WORKING PAPER #3 Version 1.0 (ACPET Energy Futures Lab): This working paper presents preliminary research on low-emission transport pathways for India. It shares early modelling results to inform discussion, support evidence-based policy thinking, and invite constructive feedback from experts and stakeholders. The analysis reflects ongoing work by the research team and may be refined as new data, comments, or policy developments become available.

PATHWAYS FOR A LOW-EMISSION TRANSPORT FUTURE IN INDIA

ASHOKA UNIVERSITY
CENTRE FOR A People-centric Energy Transition

Authors

Ms. Navya (Junior Research Associate)

Dr. Anandajit Goswami (Research Lead & Senior Research Fellow)

Ms. Ilika Mohan (Research Manager)

Institution

Ashoka Centre for a People-Centric Energy Transition (ACPET)

Location - Plot no.222, Second Floor, Okhla Industrial Estate, Phase III, New Delhi-110020

Email

contact@acpet.ashoka.edu.in

Website

https://www.acpet.ashoka.edu.in/

LinkedIn

https://www.linkedin.com/company/ashoka-centre-for-a-people-centric-energy-transition-acpet/

Abstract

India's transport sector plays a critical role in its economic development. It accounts for nearly 19% of total final energy consumption and 14% of energy-related greenhouse gas emissions, with road transport dominating both energy use and emissions. As India pursues its climate commitments, including a 45 percent reduction in emissions intensity by 2030 and net-zero emissions by 2070, the sector must transition toward cleaner and more efficient mobility systems. This working paper models future transport energy demand and emissions using the LEAP-ACPET Transport Model, which combines top-down macroeconomic projections with bottom-up technology and fuel characteristics to estimate activity levels, modal shifts, technology transitions, and fuel efficiency improvements. Two scenarios are assessed through 2050. The Business-as-Usual pathway continues current trends, while the Ambitious pathway incorporates stronger policy action. Results show that under Business-as-Usual, transport emissions rise steadily, while the Ambitious pathway leads to emissions in 2050 that are about 30 percent lower, along with 13 percent lower energy demand. The findings highlight the importance of accelerated electrification, efficiency improvements, expansion of public transport, and freight modal shift to rail. Timely action to scale these interventions can significantly slow the sector's energy- and emissions-growth trajectory. If implemented effectively over the coming decade, these measures can reduce long-term reliance on fossil fuels and associated emissions in the transport sector.

Introduction

As an economy grows and population levels rise, there is an increased demand for movement of both people and goods. This increased demand for mobility in turn drives up the demand for energy for transportation, still largely met by fossil fuels (India Energy & Climate Centre, 2024). In India, the transport sector is one of the largest energy consumers, accounting for nearly 19 % of final energy use in 2020 (CEEW, 2022). It accounts for nearly 90% of the total crude oil demand in the country, most of which is met through imports (India Energy & Climate Centre, 2024). This continued dependence on imported crude oil not only raises concerns for India's energy security but also adds to environmental pressures such as rising greenhouse gas emissions and worsening air quality.

India aims to achieve a net-zero economy by 2070 and reduce the emission intensity of its GDP by 45% by 2030 as part of its commitment to emissions reduction under the Paris Agreement. As part of these commitments, India also aims to meet 50 per cent of its energy requirements from renewable energy sources and reach 500 GW of non-fossil energy capacity by 2030 (Government of India, Updated First Nationally Determined Contribution Under the Paris Agreement, 2022). As a major source of greenhouse gas emissions, accounting for 14 percent of the country's total energy-related greenhouse gas emissions (NITI Aayog, 2021), of which road transport alone accounts for more than 90%, the transport sector plays a vital role in achieving these goals. Thus, identifying and modelling pathways for reducing emissions from the transport sector is critical to achieving India's climate goals such as becoming a net-zero economy by 2070. While several broad strategies exist, India still lacks a clear, data-driven roadmap that is grounded in systematic data analysis and modelling to prioritise interventions, evaluate their long-term impacts, and align multiple strategies into coherent future pathways that link technology, policy, and behavioural shifts in a consistent direction toward a low carbon transport future The strategies that have been identified for reducing emissions from the transport sector are as follows:

- **Electrification** across all major vehicle categories.
- **Adoption of cleaner fuels** and gradual phase-down of conventional fossil fuels.
- **Improvements in fuel economy** and overall vehicle efficiency.
- **Modal shift** from private vehicles to public and shared transport.
- **Biofuel blending** targets — including ethanol, biodiesel, and compressed biogas (CBG) in petrol, diesel, and CNG.

Over the past decade, several major policy measures have been introduced to operationalise these strategies:

1. **The Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles (FAME) scheme,** launched under the National Electric Mobility Mission Plan, promotes the adoption of electric and hybrid vehicles across segments (two-wheelers, three-wheelers, passenger cars, and buses) and supports the development of charging infrastructure. FAME Phase-II, operational since 2019 and extended to 2024, allocates ₹10,000 crore for demand incentives like financial subsidies and tax rebates and infrastructure deployment (Ministry of Heavy Industries, 2023).
2. **The Corporate Average Fuel Efficiency (CAFÉ)** regulations mandate that automobile manufacturers achieve a fleet-average fuel efficiency of 130 g CO_2/km under Phase I (implemented in 2017) and 113 g CO_2/km under Phase II (effective from 2022), thus demonstrating that the standards are becoming more stringent over time (Bureau of Energy Efficiency, 2020).
3. India has also set some targets for emissions reduction from the sector, such as the target of achieving 45% share of rail in freight by 2030 under the National Rail Plan (Ministry of Railways, 2022) and EV30@30 target that aims to achieve 30% of the sales to be EVs by 2030 (Ministry of Heavy Industries, 2025). These targets represent shifts in modal and fuel shares that act as key means to achieve emission reduction, since shifting freight movement to energy-efficient rail transport and increasing the share of clean alternative technologies help lower overall transport sector emissions. There are also some targets for biofuel blending under National Policy on Biofuels (Ministry of Petroleum & Natural Gas, 2018):

- Ethanol (20% by 2030 – already achieved nationwide in 2025)
- Biodiesel (5% by 2030)

Together, these measures represent India's early steps toward a lower-emission transport future, but significant implementation and coordination challenges remain.

This working paper explores possible pathways for reducing emissions from India's transport sector. It aims to inform policy decisions by assessing how different combinations of strategies could shape future energy use and emissions trajectories in line with India's national commitments. The analysis is conducted using the Low Emissions Analysis Platform (LEAP), an energy-modelling tool developed by the Stockholm Environment Institute (SEI). LEAP is particularly suited for this study as it provides a transport-ready structure that enables detailed modelling of technology and fuel interventions, captures both greenhouse gases and air pollutants to assess co-benefits, and remains user-friendly and scalable for national and subnational analyses. It has been widely applied in developing countries, including in the preparation of over 30 NDC submissions to the Paris Agreement. LEAP's interoperability with other models such as CGE, GAINS, and WEAP facilitates integrated energy–environment planning, while its low initial data requirements and built-in Technology and Environmental Database (TED) allow easy incorporation of emission factors and scenario creation. Through this platform, future energy demand and emissions are estimated up to 2050, providing insights to support long-term energy planning and guide policy priorities for building a low-emission transport system.

Objectives

This working paper aims to explore possible pathways for low carbon and energy efficient future for India's transport sector, developed against the backdrop of India's long-term vision of achieving Net Zero emissions by 2070 and the developmental goals under Viksit Bharat @2047. The objectives of the study are two-fold:

1. **Quantify future energy demand and emissions trajectories**
   Estimate the transport sector's energy use and greenhouse gas emissions through 2050 under two contrasting scenarios:
- a **Business-as-Usual (BAU)** pathway reflecting continuation of current trends and policies, and
- an **Alternative pathway** capturing the combined effects of key transition strategies such as vehicle electrification, adoption of cleaner fuels, improvements in fuel efficiency, and modal shifts towards cleaner modes of transport.

2. **Derive policy insights for a low-emission transport transition**

Draw upon the scenario outcomes to identify policy measures that can guide India's transport system towards a sustainable and low-emission future in line with national climate commitments such as achieving net-zero by 2070.

To achieve these objectives, the study adopts the following methodological framework:

Methodology

LEAP-ACPET Transport Model

This study employs a hybrid modelling framework, termed 'hybrid' because it links **top-down projections** of transport activity with **bottom-up estimation** of energy use and emissions, integrating macroeconomic drivers with detailed technological and modal characteristics. Based on the correlation between per capita mobility and GDP per capita (Dhar & Shukla, 2015), the **top-down component** estimates total passenger and freight transport demand using GDP and population growth as primary macroeconomic drivers, along with per capita transport demand saturation limits that reflect practical constraints on how much travel can increase over time. The saturation of passenger mobility demand has been observed in developed countries such as the US, Germany, Japan and South Korea (Dargay et al., 2014). This is rooted in the idea that as income and population levels rise, people travel more, but this trend tapers off once a certain threshold is reached. A similar saturation limit is assumed for freight mobility, grounded in evidence that freight transport intensity (tonne-km per GDP) stabilises or declines as economies become service-oriented (ITF-OECD, 2024). This implies that freight activity per capita eventually reaches a steady state, and the model integrates this behaviour to capture the slowing growth of transport demand in mature economies in line with India's Viksit Bharat vision for 2047.

