ELECTRIC VEHICLE

GO GREEN

- Environment Friendly
  - Be a part of the engine that powers the world.
  - Think, Wonder, Imagine, Inspire.

: Preface :

About Government Polytechnic, Kolhapur:

Government Polytechnic, Kolhapur was established in 1961 with Civil Engineering and Mechanical Engineering Diploma Programme. Started in a small rented building, the institute was soon shifted to its independent campus of about 12 hectors covering academic building and hostels. Institute has the privilege of being the first academically autonomous government polytechnic in the state. At present, the institute offers diploma programme in Civil Engineering, Mechanical Engineering, Electrical Engineering, Industrial Electronics, Electronics and Telecommunication, Information Technology, Metallurgy, Sugar Manufacturing. The being rich with faculty of high qualifications, modernized laboratories and infrastructure, the institute has progressed serving the industry and society. The alumni either proceed for higher education or get employed in renowned industries through regular campus interviews organized by the Training and Placement Cell of the institute.

As a national level appreciation of education of the Institute, four programme were awarded 3 years accreditation by National Board of Accreditation (NBA), New Delhi in December 2003. Committed to the noble mission of developing technicians of high standards of excellence, the institute is crossing broader and newer horizons of progress keeping pace with the changing global world.

About magazine:

I am happy to present the technical magazine – 'Electric Vehicle'. It is initiative of EESA club and students of electrical engineering department. I would like to congratulate editor-in-chief, associate editors and all authors for their efforts and contribution. The magazine will increase interest among students about technical topics related to electric vehicle. I am assured that staff and students of electrical engineering department will continue this type of activities in future.

Prof. S. M. Naik

(HOD, EE)

Declaimer:

Vision of Institute

Institute of high recognition to develop competent technicians for quality professional services and entrepreneurship to cater the needs of industry and society.

Mission of Institute

- **To educate and train in multi-disciplinary multi-level programs to develop competent technicians and skilled manpower for industrial needs.**
- **To ensure employability, encourage entrepreneurship, promote lifelong learning.**
- **To inculcate in students the qualities of a good citizen at individual, social and professional level.**
- **To provide quality management system with focus on effective student-centric education and high recognition.**

Electrical Engineering

Programme

Vision of Programme

Skilled technicians serving the industry/society as entrepreneurs or rendering services in the fields related to electrical engineering following professional and ethical practices.

Mission of Programme

- To provide quality innovative skilled based electrical engineering courses.
- To prepare technicians for the state of art technology by promoting lifelong learning, technical expertise, ethical standards and leadership qualities.
- Commit our faculty expertise and modern facilities to the industry, the profession, and the local constituents.

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- **Omkar Suhas Chodankar**

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Review of Hybrid Energy Storage System Technology for EV Propulsion

Introduction

Resources of crude oil and petroleum gases are limited in nature. At this rate of utilisation of fossil fuels, the world's resources of crude oil are going to vanish in the next fifty years. Day by day, rates of petrol and diesel are increasing exponentially. Oil and gas has become the most important factor in international politics and world economy. 70 percent of crude oil is used for transportation. That is transportation is the main cause for depletion of crude oil resources. Transportation also causes significant air and sound pollution. 15 to 20 percent of world air pollution is caused by transportation.

There is an immense need to change the transportation fuel from petroleum to electricity. This will reduce the burden on the Indian economy as well as it will drastically reduce sound and air pollution. Electric vehicles have their own disadvantages like range anxiety, slow charging rate, high prices of battery, less technological advancement, availability of electricity etc. But still electric vehicles have significant advantages over IC engine vehicles. Electric vehicles have less maintenance, low running cost and produce less pollution.

Position of EVs in Market

Electric vehicles are gaining popularity due to its superior usage over IC engine vehicles. But there are some important areas in EV, where significant research and development is required. Some areas related to this research are

1) Range anxiety
2) Slow charging rates
3) Short life of battery
4) Transient performance of storage system

Engineers have suggested the hybrid electric vehicle as a solution for range anxiety but the IC engine increases weight and maintenance of the vehicle. Li-ion batteries are the most popular energy storage devices for EVs. Life of li-ion battery gets affected severely by sudden increase in the battery current. Research and development is going on in many energy storage devices like fuel cells, sacrificial battery materials, supercapacitors etc. Challenge for electrical engineers is to evaluate the characteristics and performance of energy storage devices accurately. From the characteristics optimal use of the energy storage device for required applications can be identified. Two energy storage devices having complementary characteristics to each other can be used together as a hybrid energy storage system for a given application. This concept will further increase the complications in the battery management system. Developing the battery management system is also an important challenge for electrical engineers.

Present Theories & Practices

To meet the energy demands of the EV power consumption, a supercapacitor

with a higher rate capability and better cyclability is used with a battery. In this design [1], the supercapacitor can provide the excess energy required while the battery fails to do so. Supercapacitors (SCs) are similar electrochemical systems for energy storage, but the main difference is that they have the high-rate capability for fast charging/discharging. The design considers the inputs: batteries SOC and outputs: vehicle's speed and acceleration, the current demand, the load voltage, state of health (SOH) of the battery, SOC of the SCs, the battery degradation under sub-zero temperatures.

Pontryagin's minimum principle(PMP) is utilized in the paper [3] to determine the best solution of component sizing and energy management strategy for a plug-in hybrid electric vehicle that is equipped with a hybrid energy storage system. PMP and Dynamic Programming (DP) have the advantage of finding globally optimal solutions. In this paper, a 2-dimensional PMP algorithm is proposed, and Operating cost strictly decreases with an increase in battery capacity.

