



Powering Progress-India's Energy Consumption & Electric Vehicle Revolution

¹Amit Kasar, ²Swayam Jaiswal, ³Pratiksha Jare, ⁴Arti Kanwate, ⁵Hansraj Gavande

¹Assistant Professor, ²³⁴⁵Student

¹²³⁴⁵Engineering Sciences Department of 1st Author,

¹²³⁴⁵International Institute of Information Technology, Pune, India

Abstract: We know that the sources of petrol and diesel are being destroyed day by day. We must find alternative ways to overcome this problem. Many vehicles in India are dependent upon petrol, Diesel sources. As petrol and diesel sources are being destroyed, we must find alternative ways like electric vehicles. The main aim of this research paper is to explain the importance of electric vehicles and how we can overcome future problems that will occur with petrol and diesel fuels.

IndexTerms - Sources, petrol, diesel, destroyed, alternative ways, overcome, problem, vehicles, India, depend, electric vehicle, main aim, research paper, explain, importance, future problems, fuels

INTRODUCTION:

The data provided sheds light on the energy consumption in India, with a particular focus on the dominance of coal-based power plants and the problems associated with conventional fuel sources. It highlights the environmental impact, economic dependency, and health implications of using petrochemicals as car fuels in India. The need for sustainable alternatives, such as electric vehicles (EVs), is emphasized, considering the environmental damage, economic vulnerabilities, and public health concerns posed by traditional fuels. The construction and working of EVs are briefly described, along with their advantages and disadvantages. Furthermore, the data reveals the growth and adaptation of EVs in India, showcasing government initiatives and the increasing number of registered EVs.

Energy Consumption in India:

1. Installed Capacity:

- As of 2020, India had a total installed capacity of coal-based power plants of approximately 229 gigawatts (GW).
- Coal-fired power plants accounted for around 54% of India's total installed power capacity.

2. Coal Consumption:

- In 2020, India's coal consumption for electricity generation was around 763 million metric tons.
- Most of the coal used for electricity production in India is domestically sourced from domestic coal mines.

3. Coal-Based Generation:

- Coal-fired power plants in India generated approximately 1,054 billion kilowatt-hours (kWh) of electricity in 2020.
- Coal-based generation accounted for around 72% of India's total electricity generation.

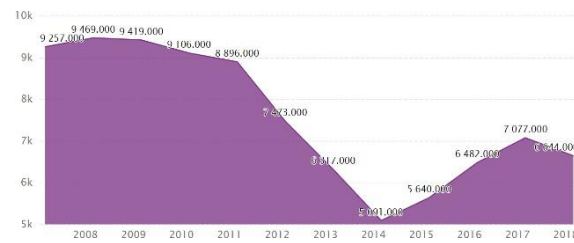
4. Largest Coal-Producing States:

- The top coal-producing states in India include Jharkhand, Odisha, Chhattisgarh, and West Bengal.
- These states contribute significantly to the country's coal production and supply for electricity generation.

5. Environmental Impact:

- Coal-fired power plants are a significant source of greenhouse gas emissions, including carbon dioxide (CO₂), in India.
- The emissions from coal combustion contribute to air pollution and have environmental and health impacts.

It's important to note that the data provided is based on available information up until 2020, and there may be updates or changes in recent years as India continues to diversify its energy mix and reduce its reliance on coal for electricity generation.



Problems Faced Due to Conventional Fuel Sources:

The usage of petrochemicals as fuels for cars in India poses several problems, ranging from environmental concerns to economic and health issues. Here is a detailed overview of the problems associated with the use of petrochemicals as car fuels in India, supported by specific necessary data:

1. Environmental Impact:

a. **Greenhouse Gas Emissions:** Burning petrochemical fuels, such as gasoline and diesel, releases carbon dioxide (CO₂) and other greenhouse gases (GHGs) into the atmosphere, contributing to global warming and climate change. In India, the transport sector is a major contributor to CO₂ emissions, accounting for about 14% of the country's total emissions.

b. **Air Pollution:** Petrochemical combustion also leads to the release of pollutants such as nitrogen oxides (NO_x), particulate matter (PM), and volatile organic compounds (VOCs), which contribute to air pollution. According to the World Health Organization (WHO), 14 out of the 20 most polluted cities in the world are in India, and vehicle emissions are a significant contributor to this problem.