The **bottom-up component** disaggregates transport activity across vehicle categories and technologies to determine energy demand and GHG emissions. This includes:

- Detailed vehicle segmentation (cars, buses, trucks, two-wheelers, etc.) to capture variation in usage and energy intensity
- Transitions in technology mix, including shifts from internal combustion engines (ICEs) to hydrogen fuel cell vehicles (FCVs), electric vehicles (EVs), and other alternative fuels
- Mode- and technology-specific fuel/energy intensities

The model further identifies five key levers shaping future energy and emissions trajectories: GDP and population growth, saturation limits for per capita demand, changes in modal split, transitions in technology mix, and improvements in vehicle fuel efficiency. These levers form the basis for scenario analysis, enabling exploration of alternative pathways and supporting policy recommendations for a cleaner, more energy-efficient transport sector.

The LEAP–ACPET transport model captures energy demand and greenhouse gas (GHG) emissions from India's transport sector across three primary modes: road, rail, and air. Each mode is further divided into passenger and freight sub-modes to reflect the distinct activity patterns and energy-use characteristics of these segments. For road transport, passenger activity includes cars, two-wheelers, buses, and other vehicle types, while freight activity is represented by heavy and light commercial vehicles. Heavy commercial vehicles (HCVs) in the model also include medium commercial vehicles. Water transport has not been included in the current version of the model due to limited data availability, particularly for coastal shipping.

The model's temporal coverage spans from 2019–20 to 2049–50, using 2019–20 as the base year. The base year has been selected to align with the most recent year for which comprehensive, pre-pandemic transport activity and energy consumption data are available across official sources such as MoRTH, Ministry of Railways, and Directorate General of Civil Aviation. The terminal year 2049–50 corresponds to mid-century planning horizons commonly adopted in national energy and climate modelling exercises and aligns with India's long-term vision of Viksit Bharat @2047. . Energy demand and emissions are estimated annually over this period. Five fuel types, gasoline/petrol, diesel, compressed natural gas (CNG), electricity, and hydrogen fuel cells (FCVs), are represented in the technological pathways, enabling simulation of transitions in the fuel and technology mix.

It is important to note that the air transport component of the model covers only the domestic aviation sector. This ensures consistency with the model's national scope and avoids overlap with international aviation emissions, which are accounted for separately in global inventories.

Figure 1 illustrates the hierarchical structure of the transport model, showing the classification of modes, sub-modes, and vehicle types across the transport sector.

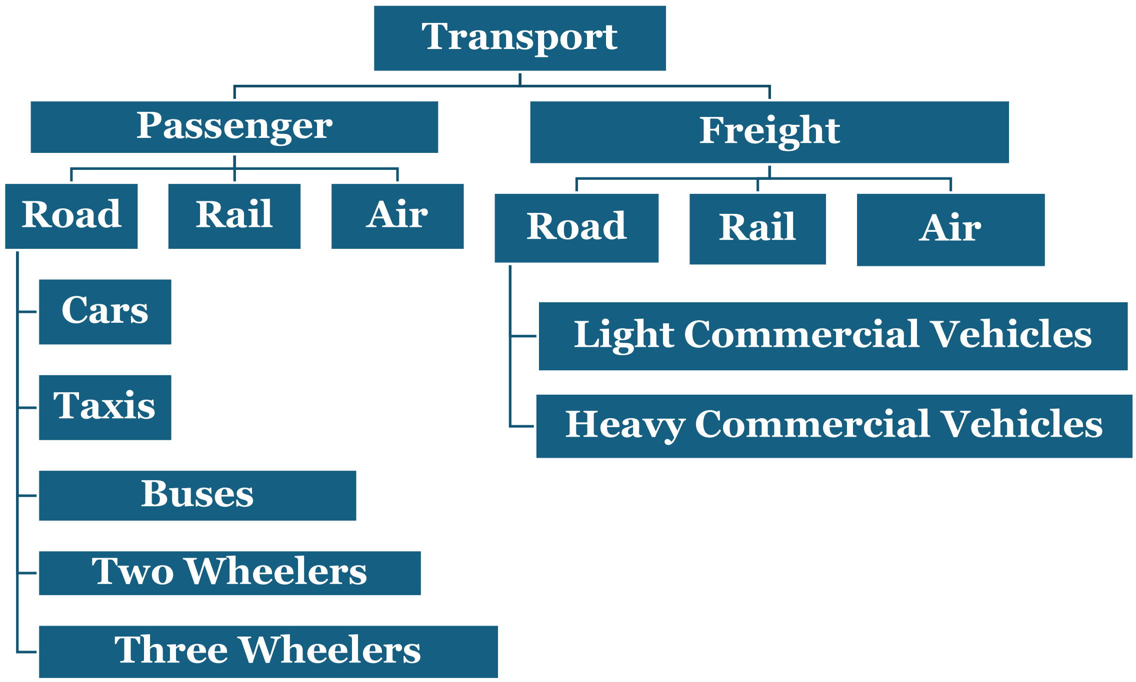


Figure 1: Categorical Disaggregation of the Transport Sector in the Model

The LEAP–ACPET transport model applies the ASIF framework (Activity–Structure–Intensity–Fuel) to systematically estimate energy demand and GHG emissions from India's transport sector. Originally conceptualized by Schipper et al. (1999) and used in the UNFCCC (2018) *Compendium on GHG Baselines and Monitoring – Passenger and Freight Transport*,

the ASIF approach decomposes total emissions into four core components:

$$GHG\ Emissions\ =\ A\ \times\ S\ \times\ I\ \times\ F$$

where:

- **A (Activity):** The total volume of passenger or freight transport, typically measured in passenger-kilometres (PKM) and tonne-kilometres (TKM). This reflects the scale of transport demand driven by demographic and economic factors.
- **S (Structure):** The modal composition of transport activity across road, rail, and air, as well as the distribution across vehicle types within these modes. Changes in modal shares (e.g., shifting from private vehicles to public transport) directly influence emissions outcomes.
- **I (Intensity):** The energy intensity of transport modes and vehicle types, expressed as energy consumption per kilometre of travel. This captures technological improvements in fuel efficiency over time.

- **F (Fuel):** The emission factor associated with different fuel types, measured in tonnes per unit of energy. This component reflects the carbon intensity of the energy mix, including transitions to cleaner fuels like electricity or hydrogen.

The ASIF framework (Schipper et al., 1999) provides a robust and transparent analytical structure to examine how policy interventions and technological changes can influence each component and thereby reduce sectoral GHG emissions. It is widely used in transport energy modelling studies for its ability to isolate the contribution of activity growth, modal shifts, technology adoption, and fuel transitions to total emissions.

In this study, the ASIF framework is operationalized within LEAP by linking demographic and macroeconomic projections (GDP and population) to transport demand, disaggregating it by mode, vehicle type, and technology mix, and combining it with energy intensities and fuel-specific emission factors.

Figure 2 illustrates this process flow, showing the relationships between key inputs (e.g., GDP, population, modal split, fuel efficiency) and outputs (energy demand and GHG emissions).

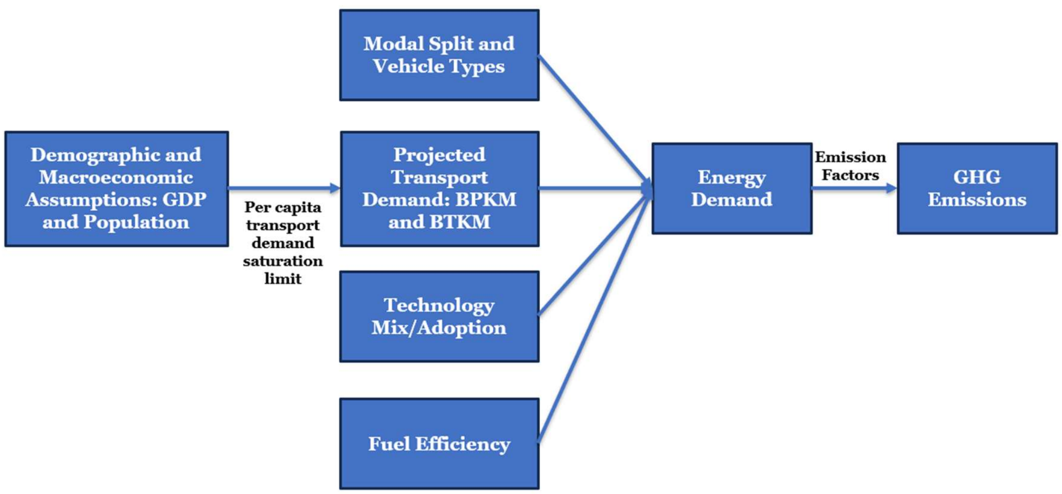


Figure 2: Flow of LEAP's Calculations

Historical Transport Demand Estimation

Historical transport demand was estimated for road, rail, and air modes over a 20-year period from 1990-00 to 2019-20. The methodology applied for each mode is described below:

Road Transport

The historical road transport demand was calculated using the following equation:

$$BPKM\ or\ BTKM = On - road\ vehicles \times Average\ annual\ distance\ travelled \times Occupancy\ or\ Payload$$

Source: ACPET LEAP Model

This yielded total billion passenger-kilometres (BPKM) for passenger vehicles and billion tonne-kilometres (BTKM) for freight vehicles.

