



SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107



AN AUTONOMOUS INSTITUTION

Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

ENERGY SCENARIO IN INDIA TRANSPORTATION PURPOSE:

The energy scenario for transportation in India is a vital aspect of the country's overall energy landscape, given the rapidly growing population, urbanization, and economic development. The transportation sector is one of the largest consumers of energy in India and plays a critical role in the country's energy security, environmental sustainability, and economic growth. Here's an overview:

1. Energy Consumption in Transportation

- **Sectoral Breakdown:**
 - **Road Transport:** Road transport is the dominant mode, accounting for the majority of energy consumption in the transportation sector. This includes passenger vehicles, commercial vehicles, two-wheelers, and buses.
 - **Railways:** Indian Railways, which is one of the largest railway networks in the world, consumes significant energy, primarily in the form of diesel and electricity.
 - **Aviation:** The aviation sector, though smaller in comparison to road and rail, is growing rapidly with increasing domestic and international air travel.
 - **Shipping:** India's shipping industry, both coastal and international, also contributes to the sector's energy consumption, primarily through the use of marine diesel and bunker fuel.
- **Fuel Sources:**
 - **Petroleum Products:** The transportation sector is heavily dependent on petroleum products, particularly diesel and petrol. Diesel is the most consumed fuel, used extensively in commercial vehicles, buses, and railways.
 - **Compressed Natural Gas (CNG):** CNG is increasingly used in urban public transport systems, including buses, taxis, and auto-rickshaws, particularly in cities like Delhi and Mumbai.
 - **Electricity:** Electrification is gradually increasing in the transportation sector, particularly in railways and the emerging electric vehicle (EV) market.
 - **Biofuels:** Ethanol-blended petrol and biodiesel are being promoted as alternatives to reduce dependence on fossil fuels and lower carbon emissions.

2. Road Transport

- **Vehicle Growth:**

- **Rapid Expansion:** India has witnessed a significant increase in the number of vehicles, with the growth of two-wheelers, cars, and commercial vehicles. This has led to a corresponding rise in energy demand, predominantly for diesel and petrol.
- **Urbanization Impact:** Urban areas account for a large share of the vehicle population, leading to increased fuel consumption, traffic congestion, and air pollution.
- **Fuel Consumption:**
 - **Diesel Dominance:** Diesel is the most widely used fuel in the transportation sector, especially for heavy-duty vehicles like trucks and buses. It accounts for around 70% of the total fuel consumption in road transport.
 - **Petrol Usage:** Petrol is primarily used in passenger cars and two-wheelers, which constitute a significant portion of the vehicle fleet.
- **Energy Efficiency:**
 - **Fuel Efficiency Standards:** The Indian government has implemented Corporate Average Fuel Efficiency (CAFE) standards to improve the fuel efficiency of vehicles, thereby reducing overall fuel consumption.
 - **Technological Advances:** The adoption of more efficient engines, hybrid vehicles, and alternative fuel vehicles is expected to improve energy efficiency in road transport.

3. Rail Transport

- **Electrification:**
 - **Expanding Electrification:** Indian Railways has been actively working towards electrifying its network, with a target to achieve 100% electrification by 2030. Currently, a significant portion of the railway network is already electrified.
 - **Energy Efficiency:** Electrification reduces reliance on diesel and improves energy efficiency. Electric trains are more efficient and have lower operating costs compared to diesel locomotives.
- **Diesel Use:**
 - **Transition Phase:** Despite increasing electrification, diesel locomotives are still in use, particularly in non-electrified sections of the network. The gradual phase-out of diesel locomotives is planned as electrification progresses.
- **Sustainability Initiatives:**
 - **Solar and Wind Energy:** Indian Railways is exploring the use of solar and wind energy to power railway operations, including the installation of solar panels on station rooftops and along railway tracks.

4. Aviation Sector

- **Growth in Air Travel:**
 - **Expanding Market:** India's aviation sector is one of the fastest-growing in the world, driven by increasing demand for both domestic and international

travel. This has led to rising fuel consumption, particularly aviation turbine fuel (ATF).

- **Fuel Efficiency:** Airlines are adopting more fuel-efficient aircraft and optimizing flight operations to reduce fuel consumption and emissions.
- **Sustainable Aviation:**
 - **Biofuels:** There is growing interest in the use of biofuels in aviation to reduce carbon emissions. The Indian government is encouraging research and development in this area.
 - **Carbon Offsetting:** Indian airlines are also participating in global carbon offsetting schemes like CORSIA (Carbon Offsetting and Reduction Scheme for International Aviation) to mitigate the environmental impact of air travel.