2. Economic Dependency:

a. **Imported Fuel:** India heavily relies on imported crude oil and refined petroleum products to meet its energy needs. This dependence on imports makes the country vulnerable to fluctuations in global oil prices, which can impact on the overall economy and trade balance.

b. **Subsidies and Fiscal Burden:** The Indian government provides subsidies for petroleum products, including gasoline and diesel, to make them affordable for consumers. These subsidies put a significant fiscal burden on the government's budget and can affect other essential sectors such as healthcare, education, and infrastructure development.

3. Health Implications:

a. **Respiratory Diseases:** The toxic emissions from petrochemical combustion contribute to the deterioration of air quality, leading to increased respiratory problems such as asthma, bronchitis, and other lung diseases. According to the Global Burden of Disease study, outdoor air pollution was responsible for over 1.7 million premature deaths in India in 2019.

b. **Environmental Justice:** The adverse health effects of air pollution disproportionately affect vulnerable populations, including children, the elderly, and those with pre-existing respiratory conditions. This exacerbates existing inequalities in access to clean air and public health services.

4. Alternatives and Solutions:

a. **Electric Vehicles (EVs):** Transitioning to electric vehicles can significantly reduce the reliance on petrochemical fuels and their associated environmental and health impacts. The Indian government has set a target to achieve 30% electric vehicle penetration by 2030.

b. **Renewable Energy Integration:** Promoting the use of renewable energy sources for electricity generation helps decarbonize the power sector, which in turn supports the adoption of electric vehicles. India has been expanding its renewable energy capacity, with a target of achieving 450 GW of renewable energy by 2030.

Specific Data:

- According to the Carbon Dioxide Information Analysis Center (CDIAC), India's transport sector accounted for approximately 14% of the country's total CO₂ emissions in recent years.

- The WHO estimated that outdoor air pollution was responsible for around 1.7 million premature deaths in India in 2019.

- As per the International Energy Agency (IEA), India is the third-largest emitter of GHGs in the world, with emissions mainly originating from the burning of fossil fuels, including petrochemicals.

- The Indian government has been promoting electric mobility through initiatives such as the Faster Adoption and Manufacturing of

Electric Vehicles (FAME) scheme, which offers incentives for electric vehicle adoption.

It is important to address these problems and promote sustainable alternatives to petrochemical fuels in India to mitigate environmental damage, reduce economic dependency, and improve public health.

Why EV?

India import crude oil from gulf countries like Iraq, United States of America, Nigeria, Saudi Arabia, UAE , Russia Keeping that in mind if we think about the current time, we understand that we cannot depend only on vehicles like petrol, because in a situation like world war, a condition may come that our fuel supply from them will stop, so it is very important that we should have some alternative. Not only this, but the fuel that we are currently using is very harmful for the environment. It is not good for the next generation, looking at the cost of this fuel, we think that we need to establish an electric vehicle.

Construction & working of EVs:

- 1) basically, electric vehicle consists of battery, controller, motor.
- 2) These are basic components of an electric vehicle.
- 3) these components are connected to transmitter system.
- 4) solar PV panels are attached to the roof of electric vehicles through which battery get charged.
- 5) The batteries used in electric vehicles are rechargeable.
- 6) There are two types of batteries used in electric cars. i.e., lead acid and lithium acid.
- 7) most electric vehicle used lead acid battery but nowadays lithium battery is majorly use because it can store more energy than lead acid.
- 8) Lithium batteries are costlier than lead acid. Inverters convert DC energy from battery to AC energy.
- 9) electric vehicles use brushless DC motor having motor controller which helps to control various properties of motor to take sufficient current and voltage to motor. When the pedal is pressed by the driver to give signal to the motor controller to adjust speed as per our needs.

Step 1) plug in charge point taking electricity from grid.

