**INTRODUCTION:**

India is steadily moving up on the path of development. However, this development has some apparent side effects. One of the major concerns of the country at this hour is the ever-increasing emissions from the millions of vehicles that run on the country’s roads each day. The major pollutants emitted by ICE vehicles are gases like carbon dioxide, carbon monoxide, photochemical oxidants which are also called air toxins and include substances like benzene (C6H6),1,3, butadiene (C4H6), LEAD (Pb), particular matter (PM), hydrocarbon (HC) compounds like aldehydes, polycyclic aromatic hydrocarbons (PAHs) oxides of sulphur (SO2) and nitrogen (NOx).

In india, almost 27% of the total pollution is caused by vehicles. Air pollution is highest due to vehicles. ICEs release particulate matter which is a serious challenge in India.

India’s first electric car was Reva by Mahindra. It was introduced in 2001 but it could sell a few units after its launch. In 2010, Toyota began the prius hybrid model, followed by the camry hybrid in 2013. Electric buses and hybrid vehicles have been commenced as a pilot proposal in a few cities like Mumbai, Bangalore and Delhi. There is a vision for 100% EV’s by 2030.

**TYPES OF BATTERIES**

Energy storage systems, usually batteries, are essential for all-electric vehicles, plug-in hybrid electric vehicles (PHEVs), and hybrid electric vehicles (HEVs).

**Lithium-Ion Batteries**

Lithium-ion batteries are currently used in most portable consumer electronics such as cell phones and laptops because of their high energy per unit mass relative to other electrical energy storage systems. They also have a high power-to-weight ratio, high energy efficiency, good high-temperature performance, and low self-discharge. Most components of lithium-ion batteries can be recycled, but the cost of material recovery remains a challenge for the industry. The U.S. Department of Energy is also supporting the lithium-ion battery recycling prize to develop and demonstrate profitable solutions for collecting, sorting, storing, and transporting spent and discarded lithium-ion batteries for eventual recycling and materials recovery. Most of today's all electric vehicles and PHEV’S use lithium-ion batteries, though the exact chemistry often varies from that of consumer electronics batteries. Research are ongoing to reduce their relatively high cost, extend their useful life, and address safety concerns in regard to overheating.

### Nickel-Metal Hydride Batteries

Nickel-metal hydride batteries, used routinely in computer and medical equipment, offer reasonable specific energy and specific power capabilities. Nickel-metal hydride batteries have a much longer life cycle than lead-acid batteries and are safe and abuse tolerant. These batteries have been widely used in HEV’s. The main challenges with nickel-metal hydride batteries are their high cost, high self-discharge and heat generation at high temperatures, and the need to control hydrogen loss.

### Lead-Acid Batteries

Lead-acid batteries can be designed to be high power and are inexpensive, safe, and reliable. However, low specific energy, poor cold-temperature performance, and short calendar and lifecycle impede their use. Advanced high-power lead-acid batteries are being developed, but these batteries are only used in commercially available electric-drive vehicles for ancillary loads.

### Ultracapacitors

Ultracapacitors store energy in a polarized liquid between an electrode and an electrolyte. Energy storage capacity increases as the liquid's surface area increases. Ultracapacitors can provide vehicles additional power during acceleration and hill climbing and help recover braking energy. They may also be useful as secondary energy-storage devices in electric-drive vehicles because they help electrochemical batteries level load power.

**TYPES OF EV’S AND THEIR BENEFITS**

There are three main types of electric vehicles: hybrid electric vehicles (HEV), plug-in hybrid electric vehicles (PHEV) and battery electric vehicles (BEV).

 ● Low operational costs: Petrol rates are Rs. 100 per litre while using 5 to 8 Rs. per kWh

● No Carbon Emissions.

● Three motors can give 30 power configurations in 3-Wheelers to support everyone’s needs. ● Less moving parts means no vibrations.

● No maintenance costs and saving on lubricants and oils.

● Reduced friction losses.

● EVs are more energy efficient. In ICEs, 16/100 units of fuel consumed result in propulsion. In the case of EVs, 85/100 units of electricity are used for driving.

● An electric vehicle is very quiet and smooth. The motor RPM can be changed easily so no need for a gearbox or clutch system. No bump or jolt in transmission.

● Electric vehicles are much lighter than ICE. This decrease brake wear and increases pick-up especially on an uphill drive. This is a benefit for goods vehicles.

**CONTRIBUTION OF EV MARKET IN INDIA’S GDP**

With the increase in global warming, making environmentally friendly choices and preventing climate change are essential. Electric vehicle (EVs) is one such ecologically friendly choice. A paradigm change is currently taking place in the global automotive sector as it attempts to transition to alternative, less energy-intensive options. One of the primary drivers behind India's recent measures to accelerate the transition to e-mobility is the increase in prices for oil imports, rising pollution, and international pledges to battle global climate change. As a result, India committed to an aspirational goal of having at least 30% of private automobiles as EVs by 2030 at the Conference of the Parties 26 (COP26) Summit. EV market in India will be a US$206 billion opportunity by 2030 if India maintains steady progress to meet its ambitious 2030 target. This would require a cumulative investment of over US$180 billion in vehicle production and charging infrastructure. In 2021, the Indian EV industry attracted US$6 billion in investment and is becoming steadily more attractive to private equity/venture capital investors. Another report India Energy Storage Alliances(IESA) projects that the Indian EV market will grow at a CAGR of 36 percent till 2026. The EV battery market is also projected to grow at a CAGR of 30 percent during the same period. Meanwhile, India’s EV market is estimated to grow 49 percent CAGR in the 2022-2030 period in a business as usual scenario as per the IESA report. Overall, by 2030, the EV industry is set to create 10 million direct jobs and 50 million indirect jobs (IVCA-EY-Induslaw report). India is also witnessing the rise of a sizeable EV financing market, with Niti Aayog projecting it to be worth US$50 billion by 2030.

**ENVIRONMENTAL IMPACT OF EV**

Compared to conventional internal combustion engine automobiles, electric cars reduce local air pollution, especially in cities, as they do not emit harmful tailpipe pollutants such as particulates (soot), volatile organic compounds, hydrocarbons, carbon monoxide, ozone, lead, and various oxides and nitrogen. Some of the environmental impact may instead be shifted to the site of the generative plant, depending on the method by which the electricity used to recharge the batteries is generated. This shift of environmental impact from the vehicle itself (in the case of ICE vehicles) to the source of electricity (in the case of EVs) is referred to as the long tailpipe of electric vehicles. This impact, however, is still less than that of traditional vehicles, as the large size of power plants allow them to generate less emissions per unit power than internal combustion engines, and electricity generation continues to become greener as renewables such as wind, solar and nuclear power become more widespread.

The specific emission intensity of generating electric power varies significantly with respect to location and time, depending on current demand and availability of renewable sources. The phase-out of fossil fuels and coal and transition to renewable and carbon powers sources will make electricity generation greener, which will reduce the impact of EVs that use that electricity.