



Global Change Analysis Model- CEEW Version *Transport Sector – Structure, Assumptions and Results*

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Low-Carbon Pathways



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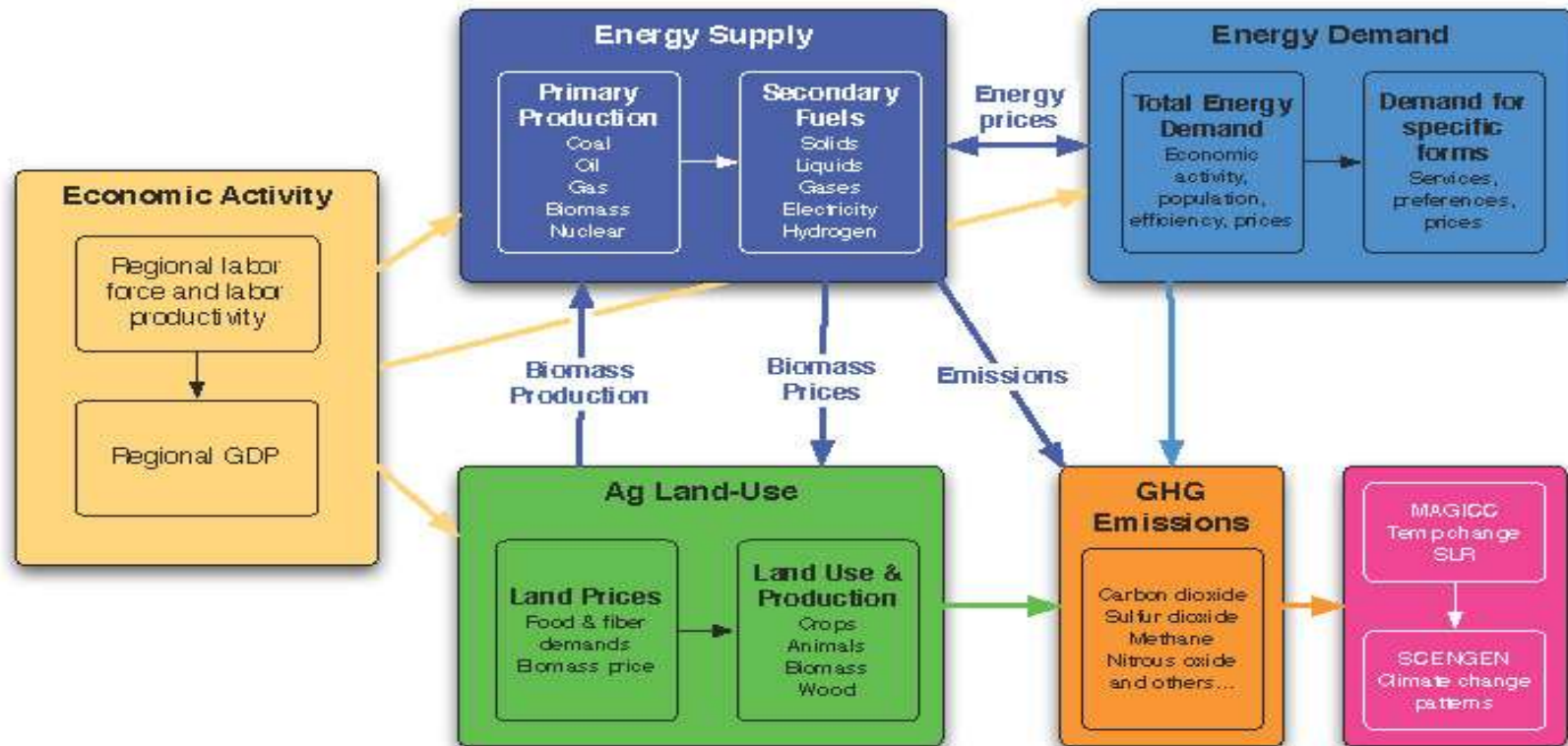
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Content