Li-ion battery is one of the best choices because of its high energy density but it has the drawback of relatively low power density and susceptibility to high rate power cycling. It always leads to oversizing of the battery to meet high transients under realistic driving conditions in order to realize optimal power management in HESS, optimization-based algorithms like DP and Model Predictive Control (MPC) can be applied. Optimal sizing parameters in the outer loop and rule-based control strategy refinement in the inner loop proved to be conventionally expensive and susceptible to being trapped in local minima.

Paper [5] utilizes the DP approach to deal with the integrated optimization problem for deriving the best configuration and energy split strategies of HESS. The cost function is employed to evaluate the HESS life cycle cost based on a dynamic degradation model of the LiFePO4 battery. The life cycle cost of the HESS initially decreases rapidly with the addition of SCs. This paper also proves that a well-tuned rule-based strategy, which can be easily implemented in a vehicle, presents rather good performance when compared to the DP approach.

Conclusion

From the present theories and practices mentioned above, it is concluded that supercapacitors and batteries have different characteristics but are complementary to each other. Supercapacitor can be effectively used during acceleration and regenerative while battery can be effectively used for constant power demand. This will maintain monotonic power consumption through the battery and result in prolonging the battery life. Control strategies need to be developed and tested in real time. There is scope for improvement in the field of management of HESS. Hydrogen based energy storage is also considered as one the best options for future need. Hydrogen based energy storage needs to be considered for developing HESS. Also scientists are working on aluminium-ion batteries, which can be a good replacement for li-ion batteries in future. It is a potential energy storage device for future HESS.

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By

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FAST EVs CHARGING CARS

Subtitle

Abstract - Slow charging times are holding back potential EV customers, but emerging science says a fast-charging battery is possible.

Introduction

EVs are vehicles that are either partially or fully powered on electric power.Electric vehicles have low running costs as they have less moving parts for maintaining and also very environmentally friendly as they use little or no fossil fuels (petrol or diesel). While some EVs used lead acid or nickel metal hydride batteries, the standard for modern battery electric vehicles is now considered to be lithium ion batteries as they have a greater longevity.

Slow Charging

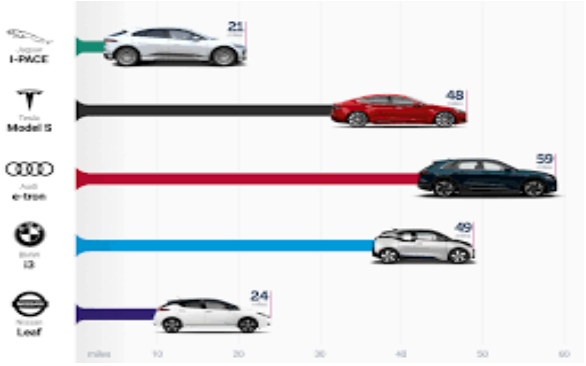
Electric vehicles are gaining popularity in market but still prospective buyers remain hesitant. One big reason is that charging EVs is slow. Drivers, now a days are accustomed to filling their gas tank approximately in less than five minutes, EVs, depending on the size of the energy storage devices and specifications of the battery, typically take more than 40 minutes to charge 85 percent at the fastest charging stations. In few upcoming years, we can have faster charging options than available today.

Companies are developing new lithium-ion battery materials, as well as new "solid state" batteries, which are more stable at faster charging speeds. They could place recharge rates of 20 minute or less within reach.

New Fast Charging Batteries Developed

Batteries capable of fully charging in five minutes have been produced in a factory for the first time, marking a significant step towards electric cars becoming as fast to charge as filling up petrol or diesel vehicles.Electric vehicles are a vital part of action to tackle the climate crisis but running out of charge during a journey is a worry for drivers. The new lithium-ion batteries were developed by the Israel company StoreDot and manufactured by Eve Energy in China on standard production lines.

StoreDot has already demonstrated its "extreme fast-charging" battery in phones, drones and scooters and the 1,000 batteries it has now produced are to showcase its technology to carmakers and other companies. The batteries can be fully charged in five minutes but this would require much higher-powered chargers



than used today. Using available charging infrastructure, StoreDot is aiming to deliver 100 miles of charge to a car battery in five minutes in 2025.

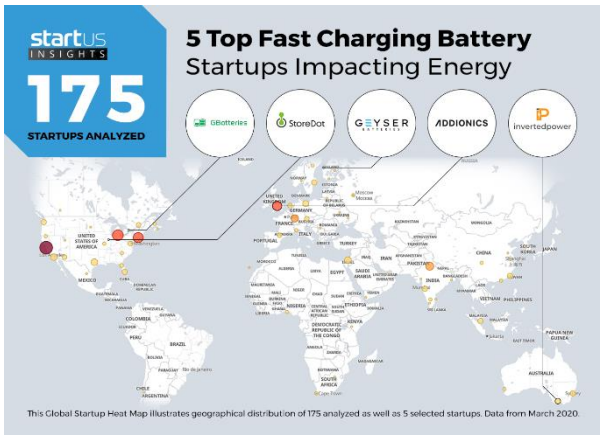
ABB

In September 2021, ABB launched the world's fastest electric car charger called Terra 360. The company claims the system can deliver 100km of range in less than three minutes.

The charging station will be available in Europe by the end of 2021, and it will arrive in the USA, Latin America, and the Asia Pacific regions in 2022. The Terra 360 charging station is designed for meeting the daily needs and expectations of EV drivers around the world, the company said in its press release.

