Modelling Emissions from Transport In India: TERI

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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.

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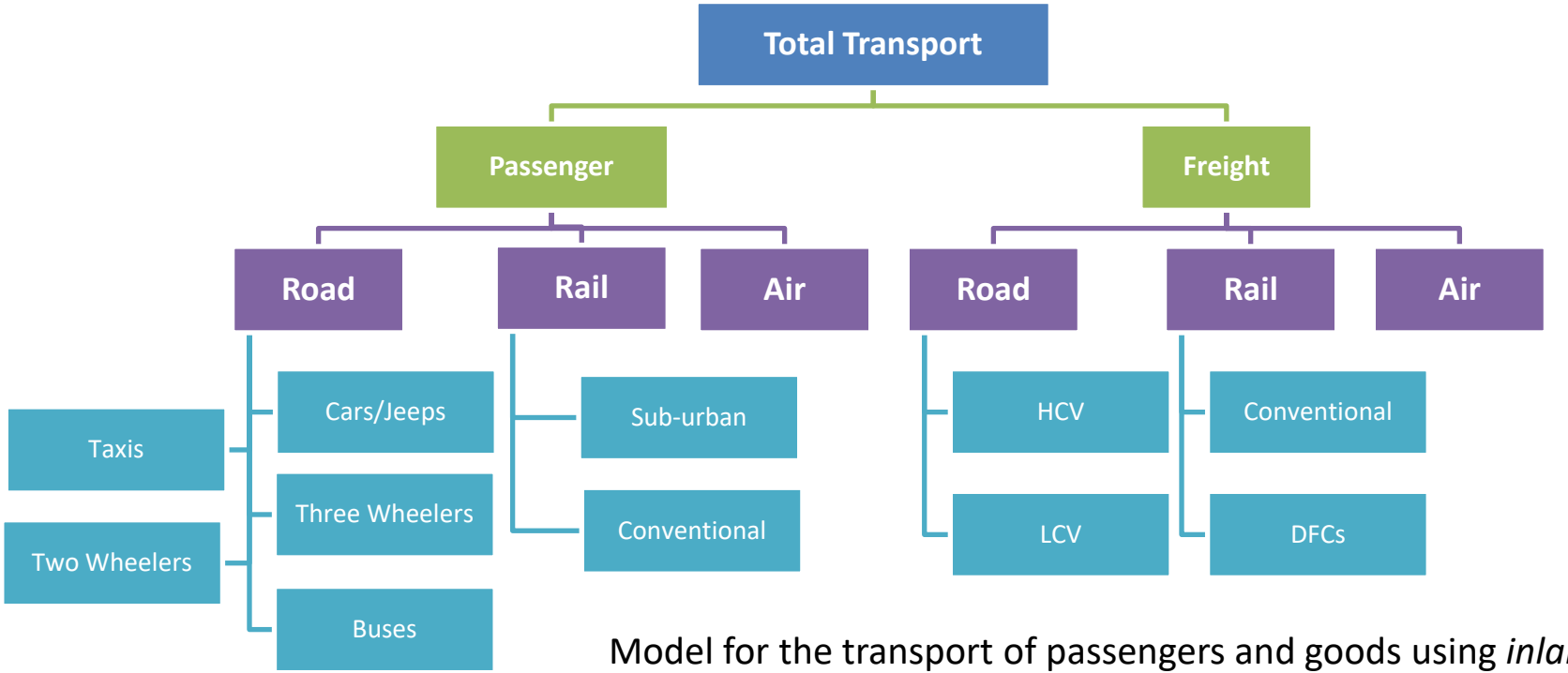
TERI Transport Model: Building Blocks



Model for the transport of passengers and goods using *inland waterways and coastal shipping* are being developed

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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)

