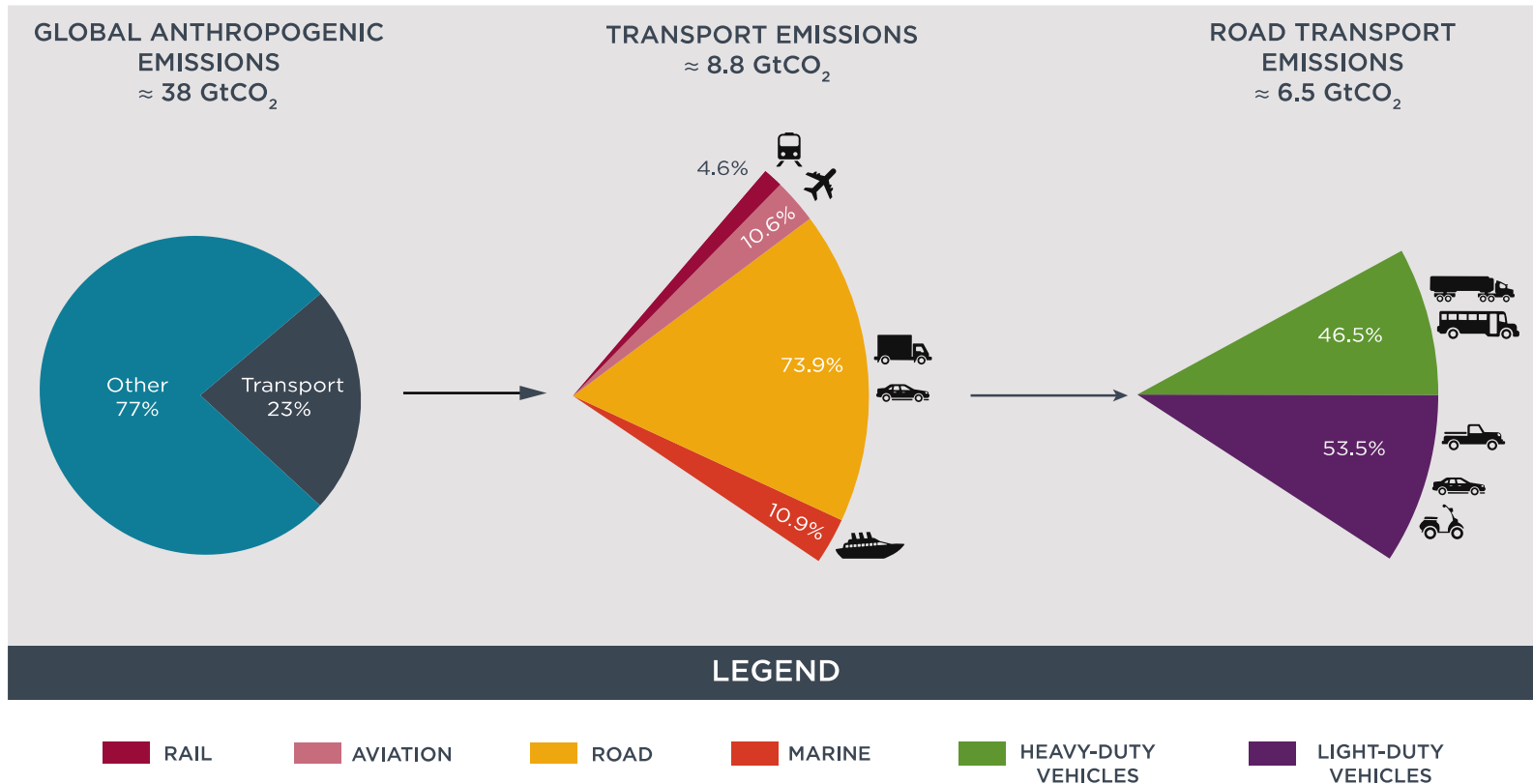


Decarbonising India's Transport

Amit Bhatt
Managing Director (India)
October 2023
New Delhi

Global emission and transport sector

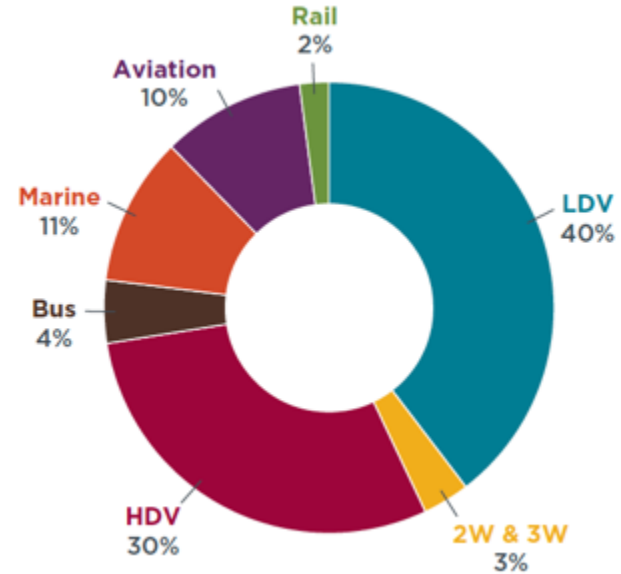
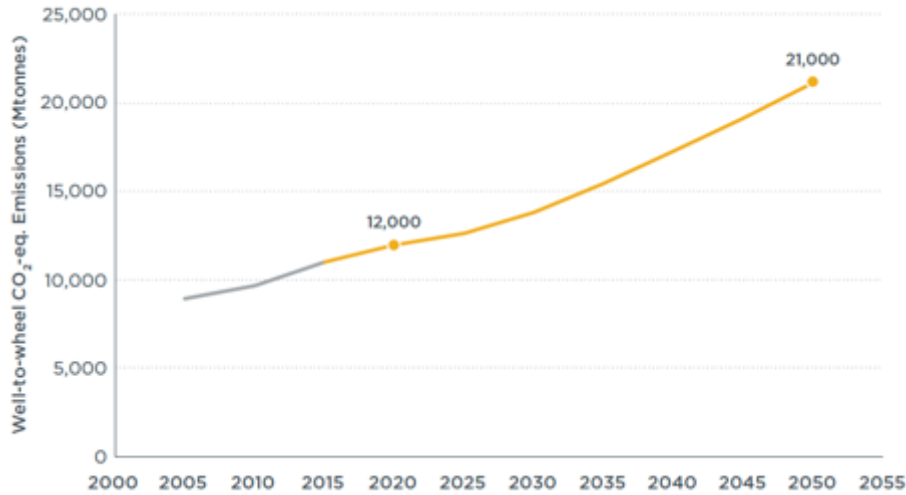


Notes:

Global anthropogenic CO₂ emissions in 2010 based on IPCC (2014).

Transport CO₂ emissions in 2010 estimated by ICCT (2014) include the full fuel lifecycle, including direct emissions from combustion & upstream emissions from extraction, refining, & distribution of fuels.

Annual CO₂-equivalent emissions from the global transportation sector have increased to ~12 Gt in 2020*