- On-road vehicles were estimated from registered vehicle data reported by the Ministry of Road Transport and Highways (MoRTH), based on assumed vehicle lifetimes.
- Average annual distance travelled, and occupancy/payload factors were obtained from secondary literature.

Detailed assumptions on vehicle life, annual distance travelled, occupancy and payload can be found in the appendix.

This estimation was carried out separately for all road vehicle categories: cars, taxis, buses, two-wheelers, three-wheelers, light commercial vehicles, and heavy commercial vehicles. The total road passenger and freight activity, expressed in BPKM and BTKM respectively, was then obtained by aggregating the values across these categories.

Rail Transport

Data for rail transport activity was obtained directly from the Indian Railways Yearbook, which provides annual statistics on passenger and freight movement.

Air Transport

Data for air transport activity was sourced from the Directorate General of Civil Aviation (DGCA) Yearly Statistics, covering domestic passenger-kilometres and freight movement within India.

Base year data in the model

This provides the base year 2019-20 data for total transport demand broken down by passenger and freight, % (percentage) share of modes under passenger and freight, %

(percentage) share of categories under road (passenger and freight), and % (percentage) share of fuels represented under each category across all modes (passenger and freight) are assumed based on literature review/ review of existing models.

The model uses 2019–20 as the base year, representing the last pre-pandemic year with complete and reliable transport activity and fleet data across modes. Projections commence from 2020–21, which coincides with the onset of COVID-19; however, the pandemic's short-term disruptions are not explicitly modelled. The projections instead represent the long-term evolution of transport energy demand based on structural factors such as economic growth, vehicle ownership, and technology transitions, without accounting for the temporary mobility restrictions and demand shocks experienced during 2020–21 and 2021–22.

Fuel consumption for the base year is calculated using the following relation:

$$Final\ Energy\ Intensity\ or\ Fuel\ Efficiency\ (l/km\ or\ kwh/km)\ = 1/\ (Occupancy\ (passenger)\ or\ Payload\ (freight)\ \times\ Vehicle\ Mileage\ (km/litre\ or\ km/kWh))$$

Detailed assumptions on vehicle mileage can be found in the appendix.

This provides estimates of fuel consumption, which are then converted into energy demand using standard fuel-to-energy conversion factors based on the energy content of each fuel type.

The resulting energy demand value is multiplied by standard emission factors (from secondary sources such as IPCC) to estimate total CO_2 emissions across all modes, vehicle types/categories and fuels for the base year, i.e., 2019-20.

Base-year results have been cross-checked with publicly available projections such as NITI Aayog's India Energy Security Scenarios (IESS) 2047, TERI's Roadmap for India's Energy Transition, and CEEW's India Transport Energy Outlook to ensure that initial model behaviour falls within credible ranges. These ranges are discussed in the Model Results Validation section.

Projection of Future Transport Demand

Future transport demand in India was projected using a saturation-based methodology that links economic growth and population increase (GDP per capita) with passenger and freight mobility. The approach is grounded in observed trends from developed countries, where transport demand tends to grow with GDP and population up to a certain level and then saturates.

1. Economic Basis of Mobility Growth

Passenger transport demand, measured in passenger-kilometres (pkm), is closely correlated with the economic activity of a country. Based on the correlation established between the two by Dhar and Shukla (2015), a logarithmic relationship was assumed between per capita GDP and per capita passenger transport demand:

$$z = LN\left(\frac{S}{(S_o - S)}\right) = LN\left(\frac{GDP}{Capita}\right) * a + b$$

Where:

- S = per capita passenger transport demand (pkm)
- S_o= saturation limit (maximum per capita demand)
- a= regression coefficient
- b = regression constant

The assumption behind this model is that as income and population levels rise, people travel more, but this trend eventually plateaus once a certain level of development is reached. Empirical evidence from developed economies shows that inland passenger mobility generally falls within 12,000–20,000 pkm per capita, for example:

- **United Kingdom:** Domestic mobility remained close to **12,500 pkm/person** from 1990 to 2015 (DDPP–UK, 2017).
- **OECD North America:** Mobility was approximately **20,800 pkm/capita** in 2005 (Greenpeace & EREC, 2008).
- **OECD Europe:** Mobility was approximately **12,900 pkm/capita** in 2005 (Greenpeace & EREC, 2008).

In this model, a saturation level of **16,000 pkm/capita** was assumed for passenger demand, based on convergence with observed values in high-income countries and aligned with India's expected development trajectory.

For GDP and population historical data and projections, data was taken from the **Handbook of Statistics on Indian Economy** and **NITI Aayog's IESS 2047 (Version 3), respectively**. All GDP values are in constant 2011–12 INR to eliminate the effects of inflation and enable a consistent comparison of real economic growth over time. The 2011–12 base year is used in alignment with national accounting practices established by the National Statistical Office (NSO).

2. Freight Transport Demand

A similar methodology was used for projecting freight transport demand (in tonne-kilometres per capita), assuming a saturation level of **10,000 tkm/capita**. This is aligned with benchmarks from China, where per capita freight demand reached approximately 10,390 tkm in 2020 (OECD, 2023).

3. Use of Logistic S-Curve for Projections

$$z = LN\left(\frac{S}{(S_o - S)}\right) = LN\left(\frac{GDP}{Capita}\right) * a + b$$

Using the equation above, values for parameters **a** and **b** were estimated through regression using historical data from 1990-00 to 2019-20. The following logistic sigmoid function was used to project future per capita transport demand, separately for passenger and freight:

$$S = \left(\frac{S_o}{1 + e^{\wedge}(-z)}\right)$$

This approach generates an S-curve reflecting slow initial growth, rapid mid-stage growth, and eventual saturation.

➔ The total transport demand is calculated as the sum of passenger transport demand and freight transport demand for the historical as well as projected timeframe.

4. Estimating Energy Demand and GHG Emissions

After projecting total passenger and freight transport demand till 2049-50, for the projected timeframe 2020-21 to 2049-50, using the methodology used for base year data, the model estimates fuel consumption , which is then used to derive energy demand and CO_2 emissions, corresponding to the projected transport demand across different modes, categories, and fuel types, under different scenarios with varying assumptions regarding modal shares, efficiency improvements and transition in technology/fuel mix (shares).

*Fuel/Energy Demand = Activity level (BPKM or BTKM) * Final Energy Intensity (fuel consumed per kilometer)*

The scenarios and their assumptions are discussed in the upcoming sections.

This step-by-step approach helps the model show how changes in modal shares, changes in shares of vehicle technologies and improvements in fuel efficiency affect fuel use and emissions over time.

Scenario Description

This working paper explores plausible pathways for emissions reduction in India's transport sector through 2050 by creating two different scenarios:

1. **Business-As-Usual (BAU):** The Business-as-Usual scenario, commonly referred to as the BAU scenario, assumes that current trends and policies continue through 2050 without any new interventions to mitigate emissions from the sector.
2. **Ambitious (AMB):** The Ambitious scenario assumes aggressive mitigation efforts aimed at achieving greater emissions reduction within the sector.

Both scenarios are developed using the same set of analytical levers, but these levers operate differently across them.
The levers are as follows:

1. **Modal shifts** among road, rail, and air transport
2. **Shifts in shares of categories** within road transport (for both passenger and freight)
3. **Changes in technology mix** under each vehicle category
4. **Annual fuel efficiency improvements**

The Business-as-Usual (BAU) scenario projects a trajectory where activity-driven energy demand and emissions continue to grow through 2050, with only marginal improvements achieved through existing policies, schemes, and targets. Private transport remains the preferred mode of travel, while the adoption of cleaner fuels such as electricity and hydrogen remains limited. The policy environment is characterised by incremental progress such as gradual uptake of electric vehicles, moderate improvements in fuel efficiency, and slow uptake of public transport infrastructure.

In contrast, the Ambitious (AMB) scenario assesses the impact of a greater policy push and higher share of clean mobility technologies. This pathway assumes accelerated electrification across all vehicle segments, higher deployment of hydrogen fuel cell vehicles (FCVs), and stronger modal shifts from private to public transport. As a result, the scenario yields a future trajectory with lower overall energy demand and reduced emissions from the sector by 2050.

