that can boost efficiency, but they are prohibitively expensive. More or less, copper is copper. You can cover it with silver to improve efficiency at higher frequencies, but this would be ineffective at 60 Hertz, which is the frequency at which most AC motors work. Silver-plated copper conductors would undoubtedly be more expensive. Permanent magnet motors are more expensive in general. This is partly due to China's recent move to regulate the supply of Neodymium permanent magnets. Researchers discovered that by placing small slices of magnet into a typical induction rotor to boost its efficiency and power density, the higher price premium of Neodymium might be mitigated. Other costs are saved as a result of the smaller overall motor size. The ultimate frontier in electric motor manufacturing is the iron that generates the magnetic field in most electric motors. Despite the fact that silicon steels have been around for a while, the core is still the most common source of loss in electric motors. The transformer business offers a wealth of material expertise, which has already resulted in some incredible advancements by companies like Nova torque. More developments should be expected

***1).* DC Motors:** *The types of dc motors which are applied in EV's mainly include Series, Shunt, and & Compound motors depending upon the type of applications.*

***2).* PMDC Motor:** *"PMDC " is the abbreviation for "Permanent Magnet DC Motor." It is a type of DC motor that can have a permanent magnet built in to create the magnetic field required for electric motor operation.*

Advantages of PMDC motor:

- PMDC motors have higher efficiency as compared to conventional DC motors.
- Since field winding are not used in PMDC motors, hence, these motors are compact in sized than conventional DC motors.
- As the magnetic field is created by permanent magnets, there is no need of field excitation arrangement in case of PMDC motors.
- Since the permanent magnets cannot produce high flux density, the electromagnetic torque produced per ampere in a PMDC motor is smaller.

Disadvantages of PMDC Motor

- There is a risk of de-magnetization of the magnetic poles which may be caused by large armature currents or excessive heating due to overloading for a long period.
- Since the field flux is fixed in the PMDC motor, it is difficult to control the speed of the permanent magnet DC motor.

***(3).* Induction Motor:** *Induction motors (sometimes known as asynchronous motors) are electric motors that work at asynchronous speeds. The energy is transferred from electric to mechanical by electromagnetic induction in an induction motor. These motors are divided into two categories based on the rotor construction: squirrel cage and phase wound.*

Advantages of induction motor

- Induction motor is very cheap in cost to compare other motors.

- It is a highly efficient motor. The efficacy of induction motor from 85% to 95%.
- The maintenance of an induction motor is very less compared to the other motor like DC motor and synchronous motor.

Disadvantages of induction motor

- The power factor of the motor is very low during the light load conditions.
- The Single-phase induction motor is not self-starting. It requires some auxiliary for stating.
- The motor cannot use in such applications where high starting torque is necessary like traction and for lifting weight.

(4) **Brushless DC Motors:** *Brushless DC motors were created with the goal of providing better performance in a smaller size than brushed DC motors. When compared to AC models, these motors are smaller. The lack of a commutator and a slip ring necessitates the use of a controller built in the electric motor.*

Advantages of BLDC Motor

- The absence of brushes reduces the frequent replacement of brushes which reduces the maintenance cost.
- A Brushless DC motor has high-level control over the speed and position of the motor.
- The lifespan of a Brushless DC motor is higher than the brushed DC motor.

Disadvantages of BLDC motor:

- Brushless DC motors are operated at relatively low speeds. Due to this low-speed vibration occurs in the system.
- The cost of these motors is high.
- As these motors consist of a feedback loop the wiring and operation are not that simple.

(5). **Switched Reluctance Motor (SRM):** *The variable reluctance concept governs the operation of switched reluctance motors. With the help of a power electronics switching circuit, a spinning magnetic field is formed. The key idea is that the magnetic circuit's reluctance is determined by the air gap. As a result, we can adjust the motor's reluctance by changing the air gap between the rotor and stator.*

Advantage of SRM:

- Because the stator and rotor slots are projected, it does not require an external ventilation system.
- The airflow between the slots was maintained.
- Because there is no winding on the rotor, there is no need to preserve the carbon brush and slip ring assembly.
- Because permanent magnets are not used, these motors are less expensive.
- The motor can be driven by a simple three- or two-phase pulse generator.
- The phase sequence can be changed to change the direction of the motor.
- It is self-starting and does not require any external assistance.
- Without excessive inrush currents, starting torque can be very high.
- Tolerance to Faults Is Extremely High Motor activities are unaffected by phase losses.
- Inertia/torque ratio is high.