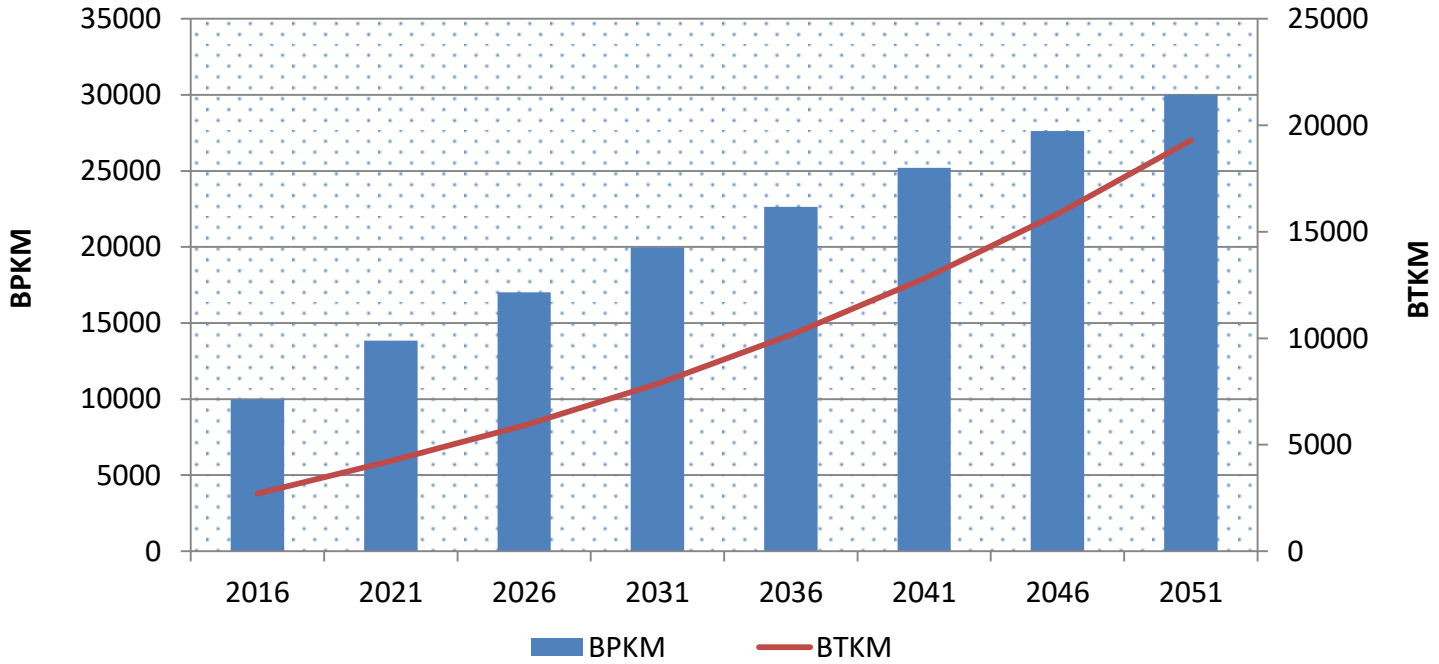
Summary of emission estimation

- 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

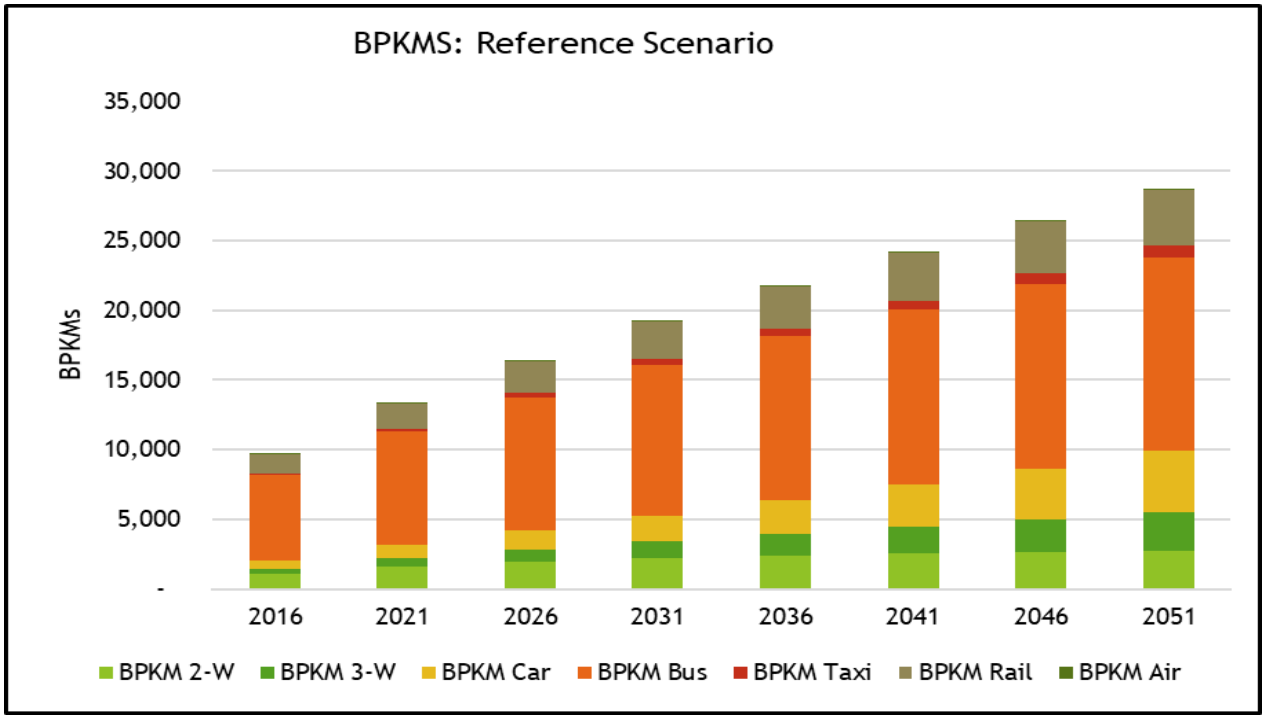
1. Modal shift to Rail/Public Transport
2. Efficiency improvements
3. Penetration alternate technologies in road transport: EVs, FCVs, LNG, CNG, etc.