- GCAM model structure
- India specific updates
- Results and Insights

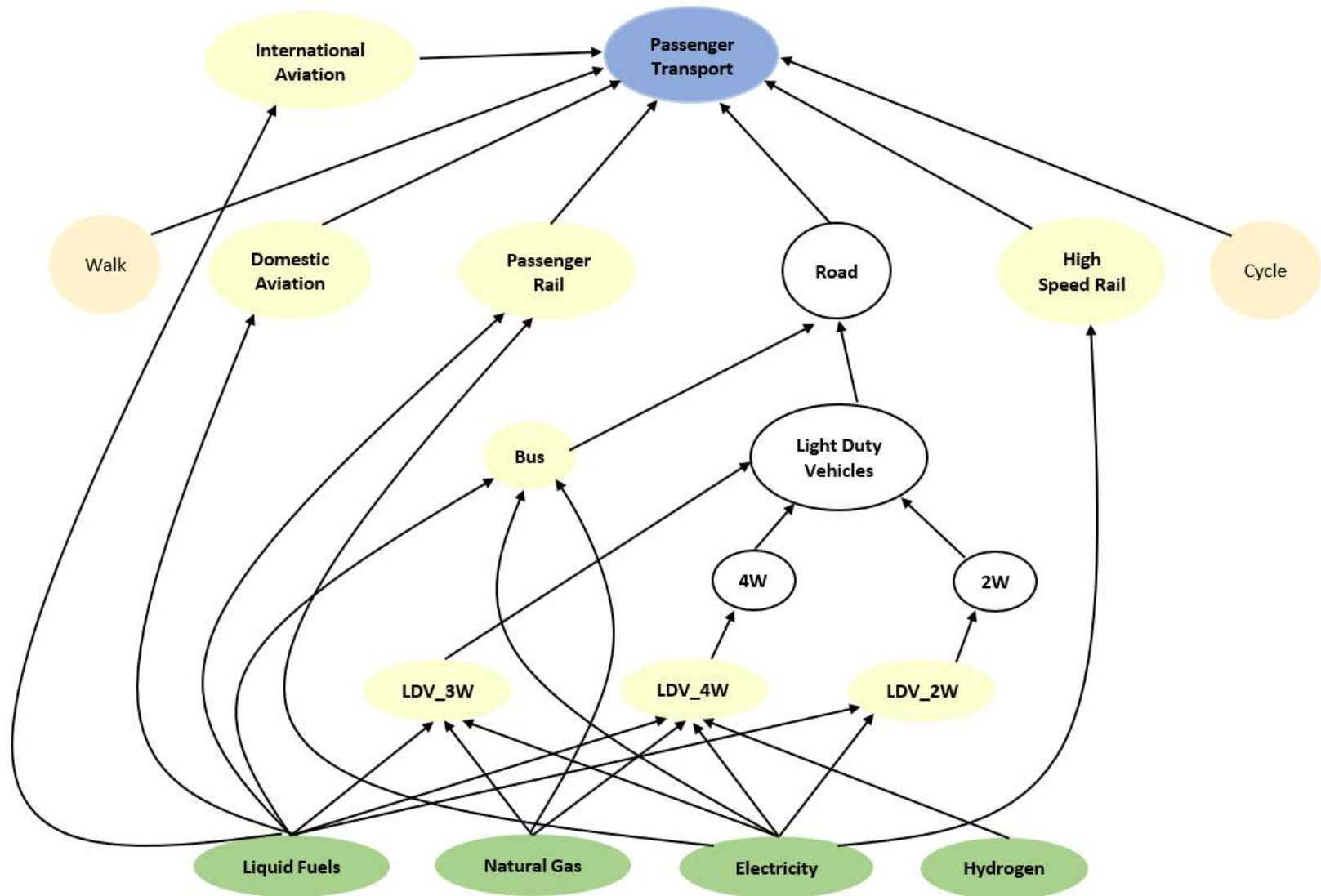
Structure

Integrated Assessment Modelling- Global Change Analysis Model

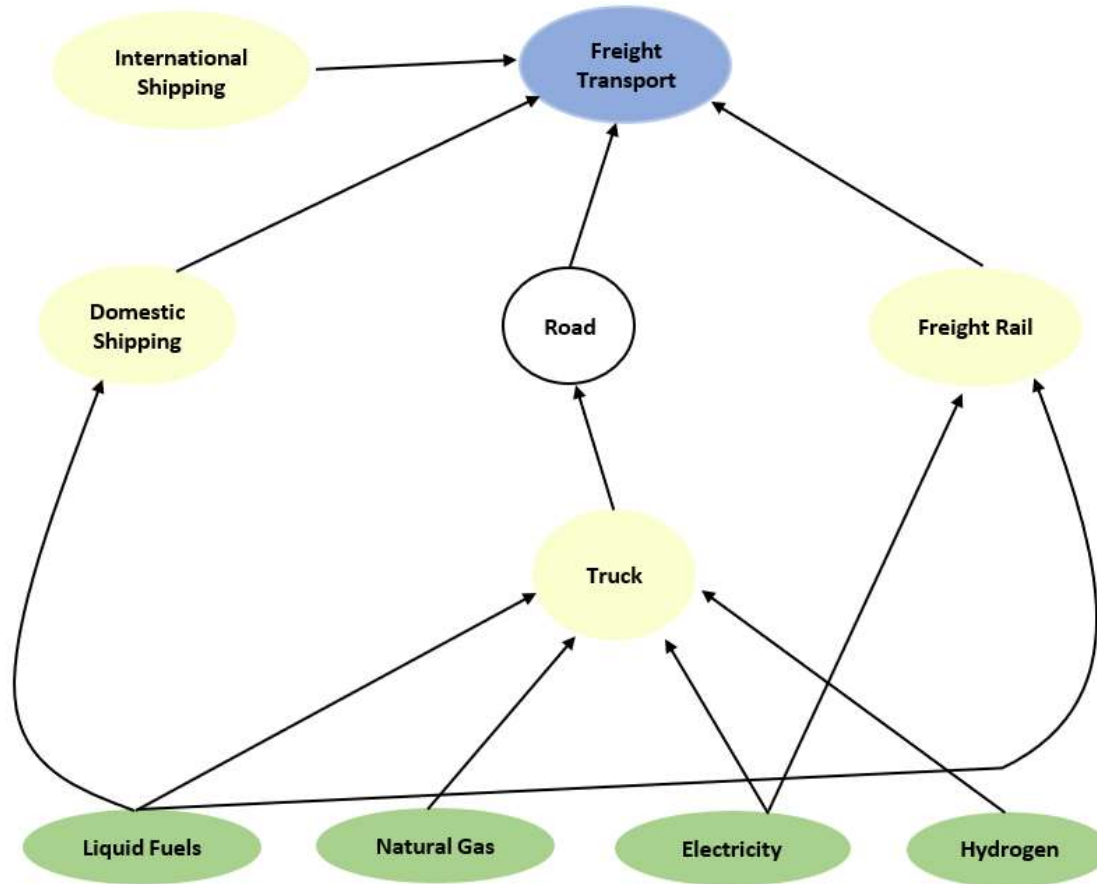


- Global model (32 regions) with India as a separate region
- India specific version, set up at IIM Ahmedabad during 2007-09, under the guidance of Prof P. R. Shukla
- Extensively published in high impact international journals
- An important part of IPCC assessments on modelling related literature
- One of CEEW's in-house models

Structure of the sector (1/2)



Structure of the sector (2/2)