The disadvantage of Switched reluctance motor

- When operating at high speeds, the torque ripples.
- It is necessary to use an external rotor position sensor. There is a lot of noise.
- The motor emits harmonics at greater speeds; thus, we need to install larger capacitors to reduce this.
- The motor must be constructed to carry a large input current due to the lack of a permanent magnet. It raises the KVA demand for the converter.

Permanent Magnet Synchronous Motor: A permanent magnet synchronous motor (PMSM) is a type of synchronous motor that uses a permanent magnet to create the excitation field. Because it generates a sine shape of flux distribution in the air gap between the rotor and stator components, it's also known as a brushless form of permanent sine wave motor. This device's current wave is also in the shape of a sine wave.

PMSMs have higher torque for a small frame size and no rotor current because they are made of permanent magnets. These devices also offer a strong power-to-size ratio, allowing for a straightforward design with negligible torque loss. There must be commutated in the same way as BLDC motors, but the signals must be in sine shape to offer higher performance due to winding constriction. PMSM devices are mostly used in controllers such as 32-bit PIC32MK or dsPIC33 digital signal processors or SAM micro controllers since they are built with advanced controlling algorithms.

Advantages and Disadvantages of PMSM:

- Permanent magnet synchronous motors these advantages
- It has the ability to eliminate copper losses in the field. Power density has increased.
- Rotor inertia is kept to a minimum.
- The motor's build is sturdy.
- Provides increased efficiency the result is a torque that is smooth and has good dynamic performance

Disadvantages of a permanent magnet synchronous motor

- Other types of motors are more expensive than the PMSM device.
- It has a DE-magnetizing effect.
- These aren't motors that start themselves.
- Field flux control loses its versatility.

EVALUATION OF DIFFERENT TRACTION SYSTEMS FOR ELECTRIC VEHICLES

Propulsion Systems / Characteristics	DC	IM	PM	SRM
Power Density	2.5	3.5	5	3.5
Efficiency	2.5	3.5	5	3.5
Controllability	5	5	4	3
Reliability	3	5	4	5
Technological maturity	5	5	4	4
Cost	4	5	3	4
Σ Total	22	27	25	23

Fig. 4 Comparison chart for motor performance

Above table is showing the comparison chart of traction motors used in electric vehicles based on various parameters. From the above table it is seen that, performance of Induction motor is better as compare to other traction machines.

Conclusion:

From the above paper we can say that there are various factors in which Electric Vehicle depends like traction system, batteries, controller, costs, mechanical strength, speed, efficiency etc. In in these aspects we can say that, for smooth running of EV's BLDC or PMSM motors can be preferred, since it is having good efficiency, reliable, easy charging control etc. In the battery management side, Lithium-Ion batteries gives best performance in regards to life cycle, charging-discharging, etc. We can also conclude that in future, there is a vast future of electric vehicles in terms of running and it becomes the primary mode of transportation due to its vast advantages like eco-friendly, less harm to environment, easy to use, renewable energy can me implemented in the EV's.

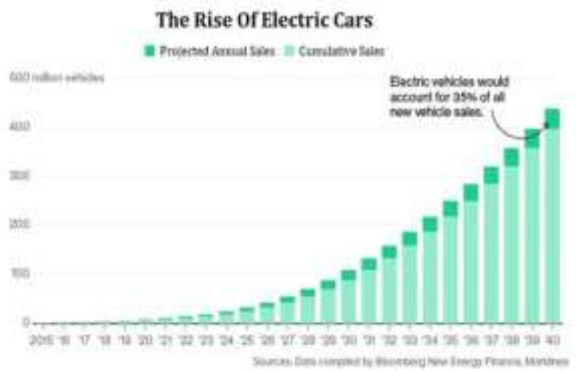

Fig. 5 Chart for expected growth of sales of EV's

Above chart is showing the expected growth of sales of electric vehicles in the market by the consumers till 2040.

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