4. Reduction in transport demand

Transport Demand In India



Source: TERI

Passenger Demand In India



Source: TERI

- 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

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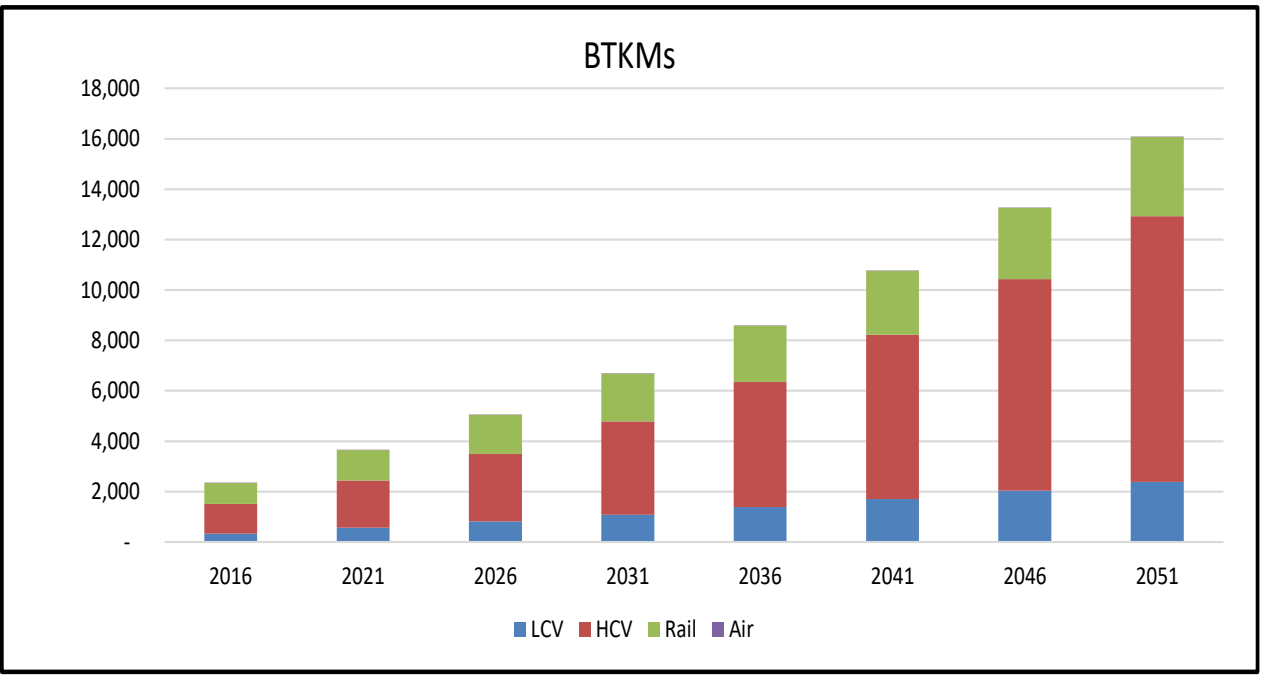
Freight Demand In India