Policy Context: Fuel Efficiency & Electrification

India has implemented several measures to improve vehicle fuel efficiency and is actively accelerating the adoption of Electric Vehicles (EVs) through initiatives like CAFÉ and FAME. Similarly, Corporate Average Fuel Efficiency (CAFÉ) norms were notified by the Government of India in 2017, under the Energy Conservation Act 2001. The primary aims of these norms are to improve vehicle fuel efficiency and reduce emissions. These rules apply to all passenger vehicles (petrol, diesel, CNG, LPG, hybrid and electric) weighing less than 3500 kg. Rather than being applied to a single vehicle's fuel efficiency, these rules set a limit on the average fuel consumption of all vehicles sold by a manufacturer (like Maruti) in a year. The government measures the average fuel consumption per 100km and average CO_2 emissions under standard lab conditions.

The norms are as follows:

CAFÉ norms	**Average CO2 emissions**	**Average fuel consumption**	**Average kerb weight**	**Effective year**
Stage 1	Less than 130g/km	Less than 5.5L/km	1037 kg	2017-18 onwards
Stage 2	Less than 113g/km	Less than 4.7L/km	1082 kg	2022-23 onwards

Table 1: CAFÉ norms

With increasingly stringent CAFÉ standards and a trend towards heavier passenger vehicles, manufacturers are working to develop more fuel-efficient and low-emission vehicles (Bureau of Energy Efficiency [BEE], 2020).

India also has an ambitious target of at least 30 percent new electric vehicle sales by 2030, under the EV30@30 initiative, a global campaign promoting EV adoption (Clean Energy Ministerial, 2025).

These policies collectively shape the environment within which the BAU and Ambitious scenarios have been developed.

Results

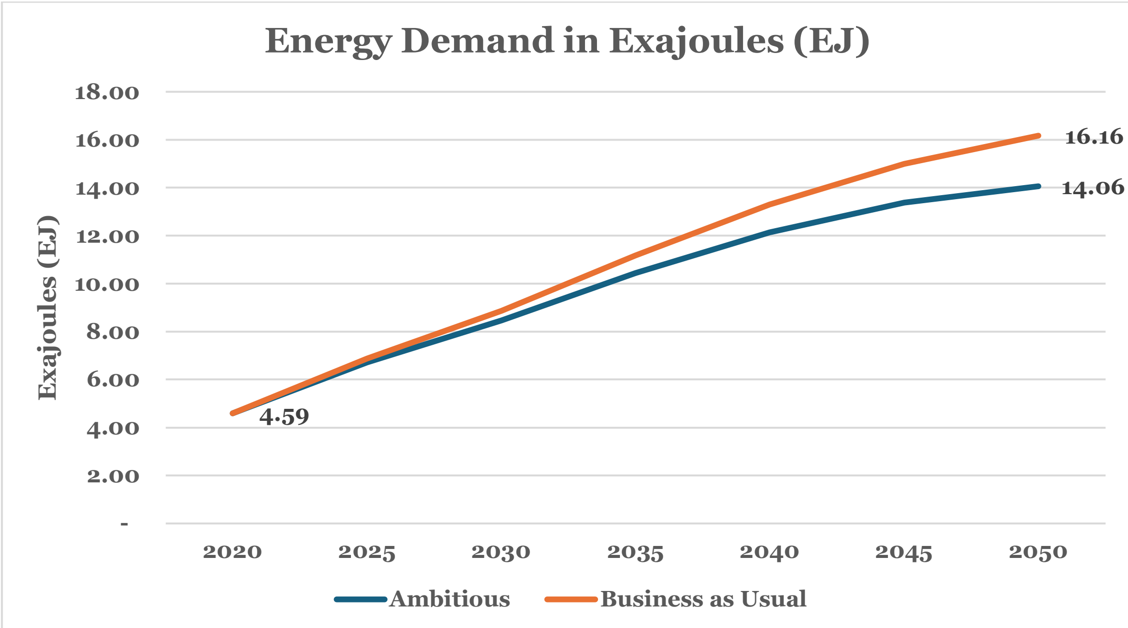


Figure 3: Transport Sector Energy Demand Projections

Figure 3 presents projected total energy demand from India's transport sector under the Business-as-Usual (BAU) and Ambitious scenarios between 2020 and 2050.

Under the BAU pathway, energy demand rises from 4.59 EJ in 2020 to 16.16 EJ in 2050, corresponding to a compound annual growth rate (CAGR) of approximately 4.3%. This growth reflects sustained expansion in passenger and freight activity driven by economic development, population increase, and continued dependence on fossil fuels. The Ambitious pathway, which assumes accelerated uptake of cleaner fuels and moderate modal shifts toward public and shared transport, results in a comparatively lower energy demand of **14.06 EJ in 2050**, around **13 percent lower** than BAU levels. Here, modal shifts refer to an increasing share of public and shared transport modes, such as rail and buses, in overall transport activity, as detailed in the scenario assumptions provided in the Appendix.

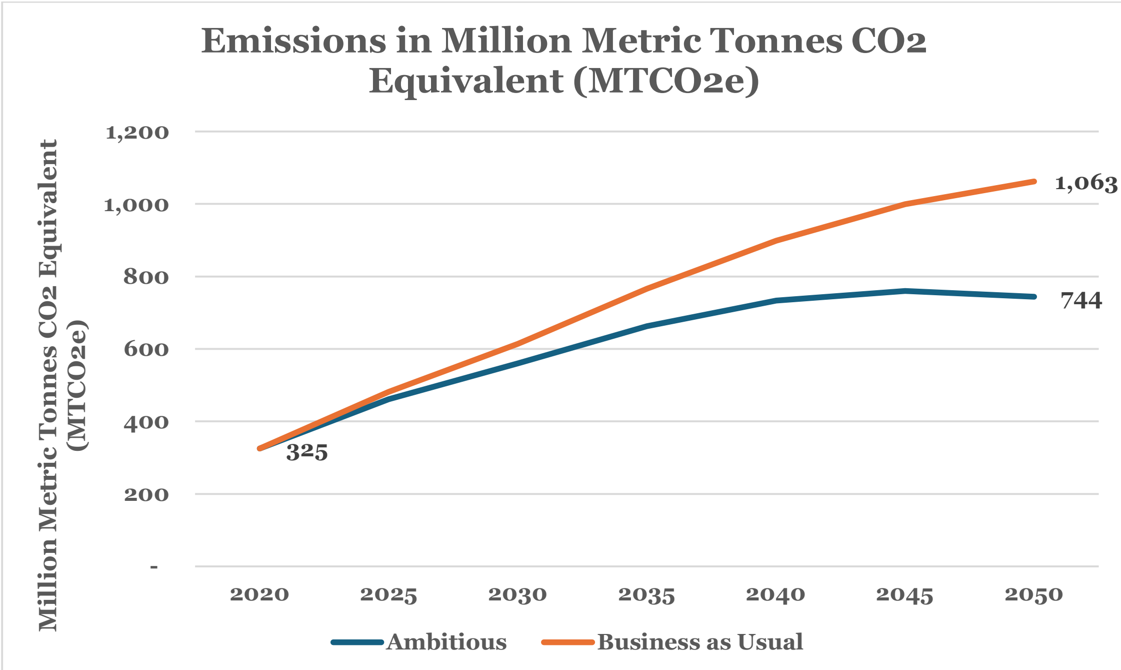


Figure 4: Transport Sector CO_2 Emissions Projections

Figure 4 shows total greenhouse-gas emissions from the transport sector over the same period. Under the BAU scenario, emissions rise steeply from **325 million tonnes CO2e in 2020** to **1,063 million tonnes CO2e in 2050**, driven by the dominance of petroleum-based fuels and the growing stock of internal-combustion vehicles.

In the BAU scenario, the scale of projected emissions could exacerbate existing environmental challenges such as poor air quality and climate change.

This will lead to poor public health and economic losses. Figure 4 shows that emissions under the Ambitious scenario increase at a slower pace, peaking around the mid-2040s and reaching **744 million tonnes CO2e by 2050**, approximately **30 percent lower** than in the BAU case.

The difference between the two scenarios becomes more visible as we move towards 2050, as differences in the level of ambition across key scenario assumptions for 2050 such as fuel mix, efficiency improvements, and modal shares lead to increasingly divergent outcomes over time. While energy demand continues to grow in both cases due to higher income levels, population growth, and expanding freight needs, the Ambitious scenario shows that ambitious and aggressive policy action can make a big difference. Measures such as improving fuel efficiency, shifting more people to public and shared transport, and introducing cleaner fuels in the mix, together slow down the overall growth in energy demand. This shows that the trajectory of India's transport energy demand and the sector's emissions will depend on how effectively efficiency improvements, cleaner fuels, and modal shifts are scaled up over the next two and a half decades.

A similar pattern is seen for emissions. In the BAU case, emissions keep increasing sharply till 2050, showing that without major policy and technological shifts, the sector remains dependent on conventional fuels for transportation. The continued use of diesel and petrol vehicles explains most of this rise and reflects a strong path dependency, as the existing vehicle fleet and fuel infrastructure continue to lock the sector into fossil-fuel use. In contrast, the Ambitious scenario reflects the combined impact of more electric vehicles, and efficiency improvements, especially visible after 2040. The curve starts to flatten slightly after the mid-2040s, suggesting that the sector could begin to see a decline in its emissions if these efforts are maintained.