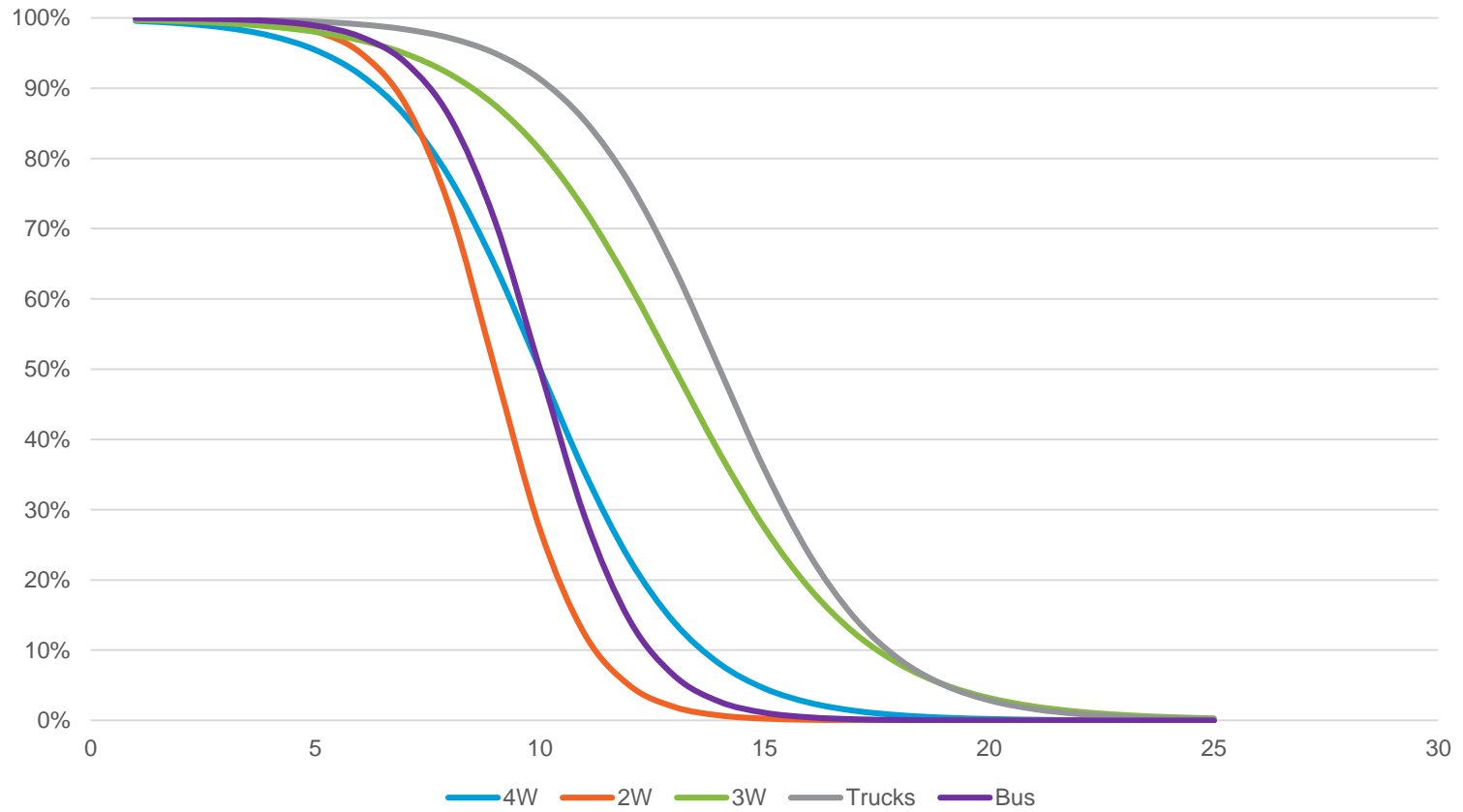


Assumptions

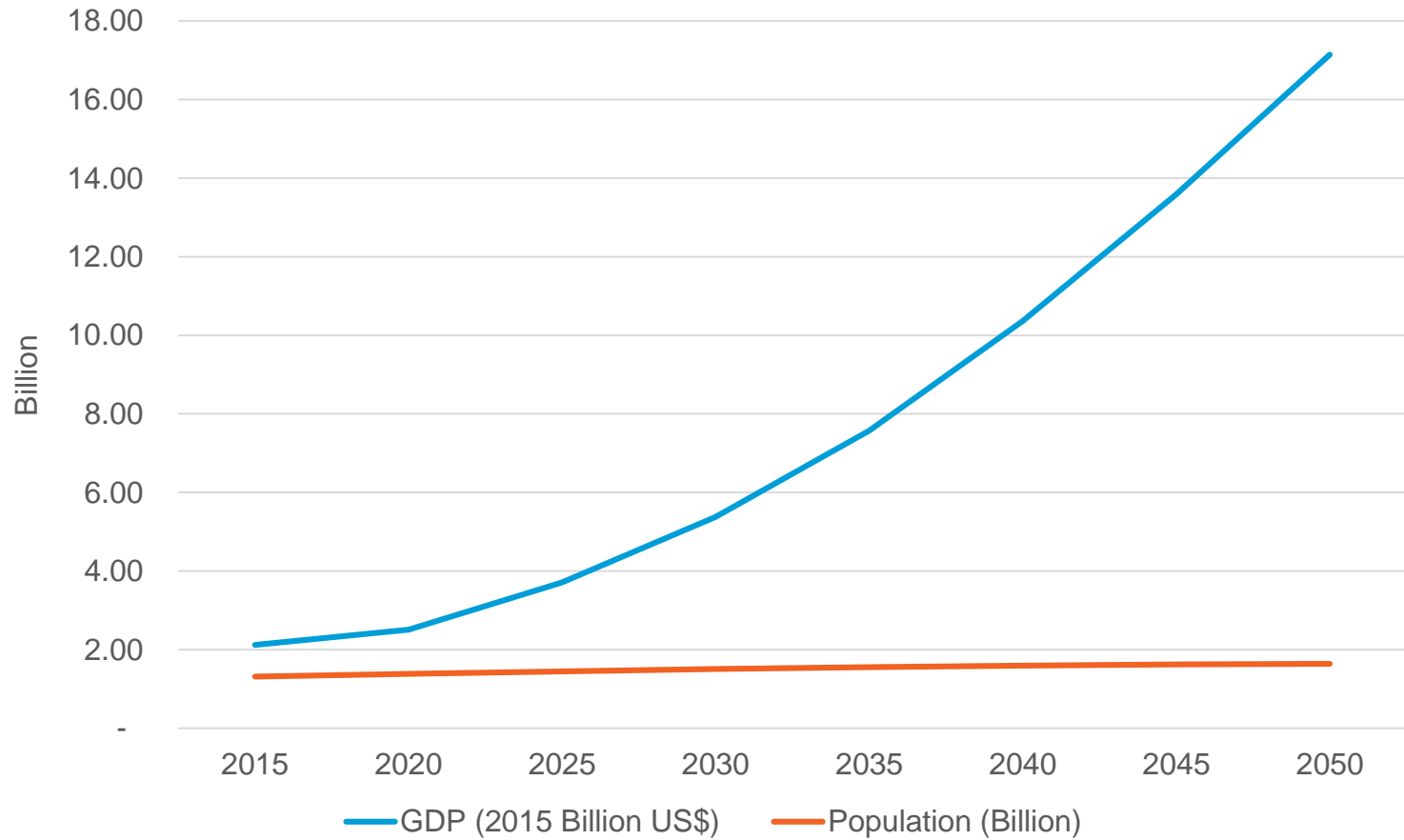
Key Assumptions

- Energy calibrated to IEA energy balances
- Cost
 - For commercial vehicles, cost represents total cost of ownership across the lifetime
 - For private vehicles, cost represents initial capital cost
 - For cars, cost is a weighted average of TCO and capital cost, weighted by the sales of commercial taxis and private cars
 - Costs of all vehicle categories reflect latest market data
 - Electric cars reach cost parity with petrol cars by 2030
 - NG price regime reflects the increase in global supply following the US shale gas discovery
- Survival curves for all vehicle types based on stock survival curves by IIT-Delhi
- We assume efficiency improvement for various technologies based on historical trends, i.e. for IC engines and electric drive trains across modes
- Model takes into value of time travel for switching between modes, e.g. as the income level rises a person is more likely to switch to a faster mode of travel

Survival Curves



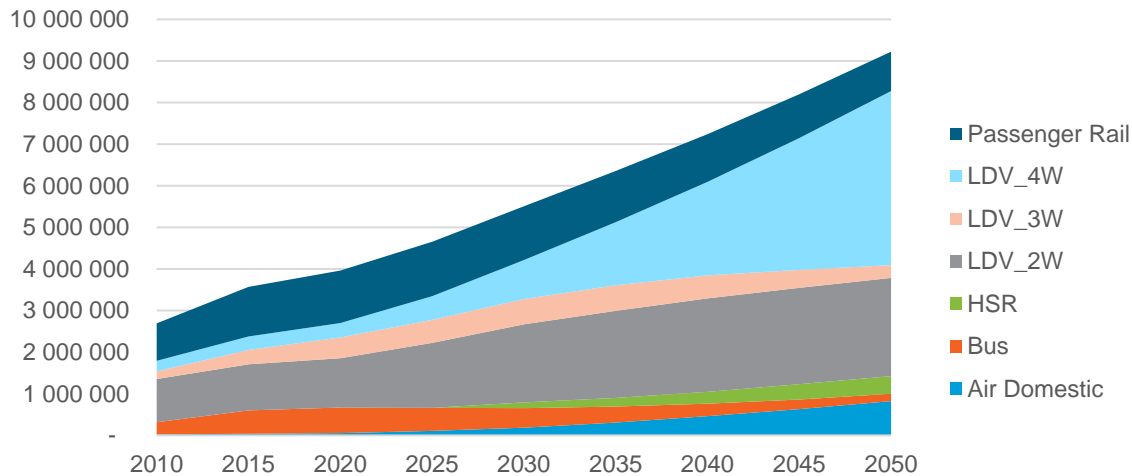
GDP and Population



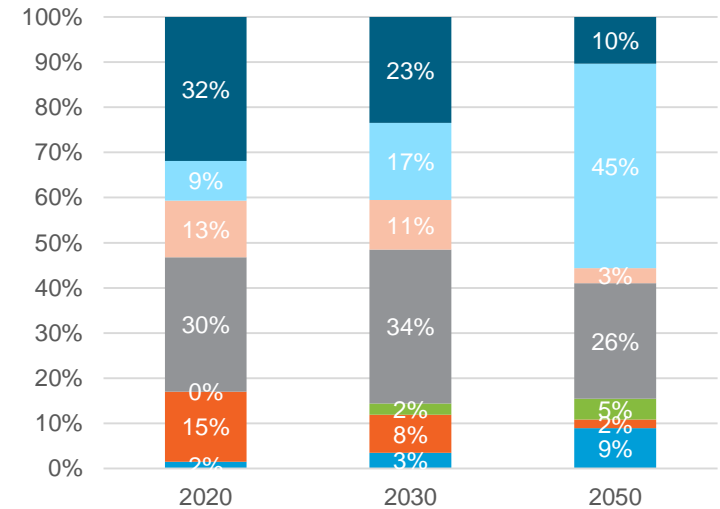
Results

Transport passenger service demand increase would be driven by cars

Passenger (PKM)