Source: TERI

- 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

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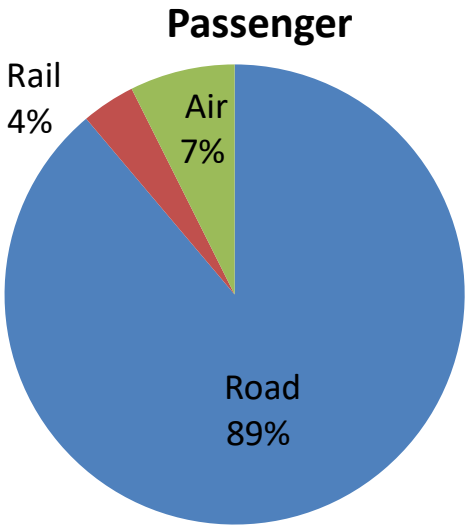
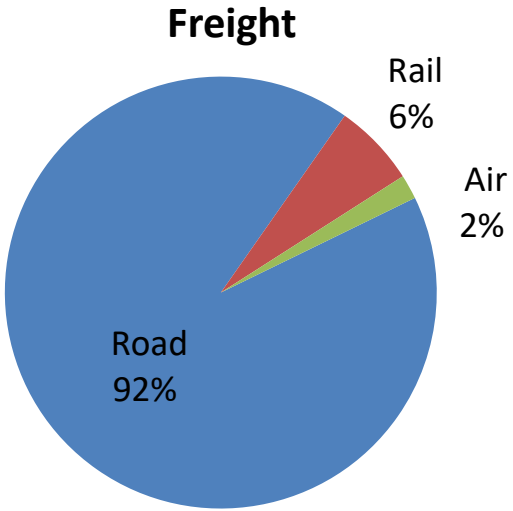
Share of Energy Consumption by Mode