Tesla

Tesla claims its Supercharger is capable of providing a rapid charge for 200 miles of range in 15 minutes with a max charge rate of 250 kW. It is currently the most widely used fast charger for EVs in the world, according to the company's website. However, for a full charge,the system may take over 30 minutes.



StoreDot	Tesla
Batteries can fully charged in 5 minutes for the first time.	Tesla claims that there supercharger is capable of providing a rapid charge for 200 miles of range in 15 minutes.
They are aiming to deliver 100 miles of charge to a car battery in 5 minutes in 2025.	They are aiming to charge the electric vehicale in 5 to 10 minutes.
This silicon-based anode technology is designed as a "drop-in" replacement for graphite anodes material in existing lithium-ion battery production facilities. It makes its easier to scale the technology using existing manufacturing lines.	All of Tesla's traction batteries are lithium-ion batteries, but they are not all the same.There are several main cathode chemistriesThe three main cathode types in Tesla EVs is **nickel-cobalt-aluminum (NCA), nickel-cobalt-manganese (NCM), lithium iron phosphate (LFP)**
StoreDot's extreme fast charging (XFC) is fast in charging.	In Tesla, Tesla Supercharger

Conclusion

Fast charging is the quickest of the lot. By using high voltage, it's possible to recoup the majority of your battery in anything from 20 minutes to an hour. How long it takes depends on the car and the battery, but it's more than enough to get you back on the road as quickly as possible.

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ELECTRIC VEHICLE

11th Sep, 2022

What do you mean by Electric Vehicle?

A Electric Vehicle operate on motor comparing to vehicles which run on combustion in engine. Electric vehicle is a possible replacement for the petrol and diesel vehicle which will reduce the issue of pollution, reducing resources. The electric vehicle concept is from a long time, in the past years a mid a rising carbon foot print.

In 2010, the first decision to incentivise the Electric Vehicles. The Ministry of New Renewable Energy (MNRE)has approved a scheme of 95 crore and also the government has announced the incentive for manufacturers for Electric Vehicle which are sold.

What are the types of EV?

1. **Battery Electric Vehicles (BEVs):**

Mostly used EV's by people are the Battery EV , which are fully electric vehicle which can be recharged. Energy to run EV's come from the battery which is recharge from the grid. This vehicles are zero emission vehicles, as there is no emission of harmful gases in the air which will not cause the pollution, which will replace the tradition of petrol and diesel vehicals.

2. **Plug-in Hybrid Electric Vehicles (PHEVs)** A **plug-in hybrid electric vehicle** (**PHEV**) is a hybrid electric vehicle whose battery pack can be recharged by plugging a charging cable into an external electric power source, in addition to internally by its on-board internal combustion engine-powered generator. Most PHEVs are passenger cars, but there are also PHEV versions of commercial vehicles and vans, utility trucks, buses, trains, motorcycles, mopeds, and even military vehicles. Plug-in Hybrid Electric Vehicles, or PHEVs, have both an engine and electric motor to drive the car. Like regular hybrids, they can recharge their battery through regenerative braking. They differ from regular hybrids by having a much larger battery, and being able to plug into the grid to recharge. While regular hybrids can (at low speed) travel 1-2 miles before the gasoline engine turns on, PHEVs can go anywhere from 10-40 miles before their gas engines provide assistance. Once the all-electric range is depleted, PHEVs act as regular hybrids, and can travel several hundred miles on a tank of gasoline. All PHEVs can charge at an EV go L2 charger, but most PHEVs are not capable of supporting fast charging.

3. **Hybrid Electric Vehicles (HEVs):**

A **hybrid electric vehicle** (**HEV**) is a type of hybrid vehicle that combines a conventional internal combustion engine (ICE) system with an electric propulsion system (hybrid vehicle drivetrain). The presence of the electric powertrain is intended to achieve either better fuel economy than a conventional vehicle or better performance. There is a variety of HEV types and the degree to which each function as an electric vehicle (EV) also varies. The most common form of HEV is the hybrid electric car, although hybrid electric trucks (pickups and tractors), buses, boats and aircraft also exist. Hybrid Electric Vehicles, or HEVs, have both a gas-powered engine and an electric motor to drive the car. All

energy for the battery is gained through regenerative braking, which recoups otherwise lost energy in braking to assist the gasoline engine during acceleration. In a traditional internal combustion engine vehicle, this braking energy is normally lost as heat in the brake pads and rotors. Regular hybrids cannot plug into the grid to recharge and cannot charge with EVgo.

Importance of Electric Vehicle

Transport is a fundamental requirement of modern life, but the traditional combustion engine is quickly becoming outdated. Petrol or diesel vehicles are highly polluting and are being quickly replaced by fully electric vehicles. Fully electric vehicles (EV) have zero tailpipe emissions and are much better for the environment.

Lower running costs

The running cost of an electric vehicle is much lower than an equivalent petrol or diesel vehicle. Electric vehicles use electricity to charge their batteries instead of using fossil fuels like petrol or diesel. Electric vehicles are more efficient, and that combined with the electricity cost means that charging an electric vehicle is cheaper than filling petrol or diesel for your travel requirements. Using renewable energy sources can make the use of electric vehicles more eco-friendly. The electricity cost can be reduced further if charging is done with the help of renewable energy sources installed at home, such as solar panels.