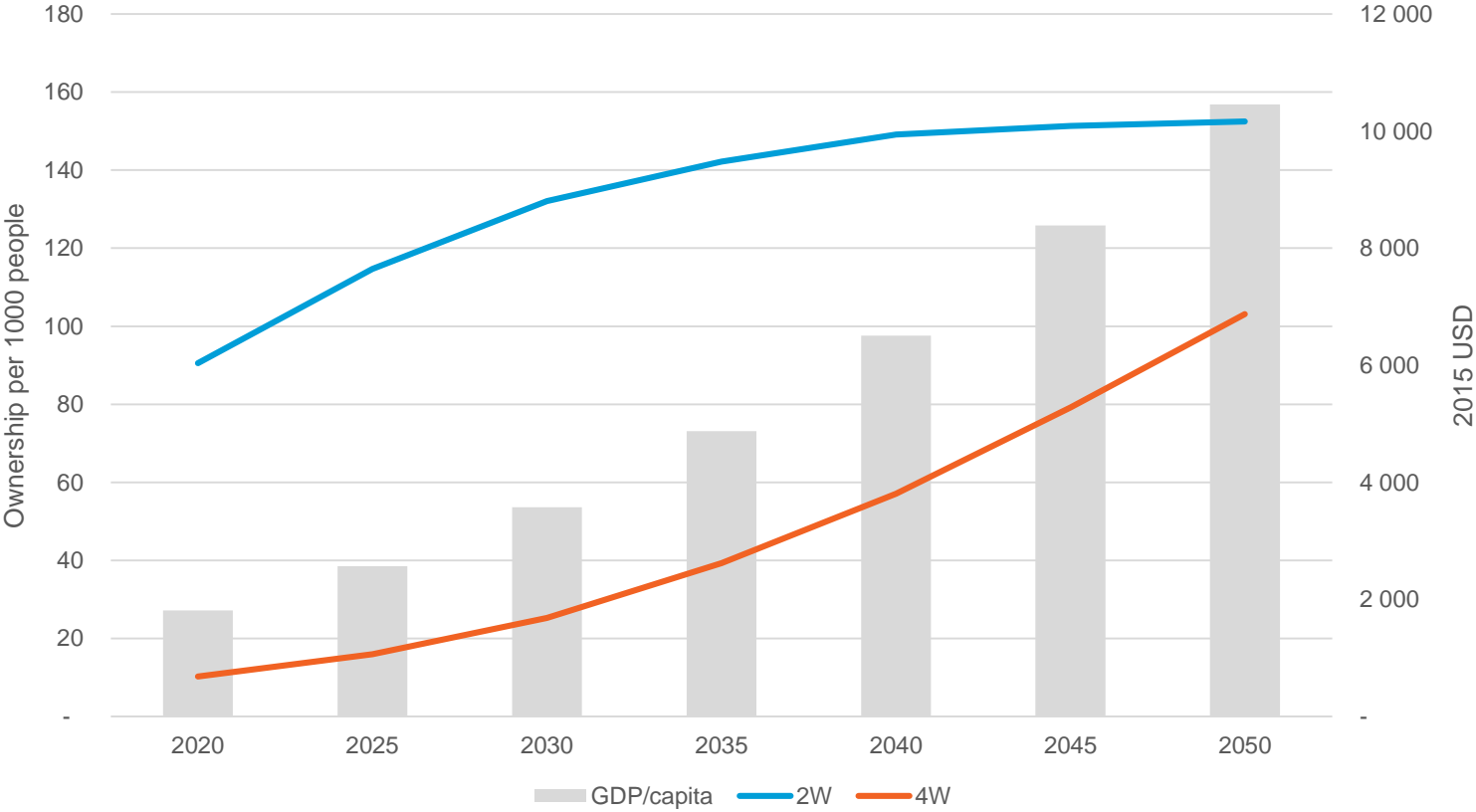


PKM Modal Share



- Four wheeler growth to emerge as a big story of the next three decades in India
- Another important component is going to be two wheelers
- A big shift towards four wheelers could have important implications for this sector's energy and emissions futures

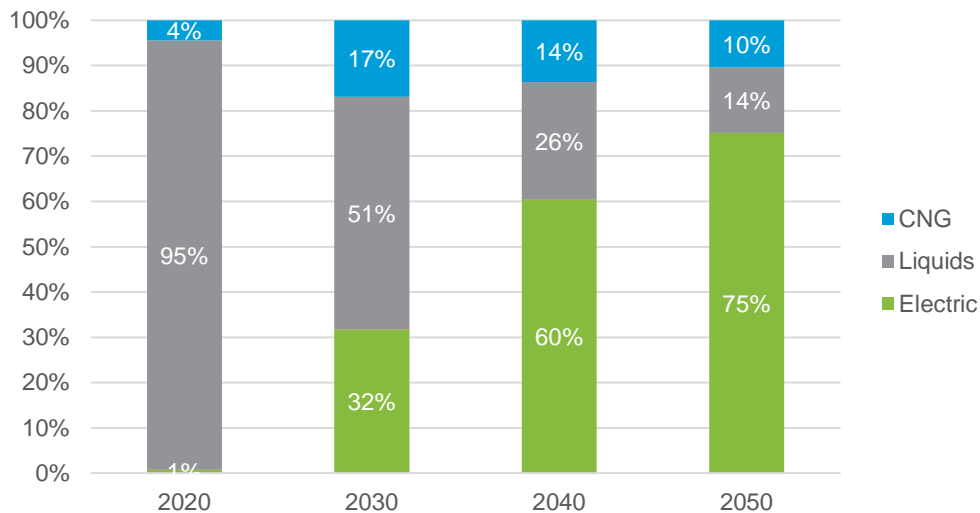
Ownership rate will grow fast for personal vehicles



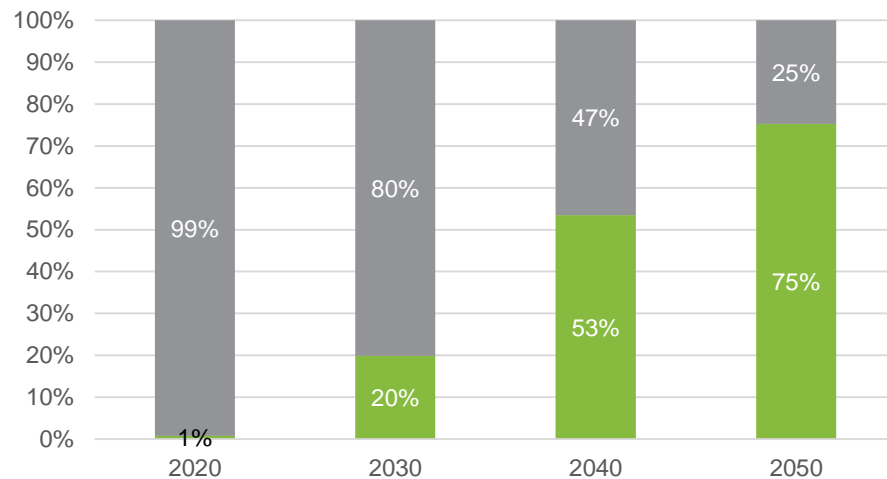
- Four wheeler ownership rate increases up to 100 per 1000 people by 2050
- Two wheeler ownership rate saturates post 2040

New Sales- Electric vehicles will come in a big way especially in four and two wheeler segment

