Modelling Emissions from Transport In India: TERI

Sharif Qamar
TERI, New Delhi

Decarbonising Transport in India: Projections and scenarios on the evolution of transport in India

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Available Models: TERI

**TERI Transport Model:** Excel-based model that estimates the total CO$_2$ emissions of the transport sector in India, 1980 onwards

**TERI MARKAL:** Bottom-up, dynamic, linear-programming model that depicts both the *supply and demand sides of the complete energy system*. Transport sector among the five sectors considered. The optimization routine selects from each of the sources, energy carriers, and transformation technologies to produce the least-cost solution, subject to a variety of constraints. The user defines technology costs, technical characteristics and energy-service demands.
TERI Transport Model: Building Blocks

Model for the transport of passengers and goods using *inland waterways and coastal shipping* are being developed
TERI Transport Model: Estimating Demand

ASIF Framework

Activity  Mode Share  Intensity  Fuel Mix

Passenger and Freight
- Vehicle types
- Utilizations
- Occupancies
- Efficiencies
Methodology for transport demand projections

- **Passenger Movement**
  - The on-road vehicles in various road based transport modes has been projected assuming demand for passenger movement to be a function of GDP per capita and population
    - Passenger Kilometers = f (GDP per capita, population)

- **Freight Movement**
  - The on-road vehicles freight vehicles on various road transport modes has been projected assuming demand for tonne movement to be a function of GDP of agriculture and industry and population
    - Tonne Kilometers = f (GDP of Agriculture/Industry/Services, population)
Summary of emission estimation

- Principle factors affecting mobility demand/activity (Why)
  - Economic
  - Demographic

- Transport of passengers and goods (What)

- Identifying the modes (How)
  - Road (Car, Jeep, Bus, HCV, LCV, etc.)
  - Rail (Conventional, Metro, Suburban, etc.)
  - Air

- Appropriating technologies

- Accounting for efficiencies

- Estimating energy demands and emissions
Policy Pathways Considered

1. Modal shift to Rail/Public Transport
2. Efficiency improvements
3. Penetration alternate technologies in road transport: EVs, FCVs, LNG, CNG, etc.
4. Reduction in transport demand
Transport Demand In India

Source: TERI
Passenger Demand In India

- Passenger transport continues to be dominated by road transport
- Passenger travel demand more than doubles by 2050
- The largest share of the demand (~60%) is met by buses
- With time, share of buses declines as a larger share is captured by private 4Ws, 2Ws and 3Ws

Source: TERI
Freight Demand In India

- Freight demand increases almost 4 times by 2050
- The largest share of the demand is met by HCVs
- Role of rail remains limited, without significant policy pushes

Source: TERI
- Road transport consumes the largest share of energy
- Railways with about 15% of the traffic requires only about 6% of the energy

Source: TERI
Energy and Emission Trends till 2050

Transport sector CO₂ emissions (2020)
430 mt → 726 mt (2030) → 1,383 mt (2050)

Source: TERI
Share of Transport in Total Emissions (MARKAL)

- The transport sector is estimated to account for around 15% of the total emissions by 2020-21.
- Without significant policy interventions, this proportion actually increases over time due to the heavy dependence of diesel and gasoline.
Energy Efficiency, Modal Shift and Electrification Can Allow Transport Fossil Consumption to Peak in the 2030s

Low Carbon Scenario Transport Demand

Source: TERI
Impact of COVID-19

How to account for major disruptions such as COVID-19 in modelling terms:

- Rethinking the horizon year in our long-term projections?
- Ignore assuming things will return to normal and impact insignificant?
  - Change in travel behaviour: Switch to private modes, reduction in PT
- Adjustments to GDP assuming long term impacts?
Selected TERI Reports

- Faster adoption of electric 2W in India: A perspective of consumers and industry
- Switching to a Sustainable Auto-rickshaws System
- Integrating electric buses in public transport: Kolkata's success story
- Roadmap for Electrification of Urban Freight in India
- Benefits of Cycling in India
- Impact of COVID-19 on urban mobility in India: Evidence from a perception study
- Making Mission Possible: Delivering a Net-Zero Economy
- Increasing the Rail Share in Freight Transport in India
- Comparison of Decarbonisation Strategies for India’s Land Transport Sector: An Inter Model Assessment
Thank you

Please Contact: Sharif Qamar
Centre for Sustainable Mobility, TERI

Sharif.Qamar@teri.res.in