The success of the interventions assumed in the Ambitious scenario depends on several enabling factors, including the availability of cleaner electricity (from non-fossil sources), adequate charging and refuelling infrastructure, development of well-planned cities that reduce the need for private travel, and behavioural shifts towards active and non-motorised modes of transport. These aspects are not explicitly modelled in this study but are critical for realising the projected decline in emissions. Lower energy use and reduced emissions generally bring wider benefits, including lower demand for petroleum products. Reduced oil consumption can make India's energy supply more secure and less dependent on imports. Lower pollution from vehicles could improve urban air quality and reduce health risks, especially in congested cities. This highlights that cleaner transport is not just about climate goals, it is equally about better health, cleaner air, and economic resilience.

Overall, the analysis shows that achieving a low-emission transport future will require ambitious and sustained policy action. The 13% lower energy demand and nearly 30% lower emissions seen in the Ambitious scenario, as compared to the BAU scenario, are a direct result of deliberate policy measures modelled as key interventions and levers. The results point to light commercial vehicles (LCVs) as the largest contributors to both energy use and emissions by 2050, highlighting the importance of targeted electrification and efficiency improvements in this segment**.** Maintaining this progress will require consistent implementation, stronger coordination between ministries, and long-term commitment to electrification, public transport, and clean fuels.

Model Results Validation

To situate the ACPET Transport Model within published studies on India's transport sector modelling, a visual cross-comparison has been carried out using results from two widely referenced sources: *India's Electric Vehicle Transition: Post-COVID-19 Economic Recovery Pathways* published by the Council on Energy, Environment and Water (CEEW) in 2020, and *Decarbonizing India's Road Transport: A Meta-Analysis of Road Transport Emissions Models* published by the International Council on Clean Transportation (ICCT) in 2022. Since the CEEW study presents modelling results for road passenger transport only, while the ICCT meta-analysis synthesises outcomes for road passenger and freight transport combined, the figures compare ACPET's road transport energy demand and tailpipe emissions within this scope. These comparisons are presented in Figure 5 (Energy Demand Comparison, 2020–2050), Figure 6 (Energy Demand Comparison, 2030) and Figure 7 (Tailpipe Emissions Comparison, 2020–2050).

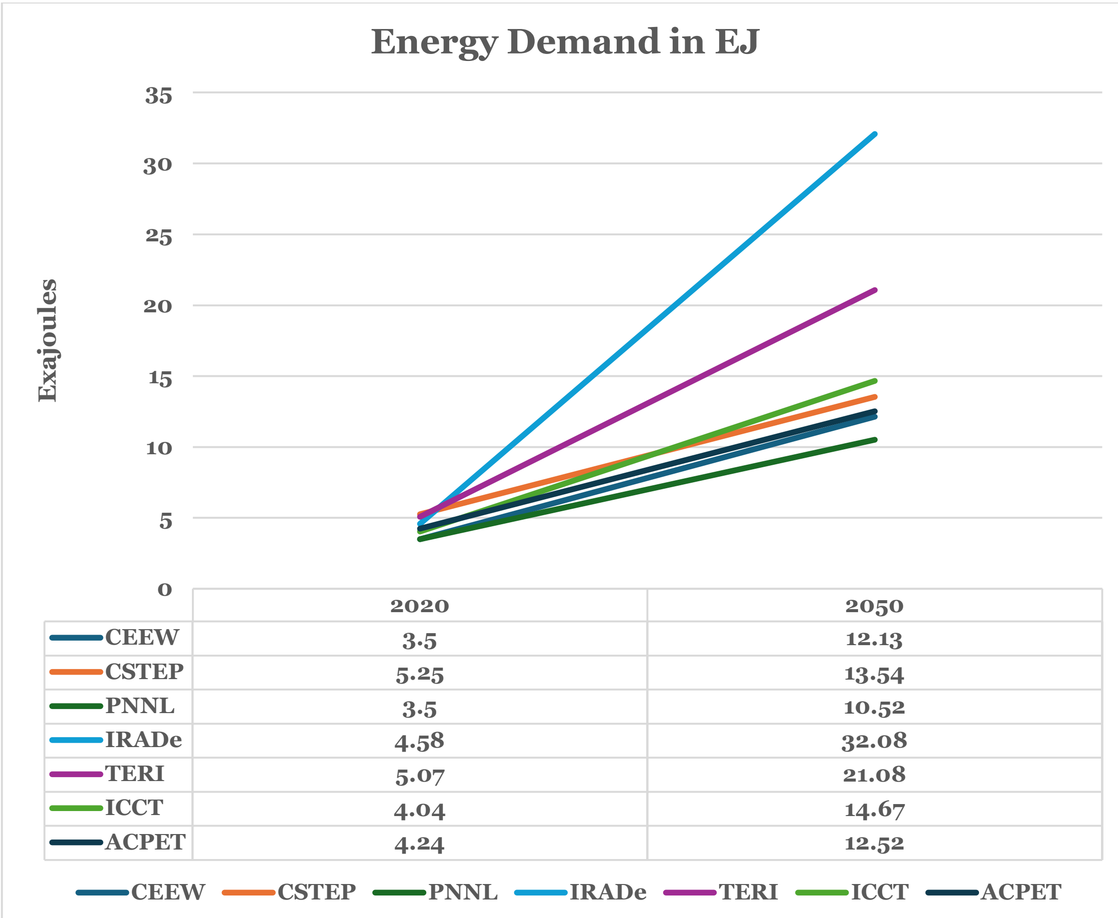


Figure 5: Energy Demand comparison across models (2020-2050)

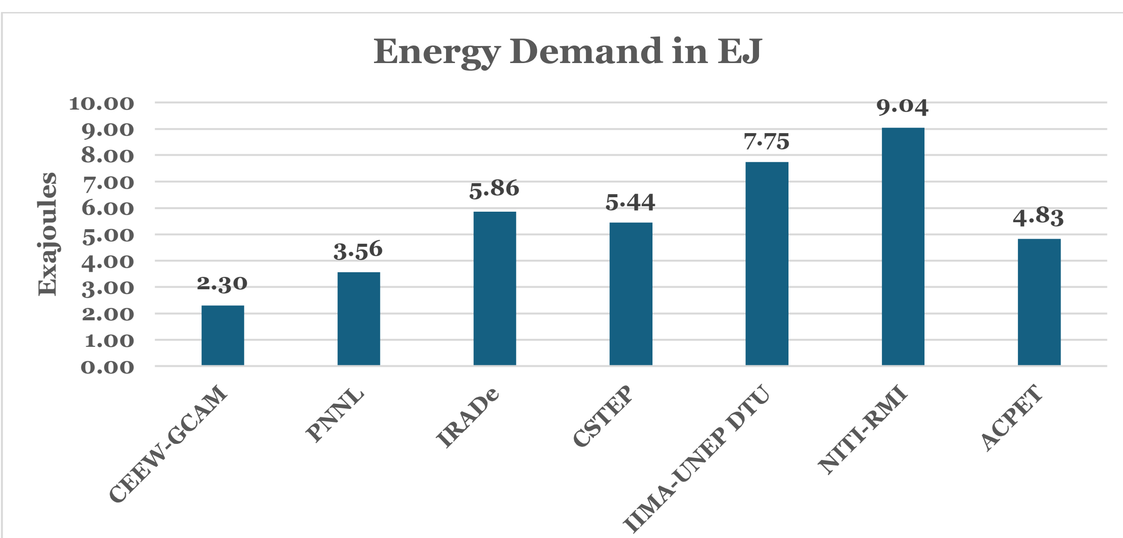
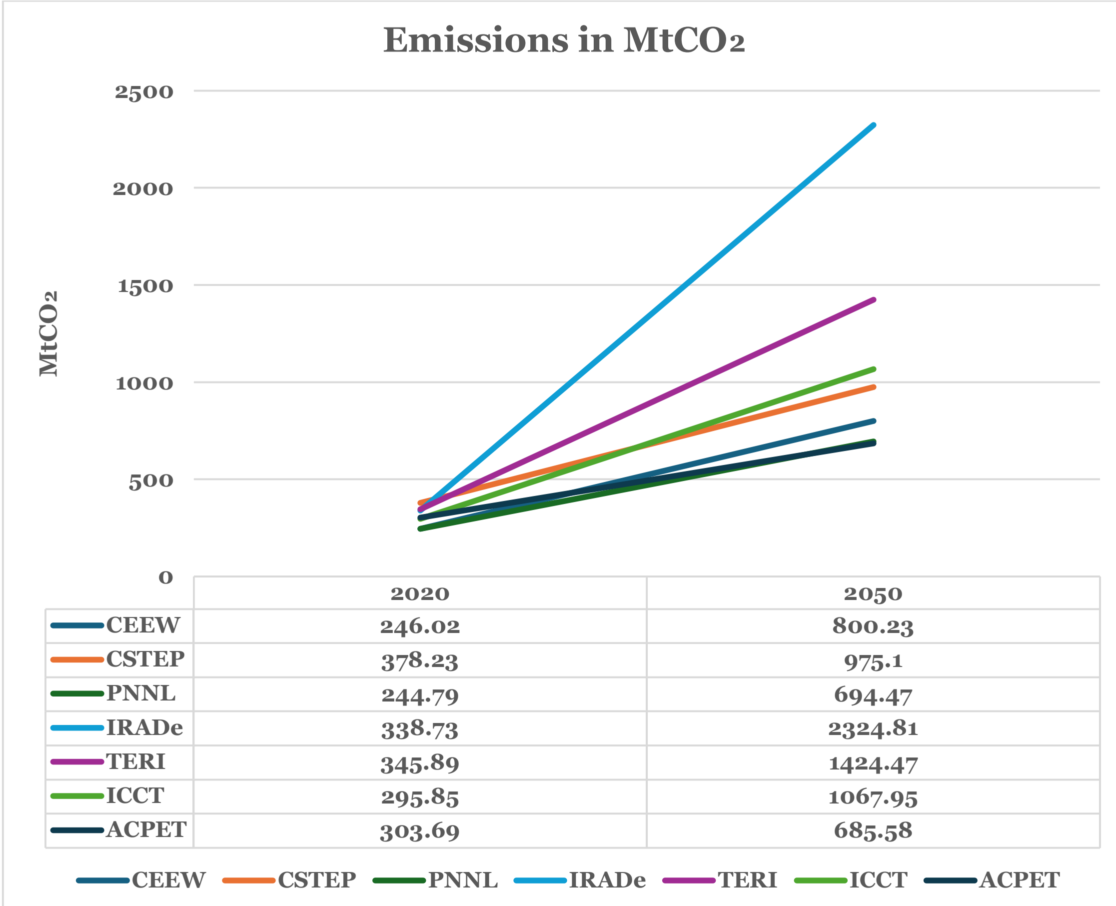