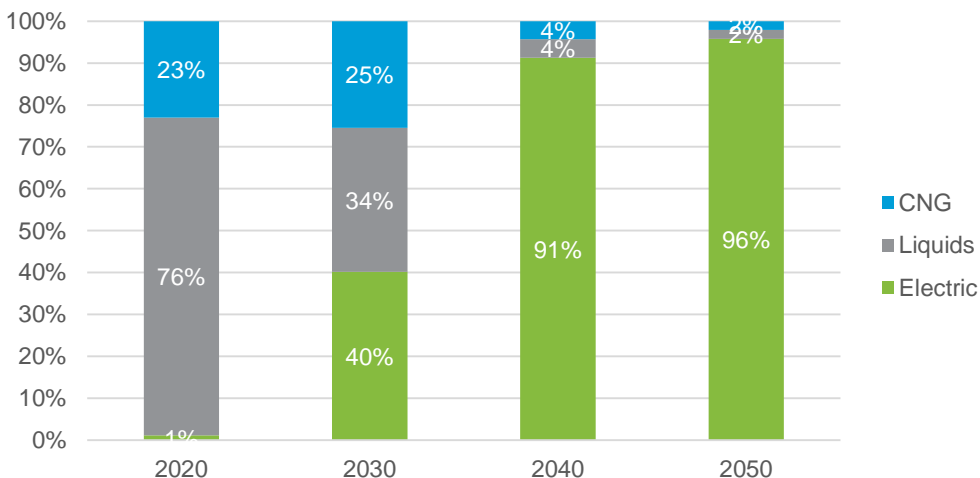
4W



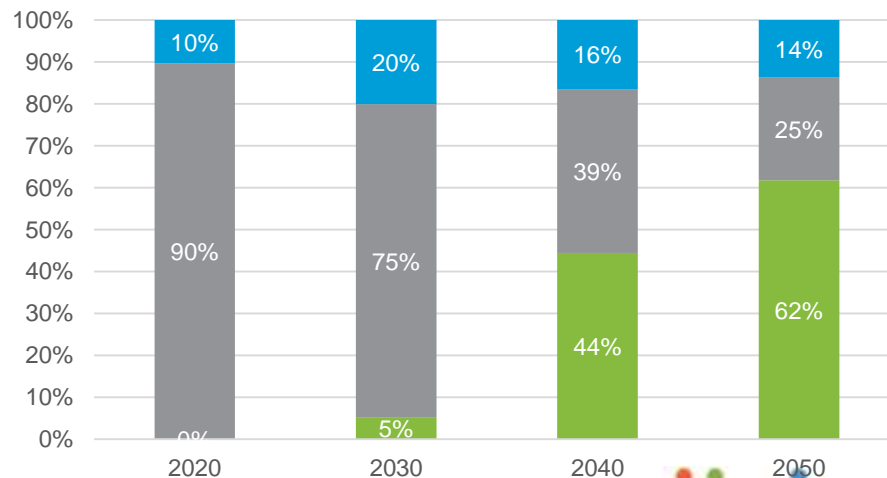
2W



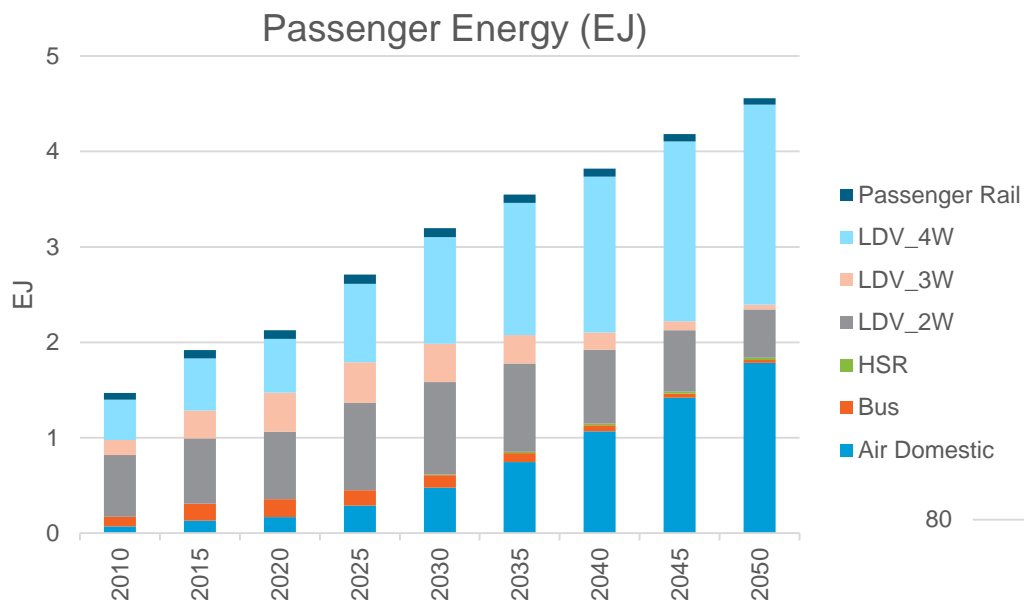
3W



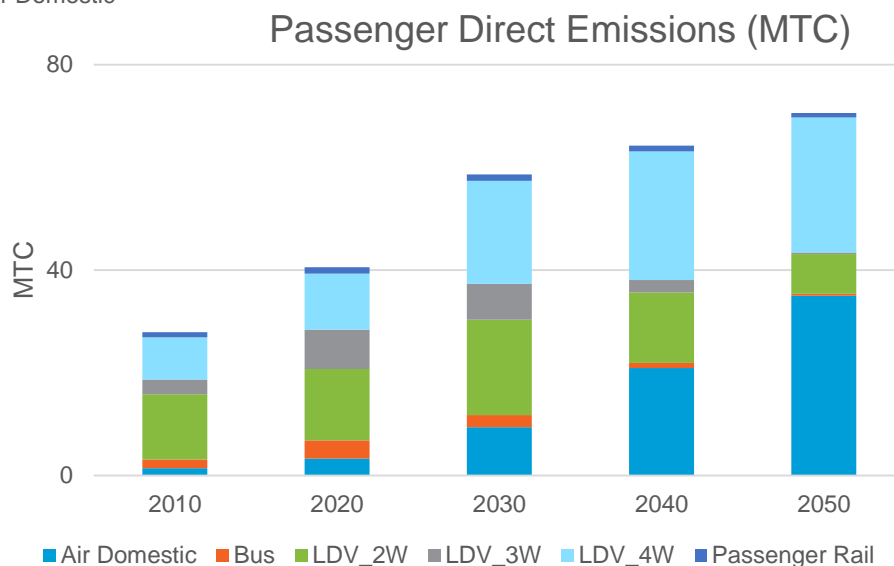
Bus



Fast electrification of passenger transport means that the share of airlines in energy and emissions becomes significant by 2050

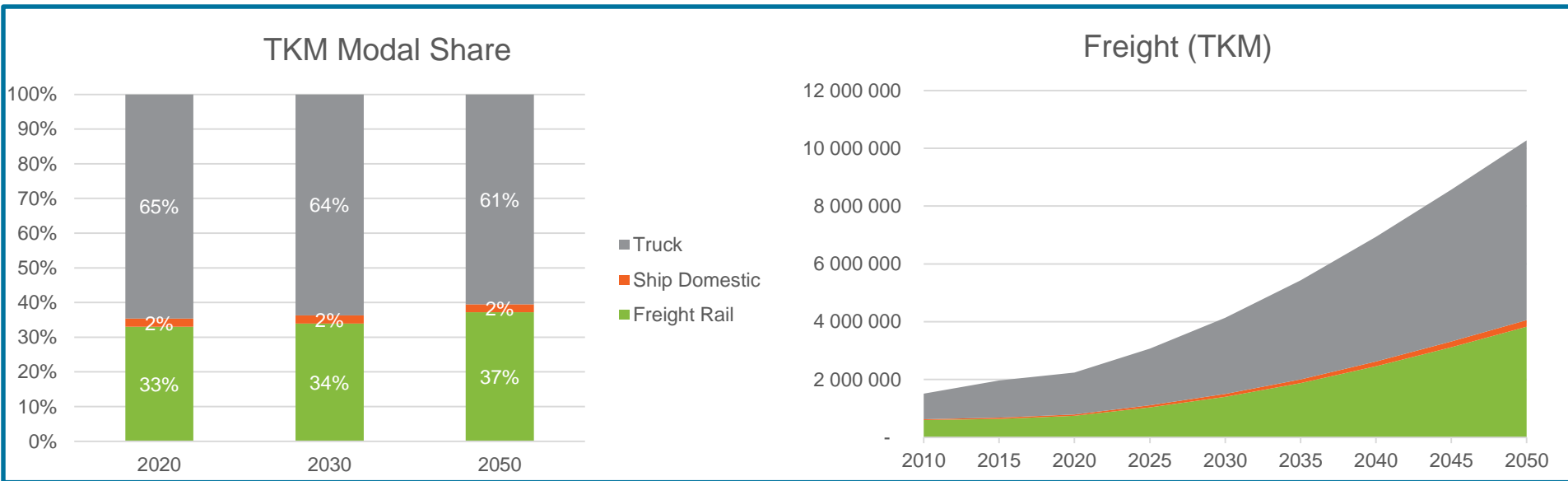


Four wheeler is the other big contributor to direct emissions



- Electrification of four wheelers negates their negative aggregate efficiency impact
- This has important implications for congestion and road infra requirements