Low maintenance cost

Electric vehicles have very low maintenance costs because they don't have as many moving parts as an internal combustion vehicle. The servicing requirements for electric vehicles are lesser than the conventional petrol or diesel vehicles. Therefore, the yearly cost of running an electric vehicle is significantly low

Zero Tailpipe Emissions

Driving an electric vehicle can help you reduce your carbon footprint because there will be zero tailpipe emissions. You can reduce the environmental impact of charging your vehicle further by choosing renewable energy options for home electricity.

Tax and financial benefits

Registration fees and road tax on purchasing electric vehicles are lesser than petrol or diesel vehicles. There are multiple policies and incentives offered by the government depending on which state you are in.

How do Electric Cars work?

You can charge an electric vehicle by plugging it into a public charging station or into a **home charger**. But to get the best deal for home charging, it's important to get the right **EV electricity tariff**, so you can spend less money charging and save more on your bill.

What are the inner parts of EV?

EVs have 90% fewer moving parts than an ICE (Internal Combustion Engine) car. Here's a breakdown of the parts that keep an EV moving:

- **Electric Engine/Moto**r - Provides power to rotate the wheels. It can be DC/AC type, however, AC motors are more common.
- **Inverter** - Converts the electric current in the form of Direct Current (DC) into Alternating Current (AC)
- **Drivetrain** - EVs have a single-speed transmission which sends power from the motor to the wheels.
- **Batteries** - Store the electricity required to run an EV. The higher the kW of the battery, the higher the range.
- **Charging** - Plug into an outlet or EV charging point to charge your battery.

Why do electric vehicles Should Be Use in future ?

Electric vehicles (EVs) offer an opportunity to replace fossil fuels in the transport sector. Electrification of the transport sector can also bring benefits in terms of increased energy efficiency and reduced local pollution. However, there are genuine concerns about meeting the future energy demand for charging EV batteries with clean and renewable sources. More importantly, the issue of long-term sustainability of EVs is underscored by the supply risks of critical material resources used in the EV batteries. Extraction of some of these material resources are linked to significant environmental impacts as well as social and ethical issues.

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The Brushless DC Motor and Its Use in ElectricCars

Renewed Interest :-

Automakers acquired a renewed interest in electric cars in the 1960s; at that time innovations with the brushless DC motor were helping NASA scientists roam the Moon in lunar rovers. The wheels in the moon buggies NASA built each had a BLDC motor in them.

While energy crises in the 1970s and 1980s again piqued interest in electric cars, automakers didn't offer hybrid and electric vehicles to U.S. consumers until the new millennium. The ever-growing cost of gas may explain why more than 40% of U.S. consumers expressed interest in owning an electric vehicle in 2013. With the help of the brushless DC motor, today's electric cars are:

- Up to 80% more efficient than traditional cars
- Less expensive to drive, at 2 cents per mile (gas-powered cars cost 12 cents or more per mile) • Cleaner, with zero tailpipe emissions

The Brushless DC Motor (BLOC Motor) in Electric Vehicles :-

Before the latest incarnation of electric windshield wipers, CD players, and power windows. Today's automakers use three different types of electric motors in green cars: the BLDC motor, brushed DC motor, and AC induction motor.

The BLDC motor has a permanentmagnet rotor surrounded by a wound stator. The winding in the stator get commutated electronically, instead of with brushes. This makes the the BLOC motor :

- Simpler to maintain
- More durable
- Smaller
- 85%—90% more efficient • Able to respond faster and at higher operating speeds • Simpler to control in regard to speed control and reversing • Lighter
- Less prone to the failures that brushed motors experience • Able to self-start

The composition of the BLOC motor also keeps the machinery inside a vehicle cooler and thermally resistant. Plus, because the motor is brushless, there is no dangerous brush sparking.

The BLOC Motor Drive:-

All of today's hybrid vehicles use a BLOC motor. Green car manufacturers often prefer BLDC motors over the alternatives because the peak point efficiency is higher and rotor cooling is simpler. The motors can also operate at "unity power factor," meaning the drive can operate at its maximum efficiency levels.

Batteries and brakes. One of the most important components of the BLOC motor drive system is the batteries. In addition to supplying energy to the engine, they allow the electrical receivers to function.
Therefore, it's important that the batteries in green cars be as effects possible.

Whenever a battery gets used, an irreversible change in the chemical structure occurs. As a result, a rechargeable battery is most efficient when maintained close to full charge. Thanks to the permanent magnets in the brushless DC motor and the ability for the external torque to work as a generator, a person operating a green car can pulsecharge the battery by applying the brakes. It's important to note,

however, that braking alone won't fully charge an electric car's battery.

Motor response. Green car manufacturers and entities like NASA prefer BLDC motors because of their fast motor responses. The high-performance, smalldiameter magnetic rotors reduce the inertia of the armature, allowing high acceleration rates, a reduction in rotational losses, and smoother servo characteristics. This optimal motor response also allows for more constant speeds, instant speed regulation and a quieter drive system.

A Look to the Future :-

The brushless DC motor isn't without fault. It's currently more expensive to manufacture than its brushed counterparts. Also, the magnetic field produced by the permanent magnets isn't adjustable. Scientists hope to make the strength of the magnetic field more adjustable so when an electric vehicle requires maximum torque, particularly at low speeds, the magnetic field will be at maximum strength. As green vehicles continue to grow in popularity, automakers and scientists expect the brushless DC motor to dominate the market. With continuing innovations in electric car manufacturing, economists predict that by the year 2020, up to 33% of new car purchases worldwide will be for green cars.