Figure 6: Energy Demand comparison across models (2030)



	2020	2050
CEEW	246.02	800.23
CSTEP	378.23	975.1
PNNL	244.79	694.47
IRADe	338.73	2324.81
TERI	345.89	1424.47
ICCT	295.85	1067.95
ACPET	303.69	685.58

Figure 7: Tailpipe Emissions comparison across models (2020-2050)

The figures present ACPET's modelling estimates alongside published results from CEEW and ICCT for comparable indicators. The values are reproduced as reported in each study and are placed together solely to illustrate the spread of outcomes emerging from different road transport models in India. As presented, the figures offer a literature-based context for interpreting ACPET's results within the range of nationally referenced assessments.

Conclusion and Recommendations

The results show that India's transport energy use and emissions will keep rising till 2050, but the rate of increase can slow down with strong and early action. In the Ambitious case, energy demand is about 13% lower (14.06 EJ) and emissions about 30% lower (744 million tonnes CO_2e) than the Business-as-Usual case, where the energy demand came out to be 16.16 EJ and emissions came out to be 1,063 million tonnes CO_2e. This means that timely policies, especially those promoting electric vehicles, efficiency, and public transport, can make a clear difference, even if emissions do not start falling yet.

India still has room to shape how its transport system grows. The next decade will decide whether transport demand becomes more efficient and cleaner, or whether the country remains locked into high fossil fuel use and high emissions.

Key Recommendations:

1. **Make public transport and non-motorized transport more attractive**
   The results indicate that even under the Ambitious scenario, transport energy demand continues to rise, underscoring the need to reduce dependence on private vehicles by enhancing public and non-motorised modes. In Bengaluru, a documented fare elasticity study found that a 10 percent reduction in bus fares was associated with approximately a 33 percent increase in bus ridership over five months, highlighting the strong responsiveness of passengers to affordability measures (Urban Mobility India, 2018). In Germany, the three-month €9 monthly ticket experiment in summer 2022 sold over 52 million tickets and was estimated to reduce car traffic and cut about 1.8 million tonnes of CO_2 emissions, demonstrating the potential of low-cost, high-access public transport in shifting mode share (World Economic Forum, 2022). Accordingly, investments in fare-reduction or subsidy schemes, reliable and clean buses and trains, first- and last-mile connectivity, dedicated pedestrian pathways, and safe cycling infrastructure are essential to make public, shared, and non-motorised options more practical and appealing for short and medium-distance trips, thereby reducing reliance on private vehicles. Complementary behavioural strategies, including awareness drives, incentive schemes, and digital nudges, can help influence travel choices toward low-emission modes. When combined with improvements in public transport and infrastructure, these approaches can reduce private vehicle dependence and lower cumulative transport-sector emissions.
2. **Green the Grid**
   Electrification plays a major role in reducing emissions, but its impact depends on the source of electricity. If EVs are powered by a coal-heavy grid, overall emission benefits remain limited. Studies show that electric trucks charged on India's current power mix emit about 20–35 percent less greenhouse gases than diesel trucks, and up to 85–90 percent less when powered by renewables (ICCT, 2024). Therefore, India must continue to green its power mix by adding renewable energy capacity and improving grid flexibility. This ensures that EVs, once scaled up, actually deliver deep emission cuts and contribute to transport sector emissions reduction goals.

3. **Build charging infrastructure and continue targeted subsidies**
   The expansion of EVs requires reliable and visible charging infrastructure. The International Energy Agency notes that expanding public charging networks and improving their interoperability are key to enabling more widespread and equitable EV adoption (IEA, 2024). India needs to scale up both public charging stations and battery-swapping facilities in urban areas, along highways, and near freight corridors. Continued subsidies and fiscal incentives will help reduce upfront costs for consumers and encourage fleet electrification in public transport and logistics. Public-private partnerships can play a key role in expanding this infrastructure quickly and efficiently.
4. **Focus on freight electrification**
   Heavy-duty freight trucks are among the hardest sources of transport emissions to reduce. In India, heavy trucks account for more than 40 percent of on-road fuel consumption and CO_2 emissions, despite representing only about 2 percent of the vehicle stock (ICCT, 2023). Pilot implementations and early industry trials suggest that India is beginning to lay the groundwork for large-scale freight electrification. Building on these initial efforts through dedicated zero-emission freight corridors, integration with logistics hubs, and renewable-powered charging and refuelling infrastructure will be essential to enable widespread deployment in the coming decades.
5. **Set EV adoption targets for each vehicle segment**
   While India's EV30@30 target sets an overall direction for electric mobility, it remains too broad to track actual progress on the ground. Different vehicle types are growing at very different rates, so having specific EV targets for each segment, two-wheelers, cars, buses, and freight vehicles, would make progress easier to monitor and manage. Clear segment-wise targets would help identify where adoption is lagging, where policy support needs to be strengthened, and how resources can be better directed to meet the overall national goal.

Study Limitations

This study focuses on road, rail, and domestic air transport and does not include metro systems or water transport, which are outside its current scope. The analysis is also not designed to represent a Net Zero 2070 outlook; instead, it explores medium-term pathways up to 2050 to understand the effects of existing and potential policy actions. In addition, biofuels are not yet represented in the model, and their role in future transport emissions reduction will be incorporated in subsequent updates of the LEAP-ACPET framework. The study also does not assess environmental externality costs or broader socio-economic impacts, which remain outside the scope of the current analysis.

Appendices

a. Overview of the LEAP Platform

For this study, Low Emissions Analysis Platform (LEAP), formerly Long-range Energy Alternatives Planning, was utilized. It is widely used for integrated resource planning, greenhouse gas (GHG) mitigation, and Low Emission Development Strategies (LEDS), especially in developing countries. Many countries rely on LEAP for reporting to the United Nations Framework Convention on Climate Change (UNFCCC) (Stockholm Environment Institute, 2025). LEAP models the impact of structural economic changes and policy interventions on energy demand, but it does not model the feedback effects of changes in energy demand on the economy. We utilized the LEAP platform to develop an in-house energy model in ACPET, called the **LEAP-ACPET model**, which can be scaled for applications ranging from cities and states to national, regional, and global levels.