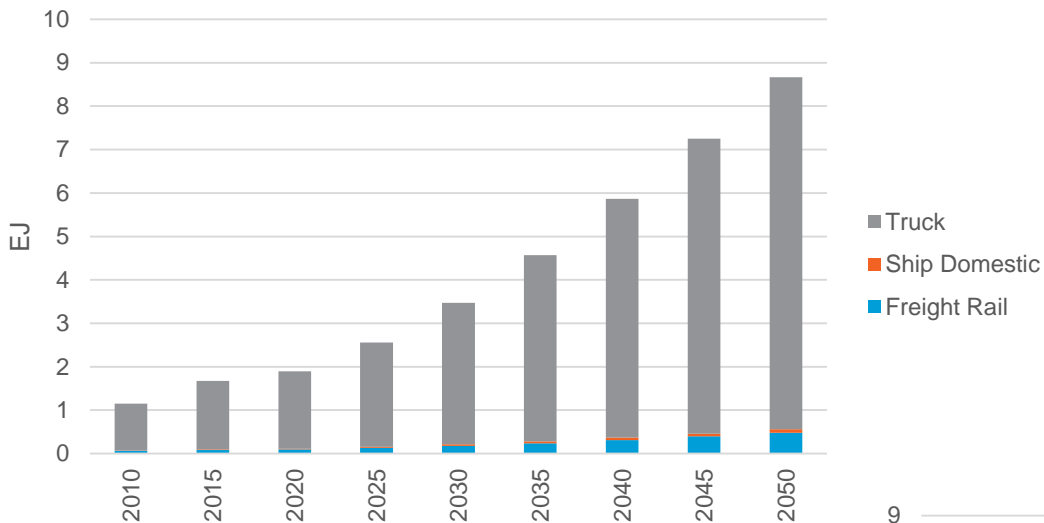
Transport freight service demand- trucks to grow fast



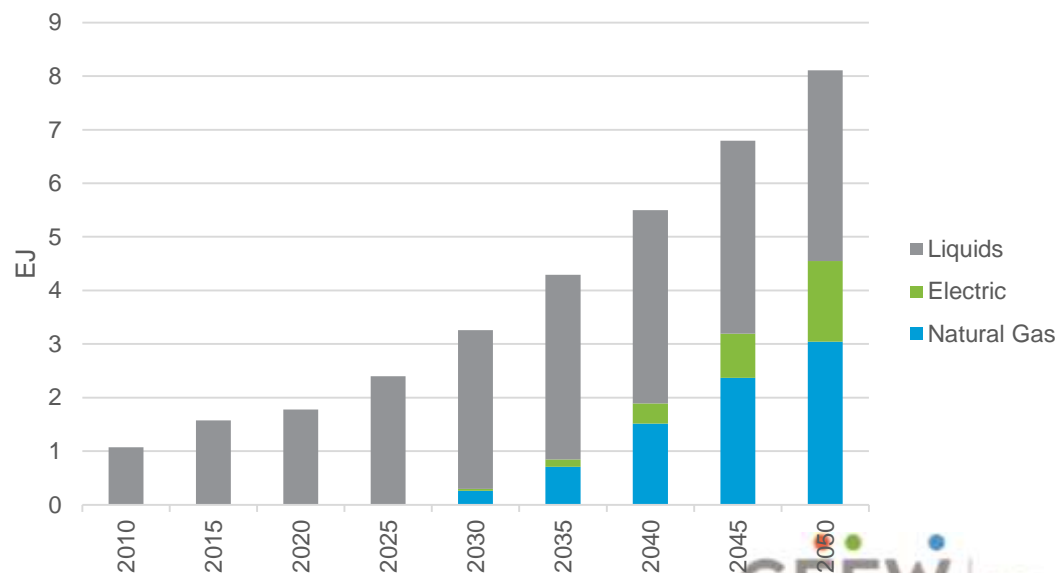
- Freight demand to grow by over five times in the next three decades
- The truck segment continues to dominate the freight business
- Railways continues to increase in absolute terms and its share marginally increases in the next three decades

Transport energy consumption would be heavily dominated by trucks, oil and NG become the two main fuels of this segment

Freight Energy (EJ)