Conclusion :

The progress that the electric vehicle industry has seen in recent years is not only extremely welcomed, but highly necessary in light of the increasing global greenhouse gas levels. As demonstrated within the economic, social, and environmental analysis sections of this webpage, the benefits of electric vehicles far surpass the costs. The biggest obstacle to the widespread adoption of electricpowered transportation is cost related, as gasoline and the vehicles that run on it are readily available, convenient, and less costly. As is demonstrated in our timeline, we hope that over the course of the next decade technological advancements and policy changes will help ease the transition from traditional fuel-powered vehicles. Additionally, the realization and success of this industry relies heavily on the global population, and it is our hope that through mass marketing and environmental education programs people will feel incentivized and empowered to drive an electric-powered vehicle. Each person can make a difference, so go electric and help make a

difference!

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Maintenance and Safety of Electric Vehicles

Maintenance and Safety measures for the Plug-In Hybrid and Hybrid Electric Vehicles are same as that of conventional vehicle, but other electric vehicle require less maintenance. While designing these vehicles Maintenance and Safety Factors are kept in mind by the manufacturers.

Maintenance Comparison

As there is internal combustion of engine, the maintenance for the PHEV's &HEV's are same as that of the conventional vehicles. As compared to conventional vehicles less maintenance is required for the electric vehicle and due to regenerative braking the brake system last for the long time than the conventional vehicle.

All electric vehicles require less maintenance as compared to conventional vehicle because:

- Components of EV like battery, motor, and electronic sensor require less maintenance.
- There are some fluids, such as engine oil, which requires the regular maintenance.
- Stress on the brake have been reduced due to regenerative braking system.
- There are some moving part in the conventional fuel engine which causes maintenace.

Battery Maintenance

Batteries used in the EV's have limited number of charging cycles i.e, it is the number of the times the batteries can be discharged and charged. We should check battery life and its warranty also should consider the manufacturers battery recycling policy. Some company uses liquid coolants for cooling batteries which keeps the system safe, and also this system can require the regular check to avoid problems.

The company design batteries which can last for lifetime they expect for the vehicles. Batteries of electric vehicle is designed as that of conventional vehicle whose life is extended. The companies offers 8 to 9 years/100,000mile warranty for the Electric Vehicle.

The companies do not publish the replacement pricings for the batteries. But the battery prices are expected to decrease as there will be improvement in the technology and also as the production of the batter increases.

Safety Requirements

Commercially available electric-drive vehicles must meet the Federal Motor Vehicle Safety Standards and undergo the same rigorous safety testing as conventional vehicles sold in the United States. The exception is neighbourhood electric vehicles, which are subject to less-stringent standards because they are typically limited to low-speed roadways as specified by state and local regulations.

All-electric vehicles, PHEVs, and HEVs have high-voltage electrical systems that typically range from 100 to 600 volts. Their battery packs are encased in sealed shells and meet testing standards that subject batteries to conditions such as overcharge, vibration, extreme temperatures, short circuit, humidity, fire, collision, and water

immersion. Manufacturers design these vehicles with insulated high-voltage lines and safety features that deactivate the electrical system when they detect a collision or short circuit. All-electric vehicles tend to have a lower center of gravity than conventional vehicles, making them more stable and less likely to roll over.

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BATTERIES

TYPES OF BATTERIES USED IN ELECTRICAL VEHICLES AND THEIR PARAMETERS

The electric vehicle market is growing everyday with the inclusion of new customers and EV manufactures.

In recent years automobile industry is revolutionising by the advancement in EV technology. Battery powered electric cars has changed the perception of vehicle users and manufacturers. During the development of EV, many types of batteries have been used for EV propulsion. In this article, three types of batteries and their characteristics have been discussed.

1. Lithium-ion Battery:

Li-ion is the most widely used battery type for the EV. This type of battery technology has been used and proven best for smaller devices like mobile and laptop. However, batteries required for EVs are of large capacity.

High energy density and high power to weight ratio of Lithium-ion battery makes it preferred energy storage device for EV applications. Li-ion batteries perform better in case of higher temperature. It also have high energy to weight ratio.

Because of smaller weights of batteries, driving range of vehicle increases. Li-ion battery has low rate of self-discharge as compared to other types of batteries. It means, this type of battery can retain its charge for longer duration. All the components of li-ion battery can be recycled; this makes the technology environment friendly. These batteries are used in BEV and PHEV.

Parameters:

1.Mass energy Density: 100-180 Wh/kg

2.Volume Energy density: 200-300 Wh/L

3.Power Density: 1000-1500 W/kg

4.Self-Discharge rate: 1-5% per month

2. Hybrid Nickel-Metal (NIMH) battery:

Another variant of electric cars is hybrid cars which contain both battery-powered and fuel-powered engines. These are the cars that mainly use NIMH batteries, but these batteries are also compatible with BEV cars. These kinds of batteries do not require any outer power source to charge.

The charging of the battery mainly depends on the regenerative braking, speed, and wheels of the car. When compared to Li-ion batteries, NIMH batteries have a better life cycle and are safer in case of intolerant use.

However, these batteries have a higher selfdischarge rate, are much more expensive, and generate considerable amounts of heat in high temperatures, which is quite common in a car. These few shortcomings make NIMH a lesser chosen option for a car whose batteries need to be charged from an outer source. This is also the main reason these batteries are used in hybrid cars.