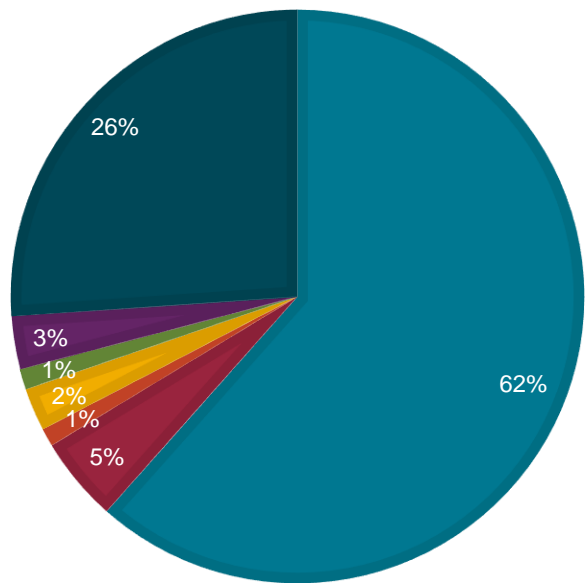


Share of 2020 well-to-wheel CO₂ emissions

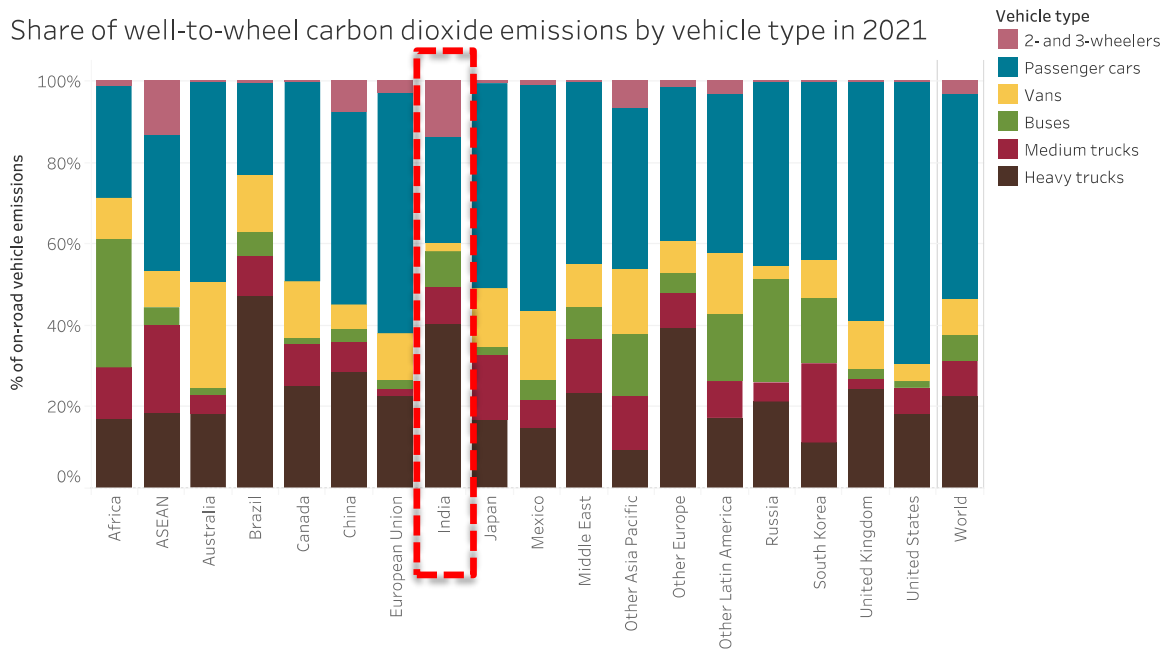
For some perspective, a tree has the potential to absorb 1 tonne of CO₂ over its 40 years lifetime on average.

Trucks account more than half of on-road CO₂ emissions in India

■ 2W ■ 3W ■ Bus ■ HDT ■ MDT ■ LCV ■ PC

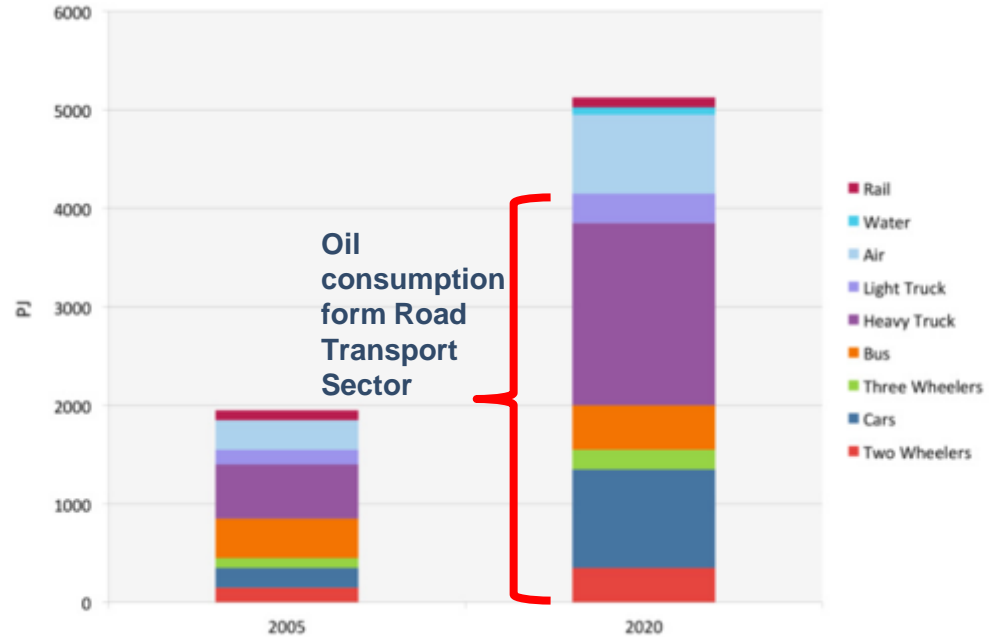


Share of well-to-wheel carbon dioxide emissions by vehicle type in 2021



Decarbonising road transport is vital for India's net zero target & energy security