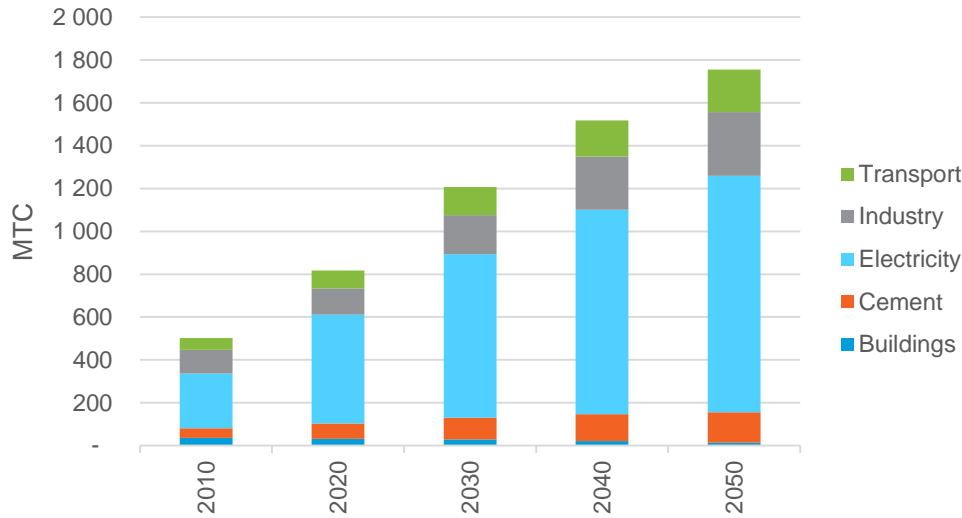
Trucks- Fuel mix



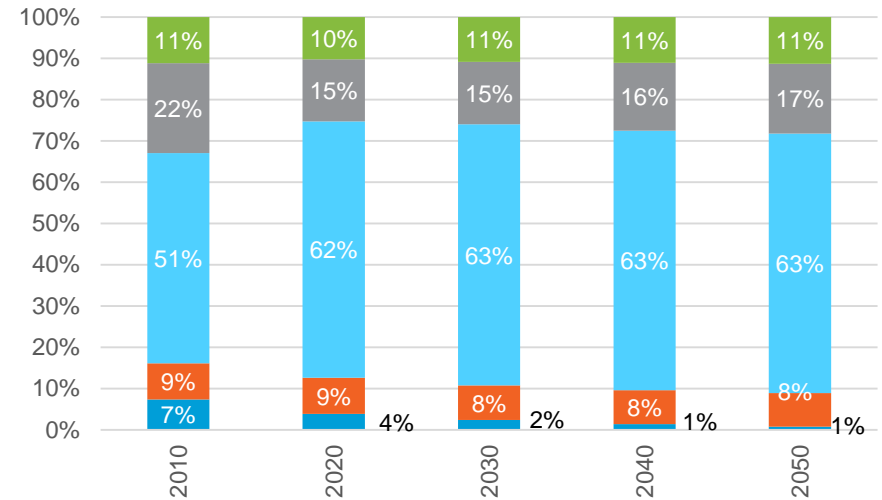
Emissions

Total emissions – Ref. Scenario vs 2_deg scenario

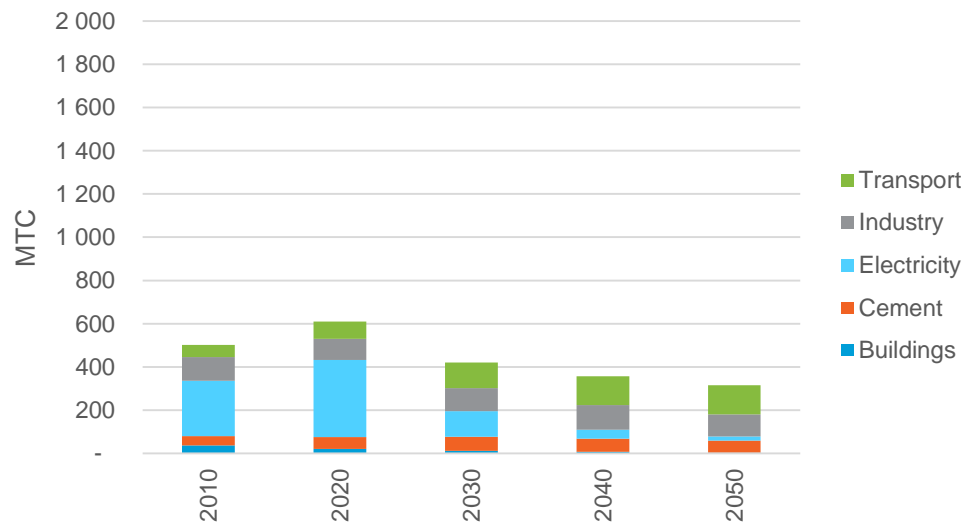
Ref. scenario - Emissions by Sector



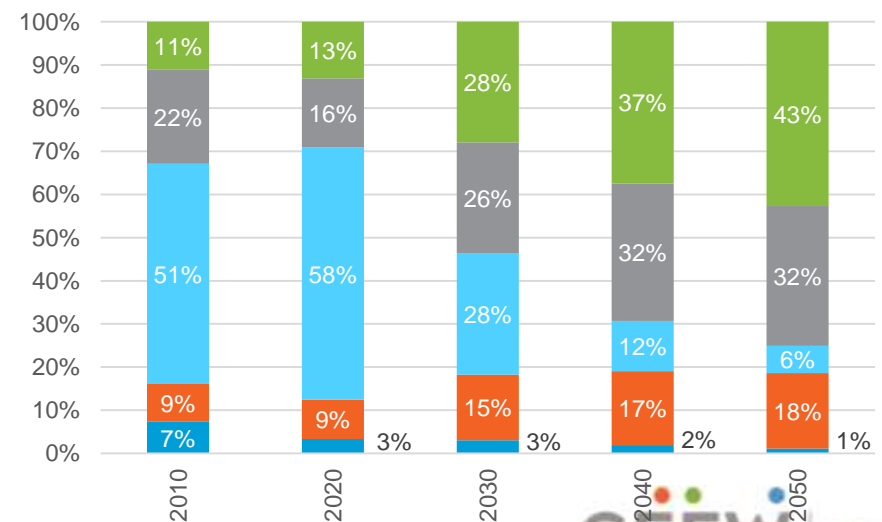
Ref. scenario - Emissions share by sector



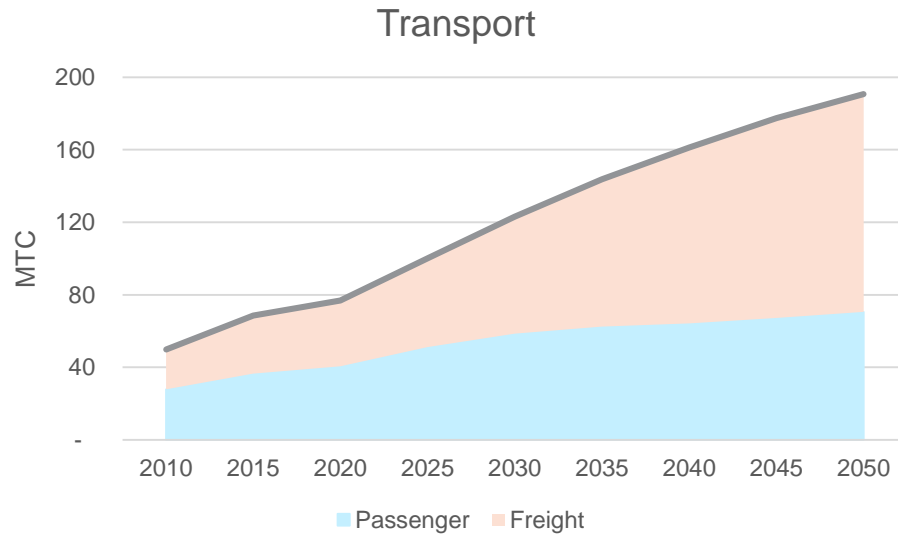
2_deg scenario - Emissions by sector



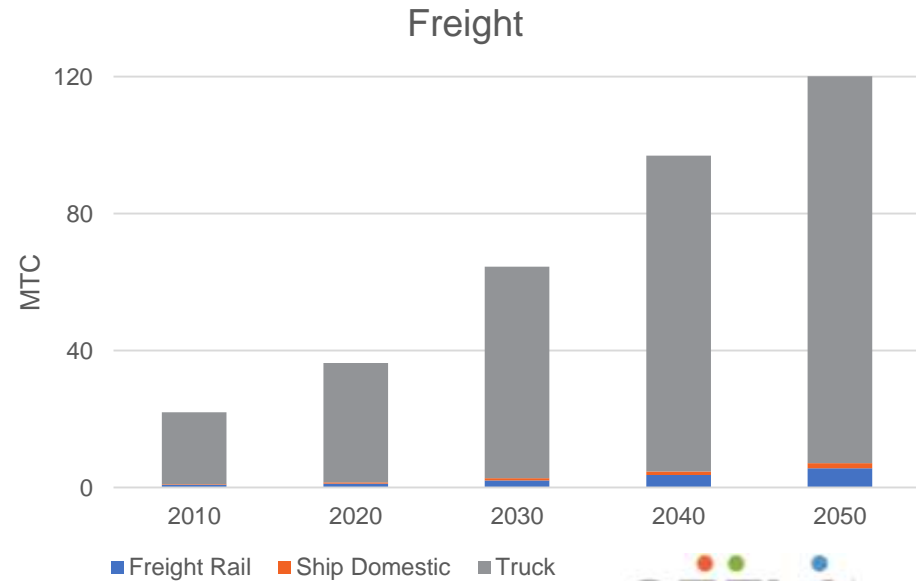
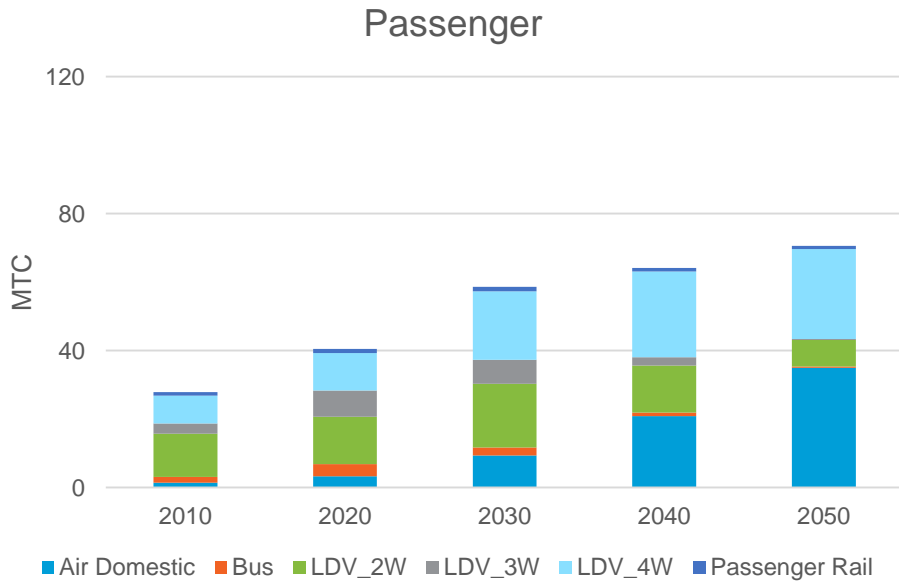
2_deg scenario - Emissions share by sector