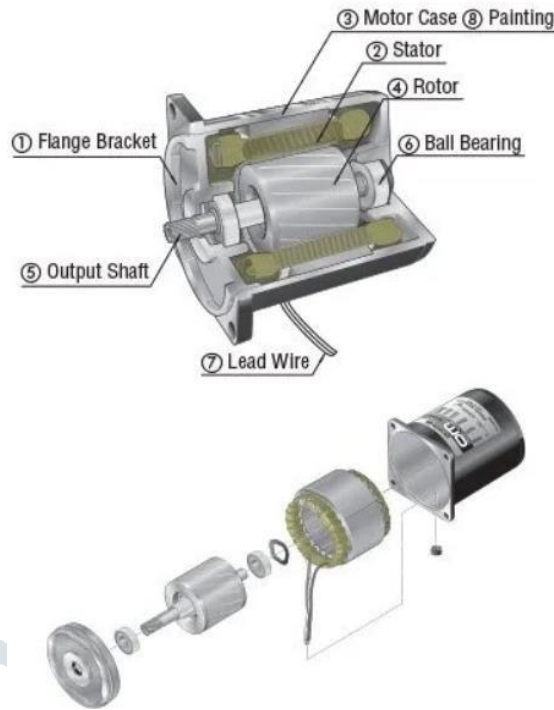
Step 2) this energy stored in battery.

Step 3) energy in battery and construct into AC and power an electric motor which turns wheel.

Step 4) electric vehicle feel lighter than drive as electric cars accelerator faster than traditional.

Motor:

- 1) Main function of motor is to convert electric energy into mechanical energy.
- 2) brushless DC motor is commonly used.
- 3) it has only two part and containing stator.
- 4) The rotor is rotating part which carry permanent magnet and stator winding.



Advantages:

1. Nonpolluting: Electric vehicles do not require fuel for combustion. There are no emissions or gas exhaust. Vehicles that run on fossil fuel are dangerous for the environment. Therefore, electric vehicles help in contributing to cleaner environment.
2. Power on which electrical vehicle run is renewable power while conventional vehicles use fossil fuel for combustion which in turn decreases world's fossil fuel stock which could be extinct anytime soon.
- 3) No Noise Pollution: Gasoline and diesel are more expensive than electricity when solar electricity is utilized at home battery recharging is cost effective.
- 4) Maintenance is low: Electric cars have fewer moving components compared to conventional automobile repair are also simpler and less expensive than combustion engine.
- 5) Government Support: Government throughout the world have granted break to encourage people to drive electric vehicle as part of green energy.

Disadvantages:

- 1) Driving range is less: As compared with conventional automobile electric vehicle have a shorter driving range are convert for short distance travel.
- 2) Limited options in model: As progress is still going on there are less options of model in terms of style appearance.
- 3) Charging time: Conventional vehicles require only few minutes to replenish there has their gas tank but charging electric vehicle takes many hours.
- 4) Limited charging station: compare with petrol pump there are few charging stations available. People who need to travel long distance
- 5) High initial cost: These vehicles are quite expensive.

Major Differences between ICE's and EV's:

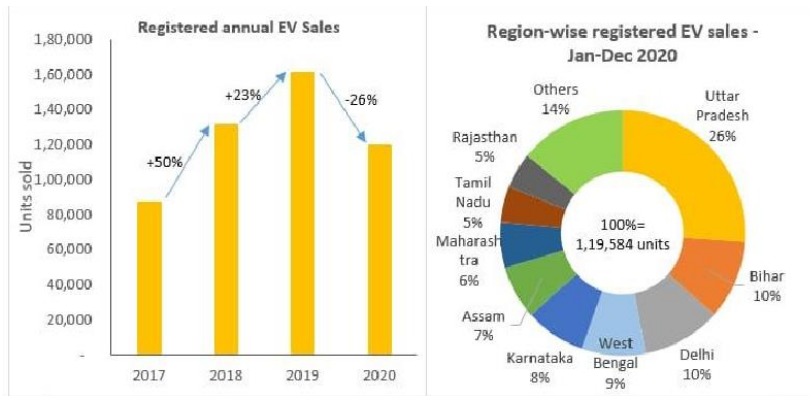
| Sr.No | IC Engines | Electric Vehicle |
|-------|--------------------------------------|-------------------------------------|
| 1 | It works on IC engine | It works on motor (Engine) |
| 2 | Specific energy of fuel is high | Specific energy of battery is low |
| 3 | Travels large distance | Travels less distance |
| 4 | Running and maintenance cost is high | Running and maintenance cost is low |
| 5 | Engine efficiency is less | Motor efficiency is more |
| 6 | Noise pollution occurs | Noise pollution does not occur |
| 7 | Complex gear system is required | Only one gear system is required |
| 8 | Short refilling time | Long charging time |

Growth and Adaptation of EV in India:

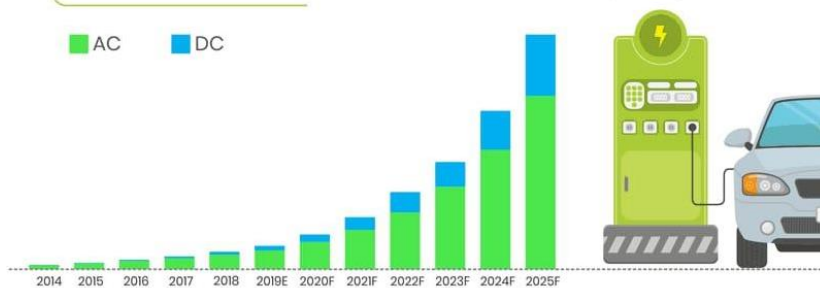
Today, India is the fifth-largest global automotive market, which includes both ICE (Internal Combustion Engines) and electric vehicles. It seems that India will grow to be the third largest global automotive market by 2030. The Indian EV market is expected to grow at a huge CAGR of 90 % in this decade to touch by \$150 billion by 2030. As there are only 6586 public charging stations available in India as on 21st March 2023 (pib.gov.in)

Up to 2030 the government is planning to make all vehicles electric vehicles.

According to data on the government’s Vahan website, approximately 9,89,000 EV’s were registered with regional transport offices in 2022 alone, indicating a more than threefold growth from 2021 already. These determines the stronghold of future of EV’s in India.



INDIA ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE) MARKET



“ The government’s target for the deployment of DC fast chargers at various corridors and highway is expected to boost the market of this category during the forecast period

| | | |
|---|--|--|
| 2019 Market Size \$1,027.9 thousand | 2025 Market Size \$13,833.0 thousand | Market Growth Rate (2019-2025) 54.2% |
|---|--|--|

Recent News Article.

Electric 2-Wheeler Registrations Nosedive to a 16-Month Low

Sharp price hike after lowering of subsidy restrained buyers in June

Shally Seth Mehila & Ashutosh Shyam

Mumbai: The dream run for India’s electric two-wheeler market has come to an abrupt halt threatening to put the government’s plans to electrify the world’s largest scooter and motorcycle market in a slow lane. Electric two-wheeler registrations have nosedived in June 2023 as buyers restrained their purchase following a price hike 15-18% after the Union govt lowered subsidy.

The overall volume dropped to the lowest in 16 months to 35,461 units till June 27, the data from vehicle registration portal Vahan shows. The steep fall has cramped the two-wheeler penetration in the overall market to 3.3% in June from 6.25% in May.

Adjusted for remaining four days sales based on the current daily volume run of 1800 units, June sales volume for the full month is likely to be around 40,000-40,500 units. This would imply a month on month decline of 61%. Based on the last five-month averages (Jan-May) of 77,728 units the drop is estimated to be slightly more than expected.

Revenue’s Phokela, chief business officer, Ather Energy said, “We were anticipating a negative impact on volumes with the price hikes post the FAME subsidy being lowered, though the drop in volumes is slightly more than expected.”

Revenue’s Phokela, chief business officer, Ather Energy’s volumes have contracted by 35-40% compared to month, but it expects sales to pick up in the next month. “We see a temporary hit to the industry but we remain optimistic in the long term. We’ve always been of the view that subsidies are gradually toned down over a period so that the market can get to more realistic market. From a long-term perspective, it is certainly a step in the right direction,” he said.

| Month | Volume (Units) | YoY % Change |
|----------|----------------|--------------|
| Jan 2022 | ~3500 | 68% |
| Feb 2022 | ~3000 | 63% |
| Mar 2022 | ~2500 | 57% |
| Apr 2022 | ~2000 | |
| May 2022 | ~1500 | |
| Jun 2022 | ~1000 | |
| Jul 2022 | ~800 | |
| Aug 2022 | ~600 | |
| Sep 2022 | ~400 | |
| Oct 2022 | ~200 | |
| Nov 2022 | ~100 | |
| Dec 2022 | ~50 | |
| Jan 2023 | ~30 | |
| Feb 2023 | ~20 | |
| Mar 2023 | ~15 | |
| Apr 2023 | ~10 | |
| May 2023 | ~8 | |
| Jun 2023 | ~5 | |

REVISED SUBSIDY NORMS KICK IN

Electric Scooter Sales Cross 100,000 for the First Time

Sales more than double in May as consumers advance purchases ahead of price rise

Sharmista Mukherjee
@timesgroup.com

New Delhi: Sales of electric two-wheelers more than doubled in May from a year ago — topping 100,000 units for the first time — pushed up by customers wanting to avoid the anticipated increase in vehicle prices.