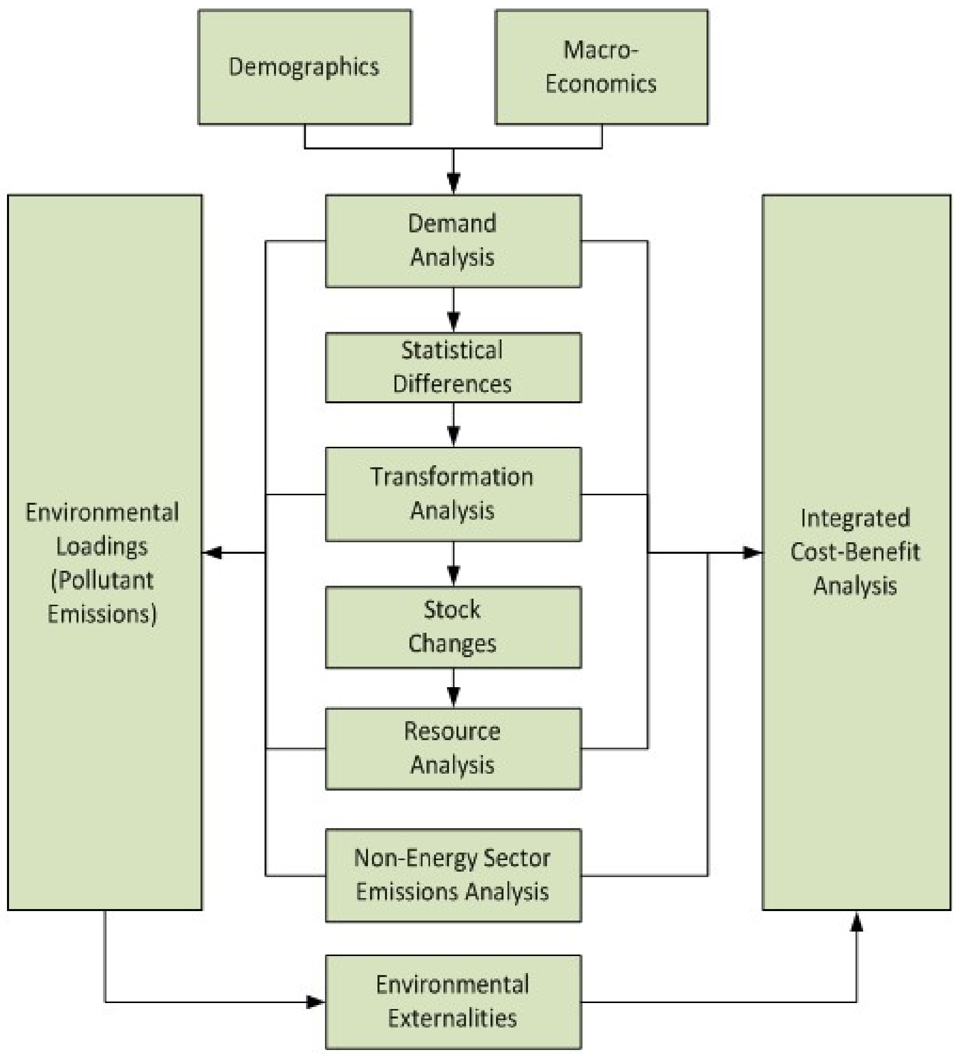


Figure A.1: The Structure of LEAP's Calculations

b. Model Configuration and Data Inputs

All base-year (2019–20) data are entered into LEAP under the Current Accounts scenario. This scenario defines the initial conditions of the model and represents historical or observed data. Emission factors are also entered exogenously in the Current Accounts and remain constant across all subsequent scenarios to ensure comparability of results.

The total transport demand for the projection period 2020–21 to 2049–50 is estimated externally (outside LEAP) and then input as an exogenous variable in all scenarios following Current Accounts. This projected total demand is disaggregated into passenger and freight components according to their percentage shares in the overall transport activity, derived from the aggregation of billion passenger-kilometres (BPKM) and billion tonne-kilometres (BTKM) projections. This total transport demand projections and passenger and freight shares remain constant across all scenarios to maintain a consistent activity base.

In the subsequent scenarios, parameters including modal shares (passenger and freight), vehicle category distributions within road transport (passenger and freight), technology composition within categories under all modes (passenger and freight), and final energy intensities or fuel efficiencies are derived by modifying the base-year values established in Current Accounts according to the scenario-specific assumptions defined in this study.

c. Representation of Vehicle Categories

Within the model, the category "Cars" is treated as representative of cars, jeeps, and vans, while "Buses" includes omnibuses under the same classification. This aggregation ensures data consistency across available statistical sources while preserving the distinct energy-use characteristics of each vehicle class.

d. Key Assumptions

1. Vehicle Life (years)

Road Vehicle Category	Assumption
Car	15
Taxis	12
Buses	15
Two wheelers	15
Three wheelers	15
Heavy Commercial Vehicles	15
Light Commercial Vehicles	15

Table A1: Vehicle Life Assumptions

2. Annual Distance Travelled (km)

Road Vehicle Category	Assumption
Car	11560
Taxis	70000
Buses	73000
Two wheelers	6300
Three wheelers	27900
Heavy Commercial Vehicles	60000
Light Commercial Vehicles	25000

Table A2: Annual Distance Travelled Assumptions

3. Occupancy

Road Vehicle Category	Assumption
Car	2.5
Taxis	2.8
Buses	35
Two wheelers	1.5
Three wheelers	2.38

Table A3: Occupancy Assumptions

4. Payload/ Load factor

Road Vehicle Category	Assumption (tonnes)
Heavy Commercial Vehicles	11
Light Commercial Vehicles	1.8

Table A4: Payload Assumptions

Sources: S.K. Singh (2006), NITI Aayog and Rocky Mountain Institute. (2017b), Voluntary Vehicle Fleet Modernization Program (V-VMP)/ Vehicle Scrapping Policy, Rue du Can et al. (2009), Vehicle Scrappage Policy, CSTEP, CEEW, IRADe, PNNL, and TERI (2019), & Arora, Vyas, and Johnson (2011), T.V. Ramachandra, Shvetmala (2009).

5. Vehicle Mileage (distance per unit of fuel)

Mode – Category - Fuel	Assumption
Road – Cars - CNG	17.44 km/kg
Road – Cars - Diesel	14.9 km/l
Road – Cars - FCV	2.93 km/kwh
Road – Cars - Petrol	15.8 km/l
Road – Cars – Electric	31.5 km/kwh
Road – Taxis - CNG	17.44 km/kg
Road – Taxis - Diesel	14.9 km/l
Road – Taxis - Electric	9.48 km/kwh
Road – Buses - CNG	2.26 km/kg
Road – Buses - Diesel	4.5 km/l

Road – Buses - FCV	0.29 km/kwh
Road – Buses – Electric	0.8 km/kwh
Road – 2W - Petrol	57.4 km/l
Road – 2W - Electric	50 km/kwh
Road – 3W - CNG	24.1 km/kg
Road – 3W – Diesel	37.9 km/l
Road – 3W - Petrol	35.5 km/l
Road – 3W - Electric	15.4 km/kwh
Road - HCV - CNG	9.5 km/kg
Road – HCV - Diesel	6 km/l
Road – HCV - FCV	0.38 km/kwh
Road – LCV -CNG	18 km/kg
Road – LCV - Diesel	15 km/l
Road – LCV - FCV	3.5 km/kwh
Rail – Passenger - Diesel	0.26 km/l
Rail – Passenger - Electric	0.05 km/kwh
Air – Passenger - ATF	0.21 km/l

Table A5: Vehicle Mileage Assumptions

6. Vehicle Fuel Efficiency (fuel per unit of distance)

Mode – Category - Fuel	**Assumption**
Road – HCV - Electric	0.1853 kwh/km
Road – LCV - Electric	0.2834 kwh/km
Rail – Freight - Diesel	0.0049 l/km
Rail – Freight - Electric	0.0200 kwh/km
Air – Freight - ATF	0.2752 l/km

Table A6: Vehicle Fuel Efficiency Assumptions

Sources: NITI Aayog and Rocky Mountain Institute. (2017a), Goel et al. (2016), MoRTH (2017), CEEW - India's Electric Vehicle Transition (2020), ICCT (2020), TERI's ROADMAP FOR INDIA'S ENERGY TRANSITION IN THE TRANSPORT SECTOR (2024), & IESS 2047 Version 3.

e. Key Data Sources

Data	**Source**
GDP (2000 to 2025)	Database on Indian Economy - Macroeconomic Aggregates (Constant prices)
GDP (2026 to 2050)	IESS 2047 Version 3
Population (2000 to 2024)	Database on Indian Economy - Macroeconomic Aggregates (Current Prices)

Population (2025 to 2050)	IESS 2047 Version 3: United Nations, Department of Economic and Social Affairs, Population Division (2019). World Population Prospects 2019
GHG Emission Factors	GHG Protocol (World Resources Institute / World Business Council for Sustainable Development)

Table A7: Key Data Sources

f. Detailed Scenario Assumptions

1. Business as Usual Scenario (BAU)

Lever	2050 Assumption	Rationale
	Passenger Transport Demand	
	Road: 84%	Road transport continues to dominate passenger mobility due to its extensive connectivity, flexibility, and convenience for both intra- and inter-city travel. Despite improvements in rail and air services, road-based passenger activity remains high as urbanization, income growth, and private vehicle ownership expand.
	Rail: 13%	Railways' share remains stable, supported by ongoing modernization and capacity enhancement through projects such as the Vande Bharat and Amrit Bharat trains. The commissioning of Dedicated Freight Corridors (DFCs) further frees up passenger line capacity, improving reliability and speed.
Modal shift	Air: 3%	The share of air travel marginally rises owing to increasing disposable incomes and improved connectivity under the UDAN (Ude Desh ka Aam Nagrik) Regional Connectivity Scheme, which has expanded operational airports and routes across Tier-2 and Tier-3 cities.