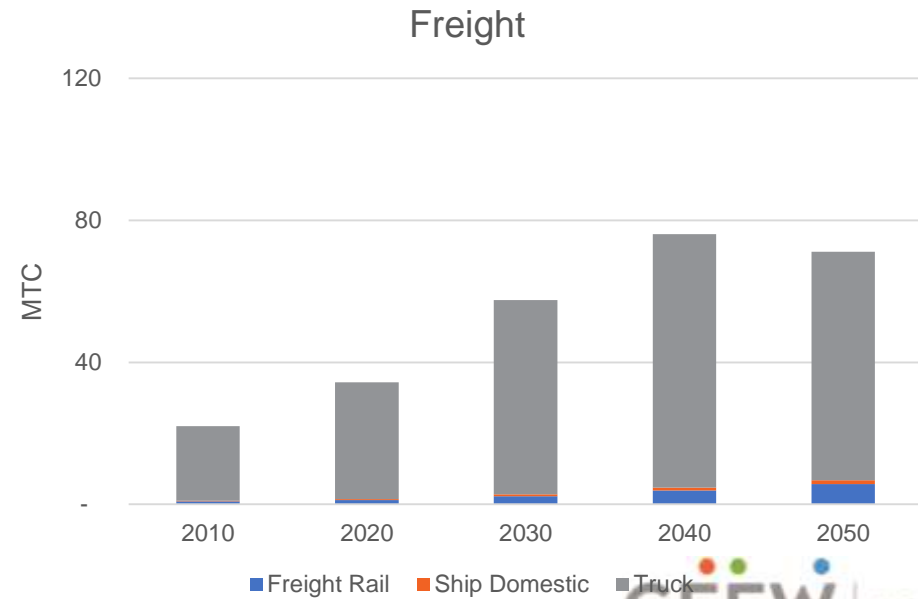
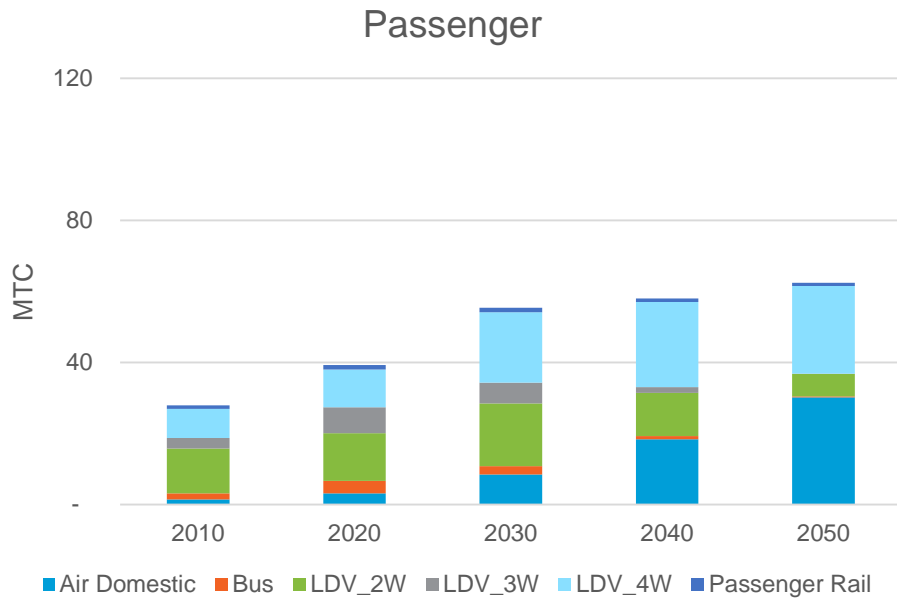
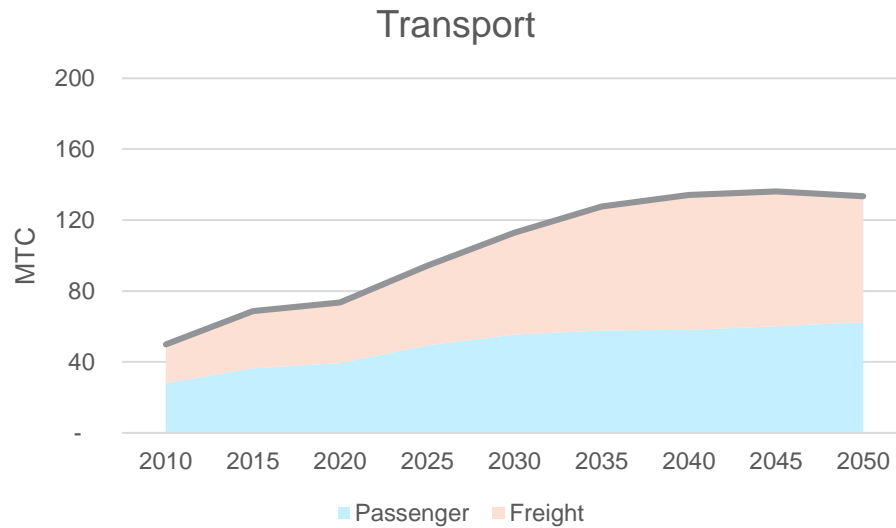
Transport emissions – Ref. scenario



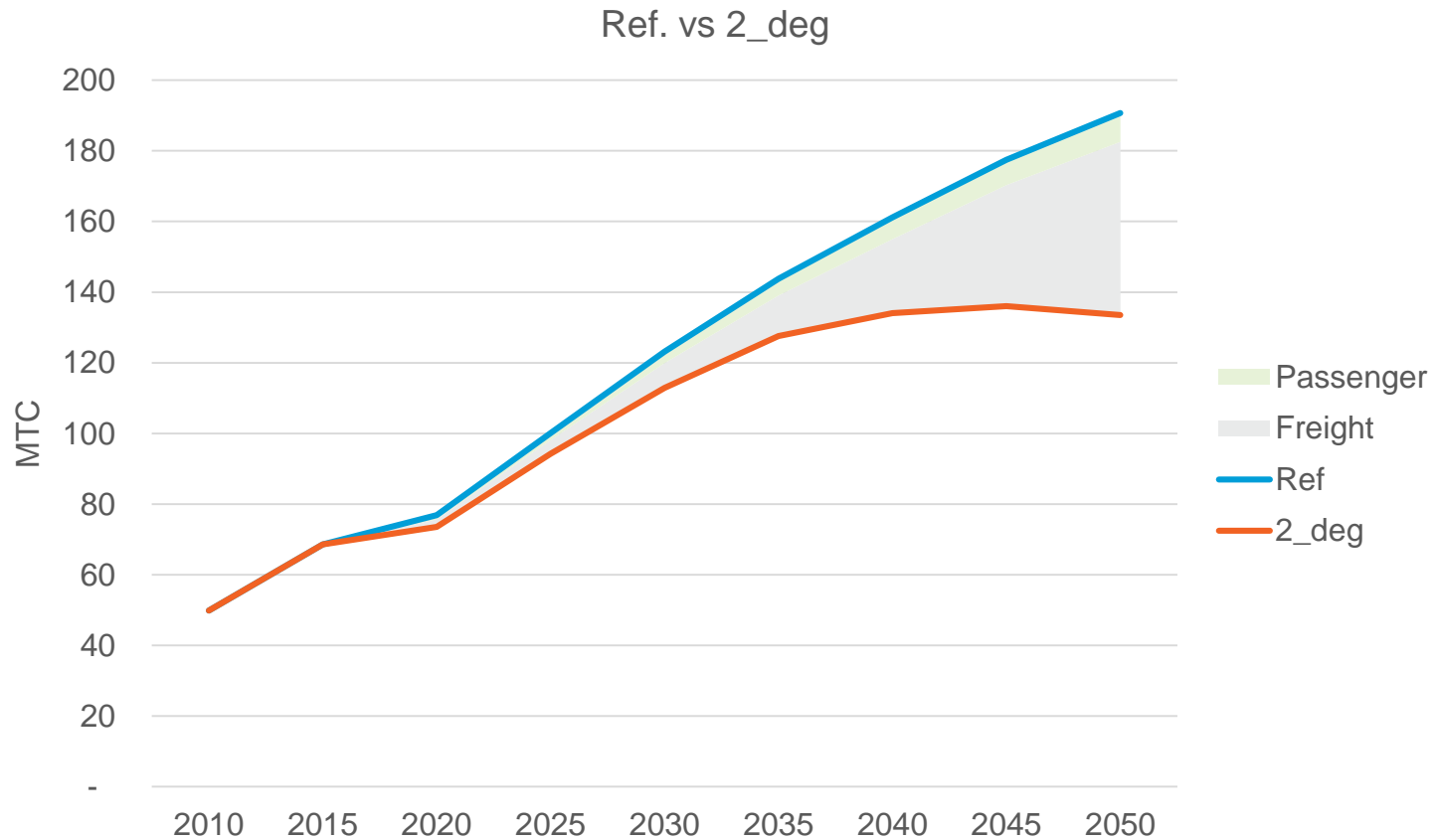
Freight trucks and airlines emerge to be the top emitters in the Ref sc



Transport emissions – 2_deg scenario



2 degree scenario



- 30 percent reduction by 2050
 - 25 percent comes from freight; mainly trucks
 - 5 percent comes from passenger; dominated by domestic aviation

Key Insights

- Four wheeler growth, fueled by economic growth
- Electrification of passenger transport, particularly 4W
- NG penetration in trucks
- Domestic airlines and freight trucks are the 'hard to abate' transport sectors

Thank you

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