Prices of electric two-wheelers registered on or after June 1 are set to increase with the government reducing the subsidy it was providing under its FAME II (Faster Adoption and Manufacturing of Electric Vehicles) scheme.

Data available on VAHAN portal of the ministry of road, transport & highways (MoRTH) shows as many as 104,771 high-speed electric scooters were registered last month, an increase of 148% over May 2022. Overall, two-wheeler sales (petrol and electric) surged by 11% in the same period.

With this, penetration of electric two-wheelers, measured in terms of registration of scooters, motorcycles and mopeds, increased to 7% last month, from 5.4% in April 2023.

“With new reduced subsidy norms to kick in from June 1, 2023, most EV OEMs are to take price hikes in the range of ₹15,000-₹30,000 (approximately 10%-15%), leading to pre-buying in May 2023,” said Elnara Capital in a note.

TVS Motor Company, Ather Energy, Ola Electric and Ampere are among the companies that have revised prices of their vehicles. Ola Electric, though, has said it is not increasing prices at the moment.

“We have recorded the best monthly sales in May 2023, with total sales of 15,256 units, registering 357% year-on-year growth,” said Ramesh Singh Phokela, chief business officer at Ather Energy.

“The market gained strong momentum this month, which can be attributed to the growing and news of the impending revision of the FAME subsidy. This led to consumers beginning forward purchases in order to avail the subsidy amount.”

Ola Electric, too, reported growth of 300% to 68,000 units in May, its best-ever monthly sales.

| Company | Sales (in units) |
|------------------|------------------|
| Ola Electric | 28,438 |
| TVS Motor | 21,254 |
| Ather Energy | 15,256 |
| Bajaj Auto | 9,911 |
| Ampere | 8,625 |
| Cherry EV | 3,875 |
| Okonovo | 2,805 |
| Hero Electric | 2,109 |
| SGGwin | 1,811 |
| Battini Electric | 1,199 |

CONCLUSION:

The data presented underlines the urgent need for India to transition from conventional fuel sources to more sustainable alternatives. The dominance of coal-based power plants and the heavy reliance on petrochemical fuels for transportation have severe environmental consequences, contributing to greenhouse gas emissions, air pollution, and climate change. Moreover, economic dependencies on imported fuels and the fiscal burden of subsidies add to the challenges faced by the country. Electric vehicles emerge as a promising solution to address these problems. By adopting EVs, India can significantly reduce its carbon footprint, improve air quality, and mitigate the health risks associated with air pollution. The government's initiatives to promote electric mobility, such as the FAME scheme, are encouraging the adoption of EVs, and the data indicates a growing trend in the number of registered EVs in the country. However, challenges remain, including limited charging infrastructure, higher initial costs, and shorter driving ranges compared to conventional vehicles. To overcome these hurdles, continued investments in charging infrastructure, technological advancements, and policy support are necessary. India's ambition to achieve 30% electric vehicle penetration by 2030 demonstrates the commitment to a sustainable and greener future. In conclusion, the data underscores the imperative for India to accelerate the transition towards electric vehicles and renewable energy sources to mitigate environmental damage, reduce economic dependencies, and improve public health. By embracing sustainable alternatives, India can pave the way for a cleaner, greener, and more resilient future.

References:

1. <https://gomechanic.in/blog/electric-vehicles-types-explained/>
2. https://www.ceicdata.com/datapage/charts/o_india_petroleum-pdt-consumption-furnace-oil-fo-total/?type=area&from=2007-03-01&to=2018-03-01&lang=en
3. <https://www.businesstoday.in/opinion/columns/story/how-data-is-fueling-the-growth-for-electric-vehicles-in-india-384416-2023-06-06>
4. https://www.researchgate.net/figure/Comparison-Of-Engine-Vehicles-Vs-Electric-vehicles_tbl2_323497072
5. https://en.m.wikipedia.org/wiki/Electricity_sector_in_India
6. [https://www.enerdata.net/estore/energy-market/india/#:~:text=Coal%20is%20the%20country's%20top,%2C%20and%20wind\)%204%25](https://www.enerdata.net/estore/energy-market/india/#:~:text=Coal%20is%20the%20country's%20top,%2C%20and%20wind)%204%25)