Parameters:

1.Mass energy Density: 40-120 Wh/kg

2.Volume Energy density: 140-400 Wh/L

3.Power Density: 300-1000 W/kg

4.Self-Discharge Rate: ~30% per month

3.Lead-Acid Battery:

SLA or lead-acid is one of the oldest kinds of rechargeable batteries. When compared to NIMH or lithium batteries, these are a lot heavier and lose capacity eventually. However, the main reason automobile companies still use it is its cheap pricing. In addition to that, since they have been used for the longest time, the technology around the fitting and using the batteries more effectively has also evolved, which makes for a better end product. Nevertheless, SLA batteries are not yet found in consumer electric vehicles, although there are a few projects under development. The main use for this kind of battery is as a secondary storage system for commercial vehicles. Another good thing about these kinds of batteries is that they are recyclable.

Parameters:

1.Mass energy Density:30-40 Wh/kg

2.Volume Energy density:60-75 Wh/L

3.Power Density:180 W/kg

4.Self-Discharge rate:3-20% per month

Conclusion:

The most common battery type in modern electric vehicles are lithium-ion and lithium polymer, because of their high energy density compared to their weight. other types of rechargeable batteries used in electric vehicles include lead acid, nickel codiun, nickel metal hybrid etc. the amount of electricity charged in batteries is measured in ampere hours or in coulombs, with the total energy often is measured in kilo-watt hour.

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E-Bikes and Its Parts

Introduction

Bicycles are low cost and fast communication technique in crowded area of city use bicycles reduce recented because driving bicycle require strength and stamina if you have batteries and motors bicycle we can reduce use of strength upward we can use bicycle in upward gradients also in less efforts and less strength we can use electric power for driving bicycles in up gradients also for increasing speed this article discusses different parts of bicycles and different components of bicycle and promotes the use of e-bike in citizen town

Cadmium, or NiMH were predominantly used in electric bikes but now a days bike manufacturers are preferring li-ion battery for the same application because of their light weight and high energy to weight ration. Li-ion technology is still in developing stage but it has matured enough to be used in real life bicycle application. Li-ion batteries are 8 to 10 times lighter than lead acid batteries and have life span of 5 to 6 years.

The Battery Packs

Lithium-ion batteries are made up of series and parallel combination of small li-ion cell. Li-ion cells can be manufactured in any shape but cylindrical small sized li-ion cells are widely manufactured in industry. Reputed manufacturers like Panasonic, Sony, Samsung, and LG manufactures these types of cells which more reliable and safe compared to any generic product. Lithium-ion batteries also require Battery Management System to avoid overcharging as well as over discharging of battery.

The voltage and current rating of the battery pack is determined by the series and parallel combination of cells. Low voltage battery pack will draw the higher current which will require larger size of cable and devices. Most of the battery packs are of voltage rating 24V, 48V and 72V. 36V to 52V is the optimised range of voltage for E-Bikes considering current required and safety from electric shocks.

The energy capacity of battery is measured in ampere-hour (Ah) or wtt-hour (Wh). Ampere-hour shows the charge capacity of battery and Wh shows the energy capacity of battery. Most ebike batteries range from 300 to about 800 watt-hours.

It's worth noting that a higher voltage battery will have less amp-hours than a lower voltage battery of the same size. For instance, a 36V 20Ah battery pack (720 watt-hours) is identical in energy storage as a 48V 15Ah battery (also 720 watt-hours). Both packs would be expected to weigh the same and cost the same and provide the same range and power capability when matched to an appropriate motor.

Factory manufacturers of e-bikes generally integrate battery pack inside the downtube which give it attractive look but these types of batteries can not be replaced. Batteries of such shape are not manufactured by any of the manufacturers. On the other hand batteries used in conversion kit are readily available in market. These batteries can be

mounted below downtube inside triangle or on the carriage rack behind bike.

Downtube vs Rack Batteries

The Motor

Generally, hub BLDC motor is used for e-bikes. Hub motor allows easy conversion of electrical energy to rotation of wheels. Hub motor is mounted inside the hub of wheel. BLDC motor have good performance and efficiency compared other types of motors. BLDC motors have hall effect sensors build inside the body of motor. Feedback signal from hall effect sensors are used to run motor effectively at required speed.

Hub motors can be geared or direct drive; small and with modest output or large, or heavy and powerful. The optimal motor choice depends very much on the application. Demanding uses like cargo hauling or long steep hill climbs requires larger heavier motors, while people needing just a small boost on mostly flat ground can get away with motors that are light and compact.

Insides of a small geared motor versus a a large direct drive hub

The single most important attribute of a motor necessary to understand how it will behave is the motor winding constant in RPM/V, often given the symbol Kv. This tells you the maximum rotational speed of the motor for a given battery voltage, and hence lets you know up to what max speed it will be able to assist a bike. Motor manufacturers can easily produce the exact same motor in a range of winding speeds, and at Grin we usually carry several winding options for each hub model. If a motor winding constant is 10 rpm/V, then that means it will spin at maximum 120 rpm with a 12V battery pack, 240 rpm with a 24V battery pack, 360 rpm with a 36V battery pack and so forth. The table below shows the relation between RPM and vehicle speed for a range of common wheel diameters.

Typical ebike hub motors are wound for around 8 rpm/V, but we usually carry faster winding choices of 10 to 12 rpm/V as well in order to support various applications with smaller wheels diameters and more flexible battery voltages. On our website, we list the RPM/V of each motor winding in the specification table and product description. Unfortunately this information is almost impossible to glean on most other manufacturer and vendor websites.

If you ride the bike faster than the maximum RPM of your motor + battery voltage combination, then either the motor will cease providing any power output (in the case of a geared motor with a freewheel), or it will automatically go into regenerative braking mode (in the case of a direct drive motor) and provide resistance to further speed increases while putting energy into the battery pack.