	Freight Transport Demand	
	Road: 64.97%	Road freight continues to dominate for short- and medium-haul deliveries. The sector benefits from improved highways and initiatives such as the Bharatmala programme and the growing logistics industry.
	Rail: 35%	The share of rail freight increases significantly, driven by the implementation of the National Rail Plan (NRP), which targets raising rail's freight share to 45% by 2030 through the DFC network and multimodal logistics parks.
	Air: 0.03%	Air freight remains a niche segment, primarily for high-value and perishable commodities, given the high cost of air logistics and limited infrastructure.
Shift in shares of vehicle categories in Road Transport	Passenger Road Transport Demand	
	Cars: 25%	Rising incomes, urban sprawl, and aspirational ownership continue to drive car demand. Private vehicle ownership remains a symbol of mobility and comfort despite growing mass transit availability.
	Taxis: 10%	Growth in app-based taxi aggregators sustains demand for on-demand, point-to-point mobility, particularly among younger urban users who prioritize convenience over ownership.
	2W: 28%	Two-wheelers remain the most affordable and flexible mobility mode, widely used for commuting and last-mile connectivity. Urban delivery and logistics services further sustain this segment.

	3W: 6%	The share of 3-wheelers slightly declines as app-based taxi services and affordable 2W taxis gain prominence, offering better comfort and transparent pricing.
	Buses: 31%	Bus usage remains significant but declines due to competition from private modes and metro expansion. Nevertheless, programs such as PM e-Bus Sewa continue to strengthen bus-based public transport.
	Freight Road Transport Demand	
	LCV: 30%	The share of Light Commercial Vehicles (LCVs) increases as e-commerce and last-mile delivery services expand. LCVs are cost-effective for small-load, short-haul movement and benefit from the rise in intra-city logistics.
	HCV: 70%	Heavy Commercial Vehicles (HCVs) continue to dominate bulk and long-haul freight but experience a marginal decline in share as some bulk movement shifts to rail following DFC operationalization.
Share of electric vehicles/ electricity as a technology	Passenger	
	Cars: 15%	Electric car adoption progresses with continued incentives under FAME-II and successor programs, along with declining battery costs. However, limited charging infrastructure and high upfront prices constrain rapid uptake.
	Taxis: 15%	Electric taxis increase gradually, supported by fleet-level economics and government incentives. Operational challenges such as charging downtime and battery replacement costs moderate the pace.

	2W: 30%	Two-wheeler electrification accelerates under FAME-II and various state EV policies, driven by low total cost of ownership for delivery and commuter segments.
	3W: 50%	Three-wheelers emerge as the fastest-growing EV segment, favoured by short routes, depot charging, and demand incentives under FAME-II.
	Buses: 10%	The share of electric buses rises moderately under PM e-Bus Sewa, though adoption is constrained by upfront costs and infrastructure limitations.
	Rail: 100%	Indian Railways achieves complete electrification in line with its official targets, contributing to lower emissions from rail transport.
	Freight	
	LCV: 10%	Electrification in the freight sector remains limited to LCVs operating in urban and peri-urban areas. The potential for depot charging and short-haul routes enables modest EV penetration.
	HCV: 5%	Adoption of electric HCVs remains constrained due to battery weight, limited fast-charging infrastructure, and higher costs. Demonstration pilots continue, but large-scale uptake is unlikely in BAU.
	Rail: 100%	Rail freight becomes fully electric in line with national electrification targets, enhancing efficiency and reducing diesel dependence.
	Passenger	

Share of Hydrogen Fuel Cell Vehicles/ hydrogen as a technology	Cars	No significant deployment of hydrogen fuel cell passenger vehicles is expected in BAU, as policy and pilot efforts in India are presently focused on heavy-duty and industrial applications. High costs and lack of refuelling infrastructure further limit uptake.
	Buses	While pilot hydrogen buses have been tested in Leh, Gujarat, and Delhi, large-scale deployment remains unviable in BAU due to cost competitiveness of e-buses and limited hydrogen availability.
	Freight	
	LCV	No adoption of hydrogen LCVs is anticipated due to absence of dedicated policy frameworks or pilots.
	HCV	For HCVs, isolated demonstrations are underway, but commercial-scale use remains improbable in BAU without supporting refuelling networks.
Annual Fuel Efficiency Improvements	Passenger	
	Cars: -1%	Improvement aligns with the Corporate Average Fuel Efficiency (CAFE) norms notified by BEE and MoRTH. Incremental technology improvements in internal combustion engines and mild hybrids yield moderate efficiency gains.
	Buses: -0.1%	Bus efficiency improves only slightly due to slower fleet turnover and limited technology upgrades in the existing stock.
	2W: -0.1%	Gradual efficiency improvements are assumed through lighter and efficient vehicle designs.
	3W: -0.1%	Minor gains expected from efficient engines.
	Taxis: -0.1%	Fleet efficiency improves slightly but large gains are constrained by operational and cost factors.
	Freight	

	LCV: -0.01%	Improvement follows the Constant Speed Fuel Consumption (CSFC) test-based standards under the Heavy-Duty Vehicle Fuel Consumption Framework, with minimal efficiency gains beyond compliance in BAU.
	HCV: -0.01%	Similar to LCVs, fuel efficiency improvements are compliance-driven, with limited room for further gains due to cost and design constraints.

Table A8: BAU Scenario Assumptions

2. Ambitious Scenario

Lever	2050 Assumption	Rationale
	Passenger Transport Demand	
	Road: 72%	The share of road transport declines as investments in public transport and rail infrastructure improve intercity and regional connectivity, reducing dependence on private road travel.
	Rail: 25%	The share of rail transport rises due to network electrification, increased frequency of passenger services, and completion of high-speed and regional rail corridors under the National Rail Plan.
	Air: 3%	Air transport maintains its share as improved connectivity through the UDAN scheme is balanced by a modal shift toward rail for medium-distance routes.
	Freight Transport Demand	
	Road: 54.97%	The share of road freight reduces as bulk commodities increasingly shift to rail.
Modal shift	Rail: 45%	The share of rail freight increases in line with the National Rail Plan target of achieving 45% freight movement by rail through DFC expansion and improved logistics integration.

	Air: 0.03%	Air freight remains marginal, primarily catering to high-value and time-sensitive goods, with limited infrastructure expansion.
	Passenger Road Transport Demand	
	Cars: 20%	The share of private cars declines as public transport systems expand, and shared mobility options become more accessible.
	Taxis: 15%	The share of taxis increases due to wider adoption of app-based on-demand mobility services.
	2W: 23%	The share of two-wheelers declines gradually with improved reliability of public transport options.
	3W: 4%	The share of three-wheelers decreases slightly as taxis and two-wheelers capture a portion of the short-distance mobility market.
	Buses: 38%	The share of buses increases as urban and intercity bus fleets expand under schemes like PM e-Bus Sewa and state-level electric mobility programs and a policy push for shift from private to public transport.
	Freight Road Transport Demand	
	LCV: 50%	Light Commercial Vehicles retain a significant share, reflecting growth in e-commerce and last-mile delivery.
Shift in shares of vehicle categories in Road Transport	HCV: 50%	Heavy Commercial Vehicles' share declines relative to BAU as long-haul freight gradually shifts toward rail.
Share of electric	Passenger	

vehicles/ electricity as a technology	Cars: 30%	Electric cars account for a growing portion of private vehicle stock, driven by falling battery prices, expansion of charging networks, and policy continuity through FAME-II and future successor schemes.
	Taxis: 30%	Electric taxis grow steadily due to lower operational costs and targeted fleet incentives in major cities.
	2W: 60%	Two-wheelers achieve high electrification due to declining upfront costs, supportive state EV policies, and demand growth in delivery and commuting sectors.
	3W: 65%	Electrification of three-wheelers accelerates because of depot-based charging, government subsidies, and suitability for short routes.
	Buses: 25%	A quarter of buses become electric through large-scale adoption under PM e-Bus Sewa and targeted state policies.
	Rail: 100%	Railways achieve full electrification as per Ministry of Railways targets, contributing to reduced transport emissions.
	Freight	
	LCV: 30%	The share of electric light commercial vehicles increases through fleet electrification in logistics.
	HCV: 15%	Electric heavy commercial vehicles remain a niche but growing segment as battery performance and corridor charging infrastructure improve.
	Rail: 100%	Freight rail is entirely powered by electricity, aligned with the Indian Railways electrification strategy.

Share of Hydrogen Fuel Cell Vehicles/ hydrogen as a technology	Passenger	
	Cars: 5%	Slight increase as compared to BAU scenario.
	Buses: 5%	
	Freight	
	LCV: 5%	Slight increase as compared to BAU scenario.
	HCV: 5%	
Annual Fuel Efficiency Improvements	Passenger	Same as in BAU scenario
	Cars: -1%	
	Buses: -0.1%	
	2W: -0.1%	
	3W: -0.1%	
	Taxis: -0.1%	
	Freight	
	LCV: -0.01%	
	HCV: -0.01%	

Table A9: Ambitious Scenario Assumptions

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