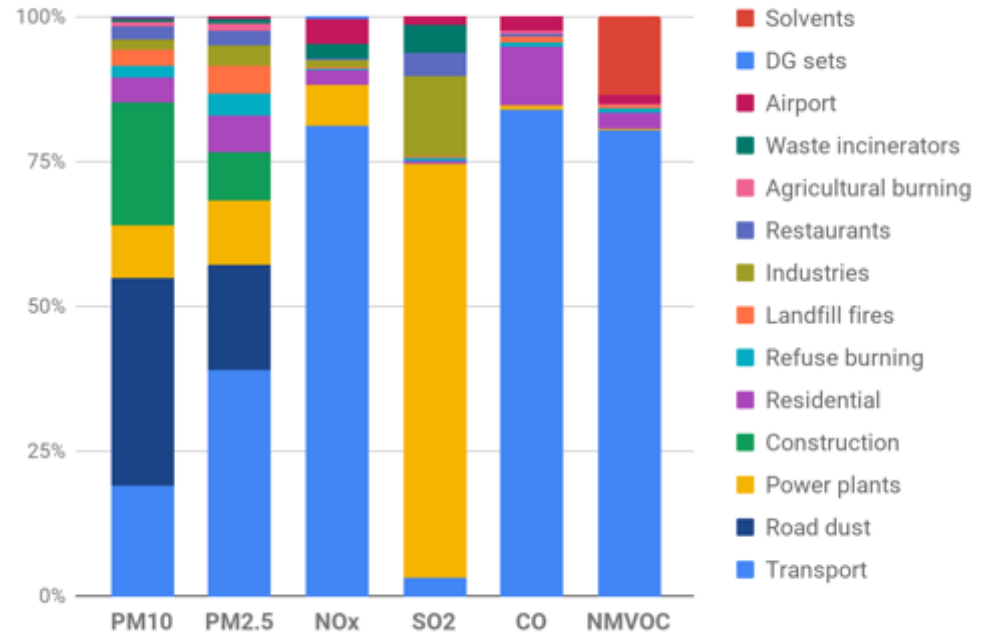
- Transport is the fastest growing sector in India
- It accounts for 14% of India's CO₂ emissions
- Road transport is responsible for 90% of the emission & energy consumption within the entire transport sector



Cleaning road transport is vital for improving public health

- Motor vehicle exhaust are the largest source for air pollution in cities
- Reduction in tail pipe emission can significantly improve air quality in cities
- Improvement in air quality will positively impact public health

Annual emission of pollutants from within Delhi (%)



Only battery-electric and hydrogen fuel cell vehicles have the potential to achieve near-zero GHG emissions

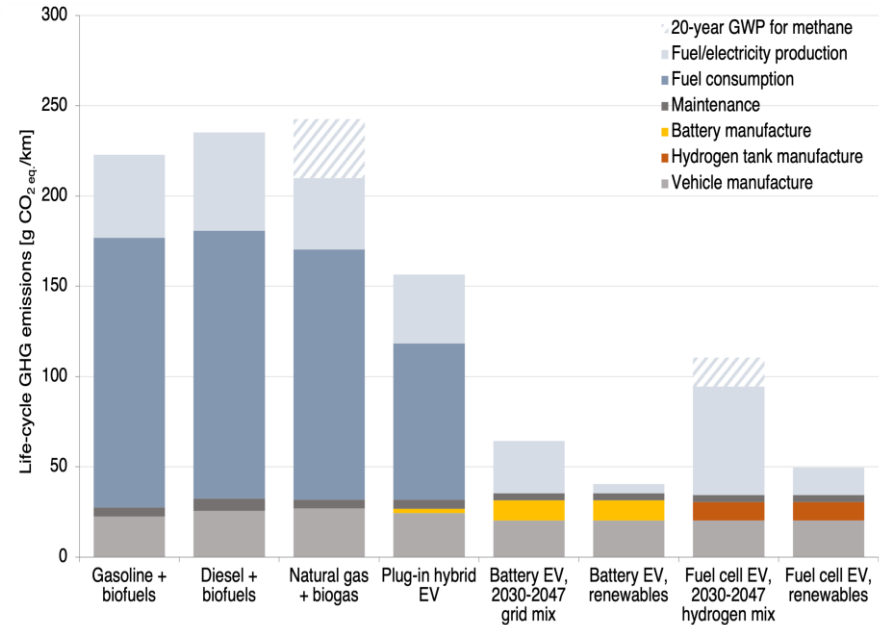
There is no realistic pathway to fully decarbonize the internal combustion engine.