5. Shipping and Maritime Transport

- **Energy Use:**
 - **Marine Diesel:** Shipping in India relies heavily on marine diesel and bunker fuel, which are used by both coastal and international shipping vessels.
 - **Efficiency Improvements:** Efforts are being made to improve the energy efficiency of the shipping industry, including the adoption of more efficient engines and hull designs.
- **Green Shipping Initiatives:**
 - **LNG as Fuel:** The use of liquefied natural gas (LNG) as a cleaner alternative to marine diesel is being explored for shipping, though adoption is still in the early stages.
 - **Renewable Energy Integration:** There are initiatives to explore the use of renewable energy, such as wind and solar, to supplement power for maritime operations.

6. Emerging Trends and Innovations

- **Electric Vehicles (EVs):**
 - **Government Push:** The Indian government is strongly promoting the adoption of electric vehicles to reduce dependence on fossil fuels and cut emissions. Incentives under schemes like FAME (Faster Adoption and Manufacturing of Hybrid and Electric Vehicles) are encouraging EV adoption.
 - **EV Infrastructure:** The development of charging infrastructure is key to supporting the growth of EVs. Major cities are seeing an increase in the number of public charging stations.
 - **Two-Wheelers and Public Transport:** The focus on electrifying two-wheelers and public transport, such as buses and three-wheelers, is particularly strong, given their widespread use in India.
- **Alternative Fuels:**
 - **CNG and LNG:** The use of compressed natural gas (CNG) and liquefied natural gas (LNG) is being promoted as cleaner alternatives to petrol and diesel. CNG is particularly popular in urban public transport, while LNG is being considered for long-haul trucking and shipping.

- **Biofuels:** The blending of ethanol with petrol and biodiesel with diesel is part of India's strategy to reduce oil imports and carbon emissions. The government has set targets for increasing the ethanol blend in petrol to 20% by 2025.
- **Smart and Sustainable Mobility:**
 - **Shared Mobility:** Ride-sharing and car-pooling platforms are becoming more popular, particularly in urban areas, helping to reduce the number of vehicles on the road and overall energy consumption.
 - **Public Transport Enhancement:** Investments in public transport infrastructure, such as metro systems and electric buses, are aimed at providing energy-efficient and sustainable mobility options in cities.
 - **Smart Cities:** The Smart Cities Mission includes plans to integrate smart transportation solutions, such as intelligent traffic management systems, to optimize energy use and reduce congestion.

7. Challenges in the Transportation Sector

- **Dependence on Fossil Fuels:** The transportation sector's heavy reliance on fossil fuels, particularly diesel and petrol, poses significant challenges in terms of energy security and environmental sustainability. Reducing this dependence is a key priority.
- **Infrastructure Development:** The development of infrastructure, including roads, railways, ports, and charging stations for EVs, is crucial to support the growing demand for transportation and the shift towards cleaner energy sources.
- **Environmental Impact:** The transportation sector is a major contributor to air pollution and greenhouse gas emissions. Balancing the need for mobility with environmental concerns is a significant challenge.
- **Energy Efficiency:** Improving energy efficiency across all modes of transport is essential to reduce fuel consumption and emissions. This requires investment in technology, innovation, and policy support.
- **Affordability and Accessibility:** Ensuring that cleaner and more efficient transportation options are affordable and accessible to all segments of the population is critical for widespread adoption.

8. Government Policies and Initiatives

- **National Electric Mobility Mission Plan (NEMMP):** The NEMMP aims to promote electric vehicles through incentives, subsidies, and infrastructure development. The plan envisions a significant shift towards EVs by 2030.
- **FAME Scheme:** The FAME (Faster Adoption and Manufacturing of Hybrid and Electric Vehicles) scheme provides financial incentives to promote the adoption of electric and hybrid vehicles, with a focus on public and shared transport.
- **National Policy on Biofuels:** The policy promotes the use of biofuels in the transportation sector, with targets for ethanol blending in petrol and biodiesel blending in diesel. It aims to reduce dependence on imported oil and lower emissions.

- **Smart Cities Mission:** Under the Smart Cities Mission, the government is promoting the development of integrated, sustainable urban transportation systems, including public transport, non-motorized transport, and smart traffic management.
- **Railway Electrification and Modernization:** Indian Railways is undergoing significant electrification and modernization efforts, aimed at reducing diesel use, improving energy efficiency, and integrating renewable energy into its operations.