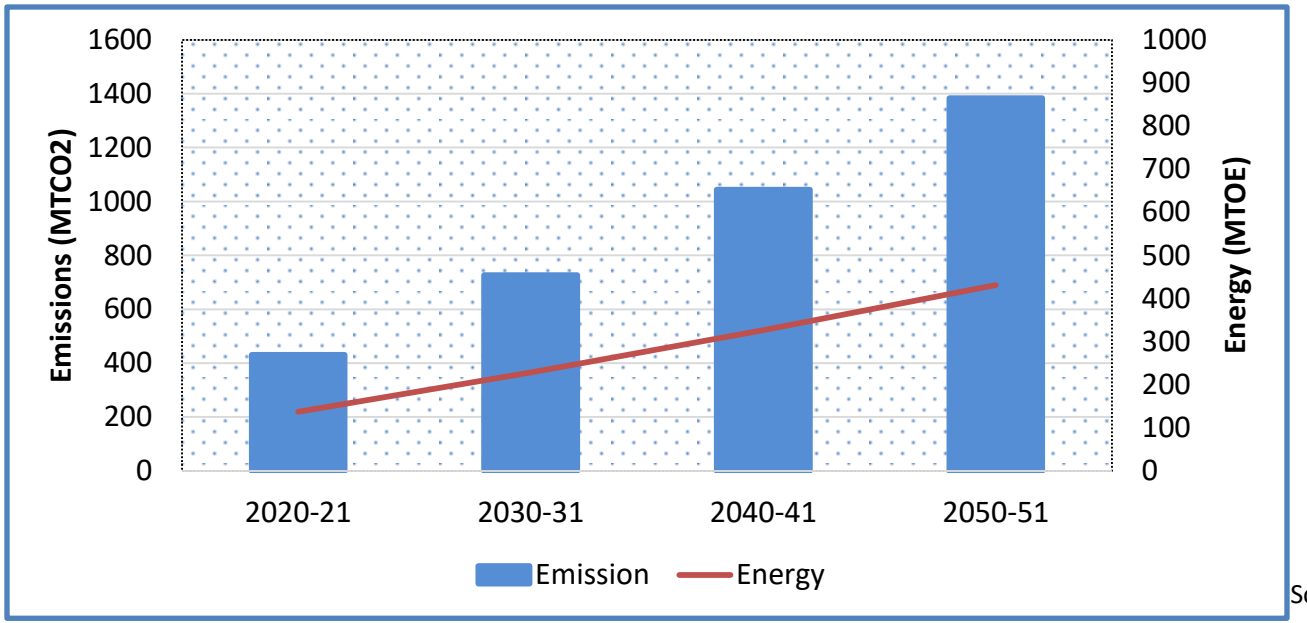




Source: TERI

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

Energy and Emission Trends till 2050



Source: TERI

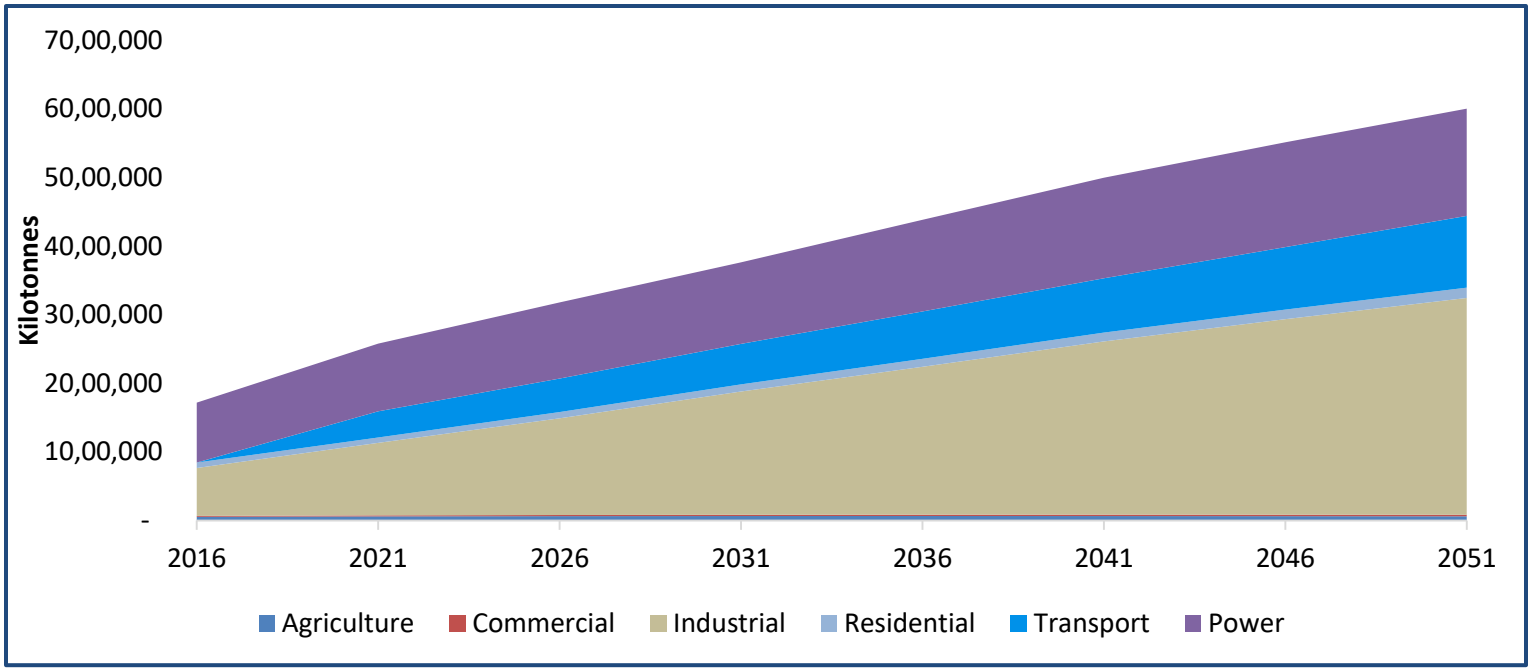
Transport sector CO_2 emissions (2020)