- Current biofuels have relatively high GHG emissions and minor growth potential due to limited feedstock.
- Methane's modest GHG reductions at tailpipe are offset by upstream leakage.
- Hybrid and plug-in hybrids achieve near-term gains but do not offer long-term zero-emission potential.
- E-fuels offer near-zero carbon emissions, but cost parity to fossil fuels only by 2050 in best case.

Even today, EVs have by far the lowest lifetime GHG emissions compared to all other technologies.

As electric power becomes lower carbon, GHG emissions from electric vehicles will decline further.

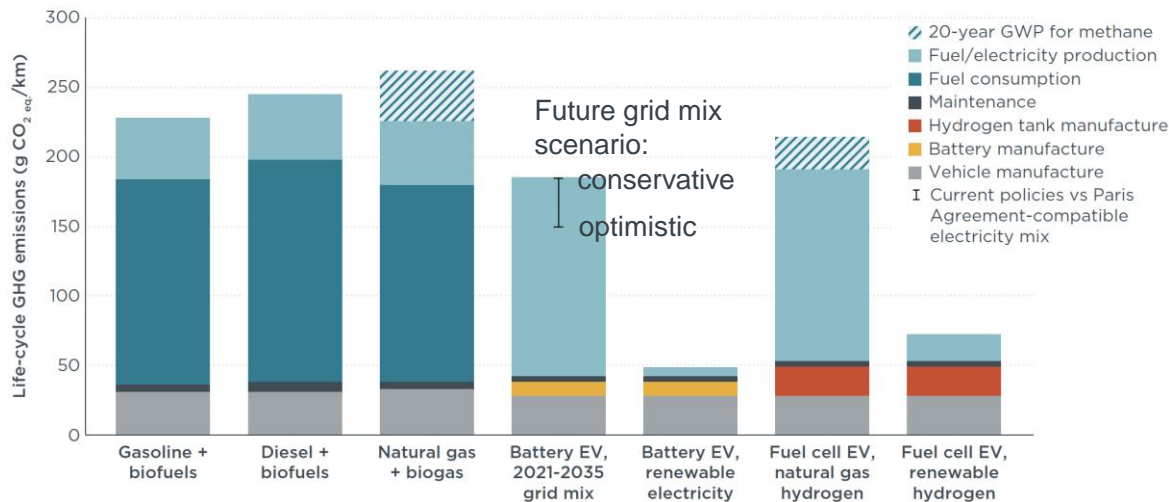
Lifecycle GHG emissions for typical passenger car sold in 2030



Even with India's coal-heavy electric grid, EVs are still cleaner than internal combustion vehicles for climate and air pollution

- **Gasoline cars:** biofuels offer only modest GHG reduction
- **Diesel and CNG cars:** no GHG emissions benefit
- **Battery EVs:** lowest GHG emissions, also in India: **19%–34% reduction for 2021 cars, 30%–56% reduction for 2030 cars, 79% reduction with renewables**
- **Fuel cell EVs:** no GHG emission benefit with natural gas hydrogen, 68% lower with renewables

Life-cycle GHG emissions for average **medium-size cars** sold in India in **2021**