Controller

The motor controller is a component that is unfamiliar to many people, but it is an essential piece of any ebike hardware since you can't directly connect a brushless motor to a battery pack. The motor controller serves two critical functions

1) It converts the DC voltage of the battery pack into 3 phase alternating current for the motor windings without which the motor could not spin, and

2) It can continuously adjust the voltage going to the motor, from 0V up to the full battery pack voltage, in response to the user's throttle signal, pedal sensors, and various current limits.

This latter bit is the most vital aspect to understand. The motor controller can reduce the voltage that makes it to the motor to any value between zero and the battery voltage. If you have a 48V battery pack, the voltage that the motor sees might be only 10-12V at low speeds, ~25V at moderate speeds, and only reach 48V when you approach the final cruising speed of the bike. If you have a 48V battery pack and ride at just 50% throttle, then the motor will see 24V, and will perform exactly the same as it would with a 24V battery at full throttle.

It is by varying the voltage to the motor via the controller that you can adjust and modulate the power output of the motor as you ride the bike, which is pretty essential to the idea of controlling an EV. Those with an electronics background should appreciate that the controller acts as an efficient DC-DC buck converter. While it steps down the voltage going to the motor, it simultaneously steps up the current by the same ratio. You can have 48V and 10 amps flowing from the battery into the motor controller, and have 24V and 20 amps flowing from the controller to the motor.

Function and Connectors of an Ebike Motor Controller

The motor controllers contain at least 6 power mosfets, large capacitors, and connectors for throttles, brake cutoffs, and displays. The controller circuitboard is often fit in an extruded aluminum box, either mounted externally on the bike or tucked inside the chassis somewhere. It's also common to have the motor controller located inside the hub motor or inside the battery mounting cradle. In these latter options, the controller is hidden from view for cleaner ebike with fewer visible components, but it is more challenging to repair or replace a damaged controller when it is integrated this way.

Motor controllers have a specific voltage range in which they works in, and also they have a current limit which tells the maximum amperage which they will draw for the battery. A Small current motor controller will take maximum 14 to 15 amperes of current from the battery. If the battery takes the more currents than its rating then automatically the voltage provided to the motor reduces to control the current. If the low current rating motor controller is used with the large motor hub , then the system will work properly but we will not get the power we are expecting from the motor. And if the large current motor controller is used with small motor

then there will chances of overheating , fire hazards and damage's to the motor or in the internal gears of motor.

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The main equipment's of E-bike are batteries, motor, and controller including number of accessories.

Reference Link :

1) Summary of Ebike Components - Learn (ebikes.ca)
2) Ebike Parts Explained - Getting Started (ebikes.ca)
3) https://ebikes.ca/getting-started/ebikes-parts-explained

Benefits Of Electric Cars to the Environment

The major benefit of electric cars is the contribution that they can make towards improving air quality in towns and cities with no tailpipe, pure electric cars produce no carbon dioxide emission when driving . This reduces air pollution considerably. Put simply, electric cars give us cleaner streets making our towns and cities a better place to be for pedestrians and cyclists.

EVs can also help with noise pollution, especially in cities where speeds are generally low. As electric cars are far quieter than conventional vehicles, driving electric creates a more peaceful environment for us all

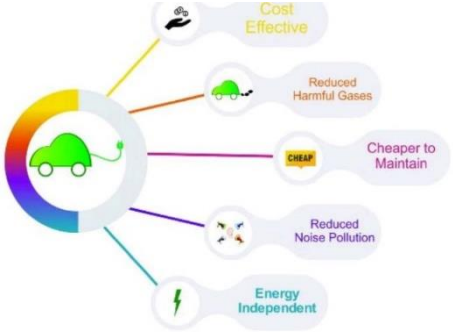
Making electric cars does use a lot of energy. Even after taking battery manufacture into account, electric cars are still a greener option. This is because of the reduction in emissions created over the car's lifetime

The emissions created during the production of an electric car tend to be higher than a conventional car. This is due to the manufacture of lithium ion batteries which are an essential part of an electric car.

EVs can produce zero direct emissions.

Full electric vehicles don't need a tailpipe, as they don't produce emissions. Traditional machines combust gasoline or diesel, creating energy at the cost of producing dangerous carbon emissions. The EVs are fully emission-free. The most common type of battery placed in EVs is the lithium-ion battery. These batteries can be depleted and charged constantly without contributing to air pollution.

Top 5 Benefits of Electric Cars



EV manufacturer's use eco-friendly materials

One of the major obstacles that EV manufacturers are facing, is producing a functional yet lightweight vehicle. Lighter EVs have a lesser range and lower carbon footprint, but traditional materials make it tricky to achieve this. Still, recycled and organic materials are now similar to traditional materials. They're feather-light, ecofriendly, strong, and durable.

Weight reduction isn't the only benefit of using recycled and organic materials, but they are also better for the environment. Using new materials like metals and plastics is unsustainable and creates pollution. Each natural or recycled material minimizes the environmental impact both during and after the EV product process.

All this shows that electric vehicles have a big role to play in reducing transport emissions and being a major factor in cleaning up the air we breathe. Advantages of an Electric Car

Advantages of EV

An electric car can be a great way for you, as a consumer, to save a lot of money on gas. However, there are so many different reasons why you should invest in an electric car in the modern-day of technology.

1. No Gas Required

Electric cars are entirely charged by the electricity you provide, meaning you don't need to buy any gas ever again. Driving fuel-based cars can burn a hole in your pocket as prices of fuel have gone all-time high.