430 mt → 726 mt (2030) → 1,383 mt (2050)



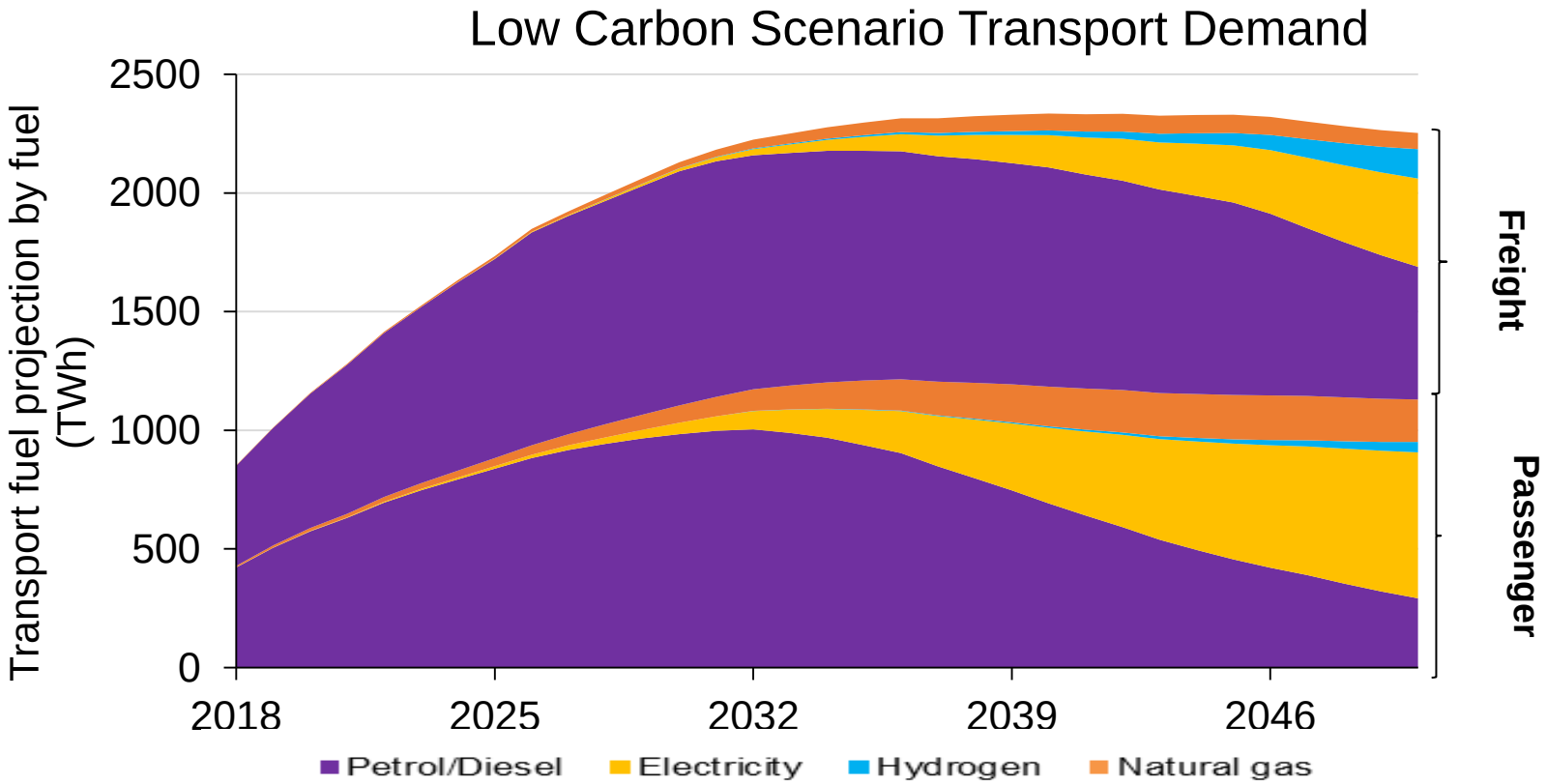


Share of Transport in Total Emissions (MARKAL)



- 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



Source: TERI





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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

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Thank you

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