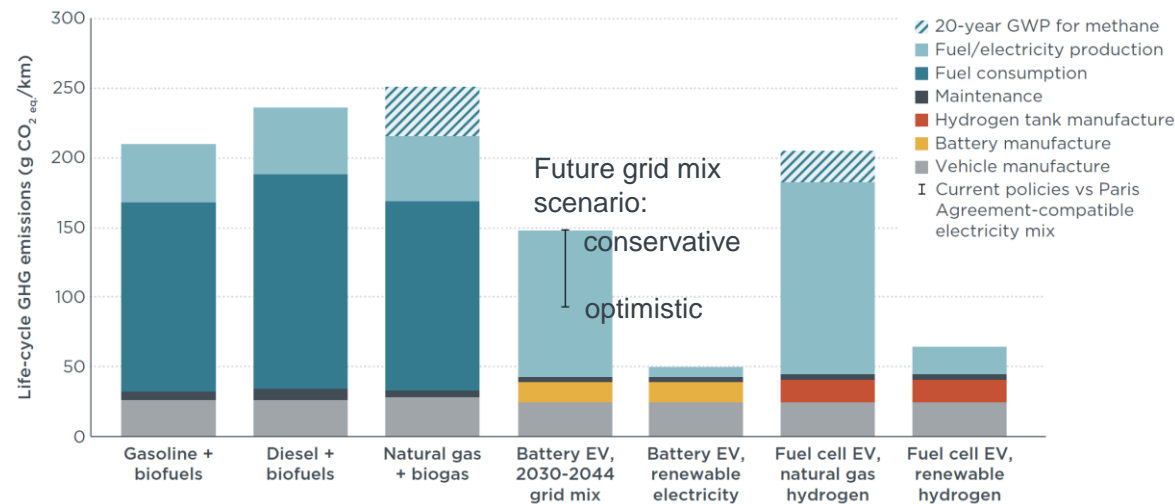


- **Electric two-wheelers:** same trends, **33%-50% reduction for 2021-2032, 45%-70% reduction for 2030-2041**

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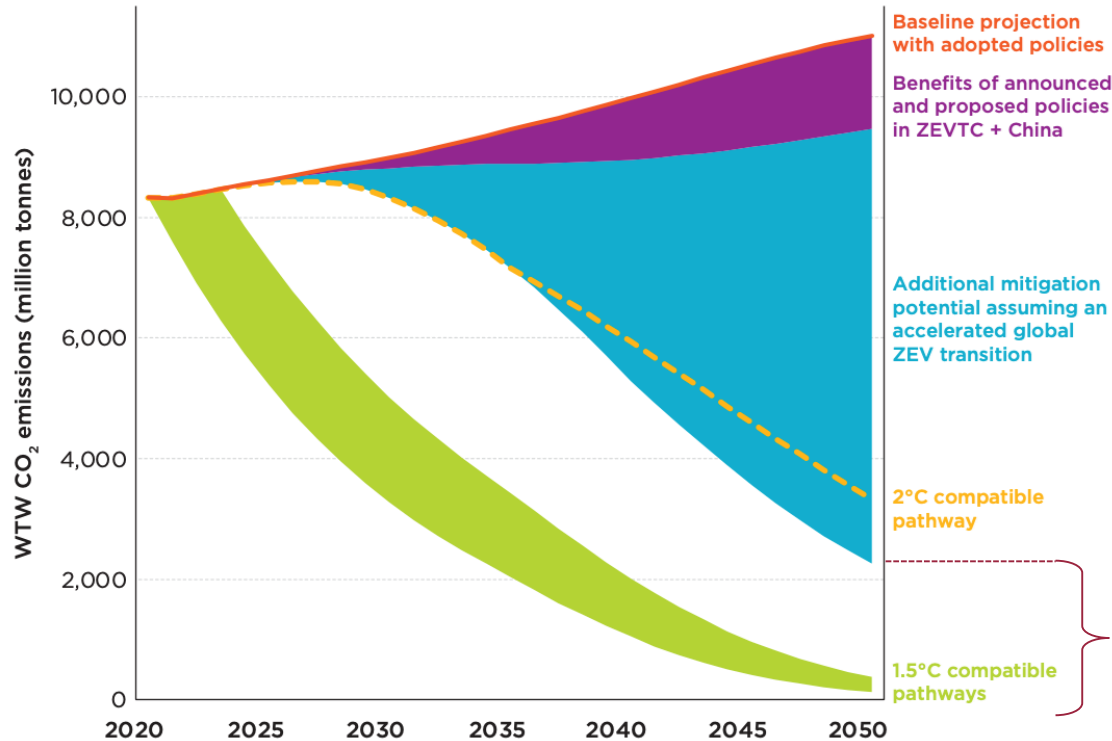
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Life-cycle GHG emissions for average **medium-size cars** sold in India in **2030**



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India needs ambitious policy and programs to limit pursue a 1.5°C compatible pathway



Along with ZEV transition, we need effective and ambitious '**Avoid**' and '**Shift**' policies to preserve and improve modal share and reduce the growth in travel demand.