The average American pays about 15 cents a mile to drive a gas-powered vehicle, whereas many electric cars run on five cents a mile. Electricity is largely less expensive than gasoline.

2.More Convenient

The electric vehicle is easy to recharge, and the best part is you will no longer need to run to the fuel station to recharge your car before hitting the road! Even a normal household socket could be used for charging an electric car.

3. Savings

These cars can be fueled for very low prices, and many new cars will offer great incentives for you to get money back from the government for going green. Electric cars can also be a great way to save money in your own life.

4. No Emissions

The biggest advantage of an electric vehicle is its green credential. Electric cars are 100 percent eco-friendly as they run on electrically powered engines.

Conclusion

The basic conclusion is that when it comes to climate change and air quality, electric cars are clearly preferable to petrol or diesel cars. Contrary to some public doubts and uncertainties about the environmental benefits of electric cars, the science is increasingly clear. The study goal was to get an estimate of the impact on environment and health for the replacement of internal combustion engine (ICE) cars by electric vehicles (EV) and this for all EU-27 countries. The impact was expressed as external costs conform the European Extern E methodology. The energy for EV comes from electricity production plants that differ in technology and fuel between countries and over time.

If successful, the shift to electric vehicles could potentially help India save up to $300 Bn (INR 20 Lakh cr) in oil imports and nearly 1 giga tonne of carbon dioxide emissions by 2030, as per a recent report by FICCI and Rocky Mountain Institute! Furthermore, EVs will be a stepping stone towards designing an intelligent, futuristic transport infrastructure in India that is capable of catering to the mobility needs of the country's huge population.

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Name –

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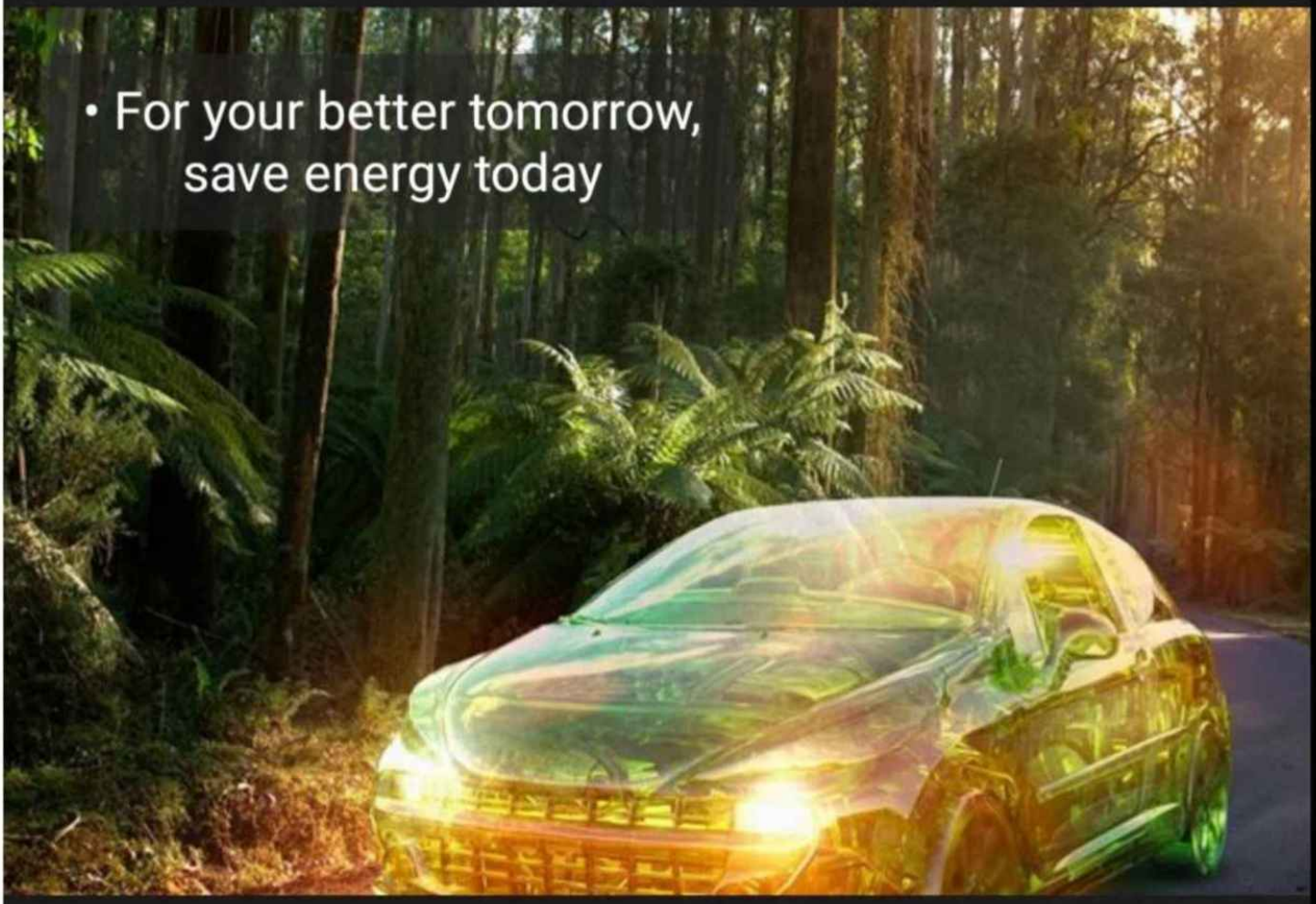
ELECTRIC VEHICLES

• Think Globally Act Locally



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