

Introduction

The transport sector in India is a heavy consumer of petroleum products and contributed to about 10% of the total Greenhouse Gas (GHG) emissions including Land Use, Land Use Change and Forestry (LULUCF) for the year 2010¹. Around 13% of the energy based emissions can be attributed to transport sector, based on the estimates published in the Biennial Update Report (BUR) by the Government of India. Emissions in transport sector can be disaggregated into four divisions based on mode – Road, Railways, Aviation and Water Navigation. Amongst these modes, road transport dominates the share of emissions as it caters to the needs of millions via private and public vehicles.

Road Transport - Fuel Consumption & GHG Emissions

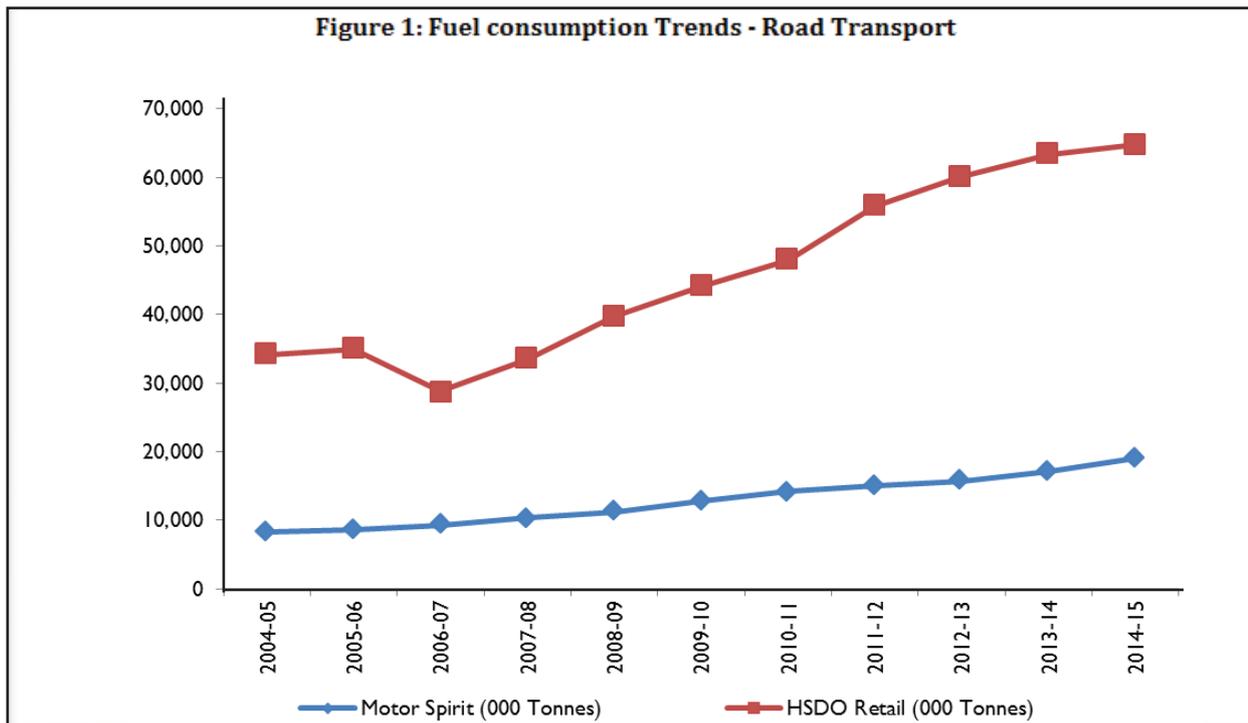
With increasing demand for transport services, emissions increased by 78% between 2005 and 2014. The road sector accounted for more than 85% of these emissions (86% in 2005 and 88% in 2014). The product of fuel consumed (quantity), emission factor (tonnes/Tera Joules) and net calorific value (Tera Joules/kilo Tonnes) will yield emissions for a given year.

Fuel consumed by road transport sector includes Motor Spirit, High Speed Diesel Oil (HSDO), Compressed Natural Gas (CNG) and Auto Liquefied

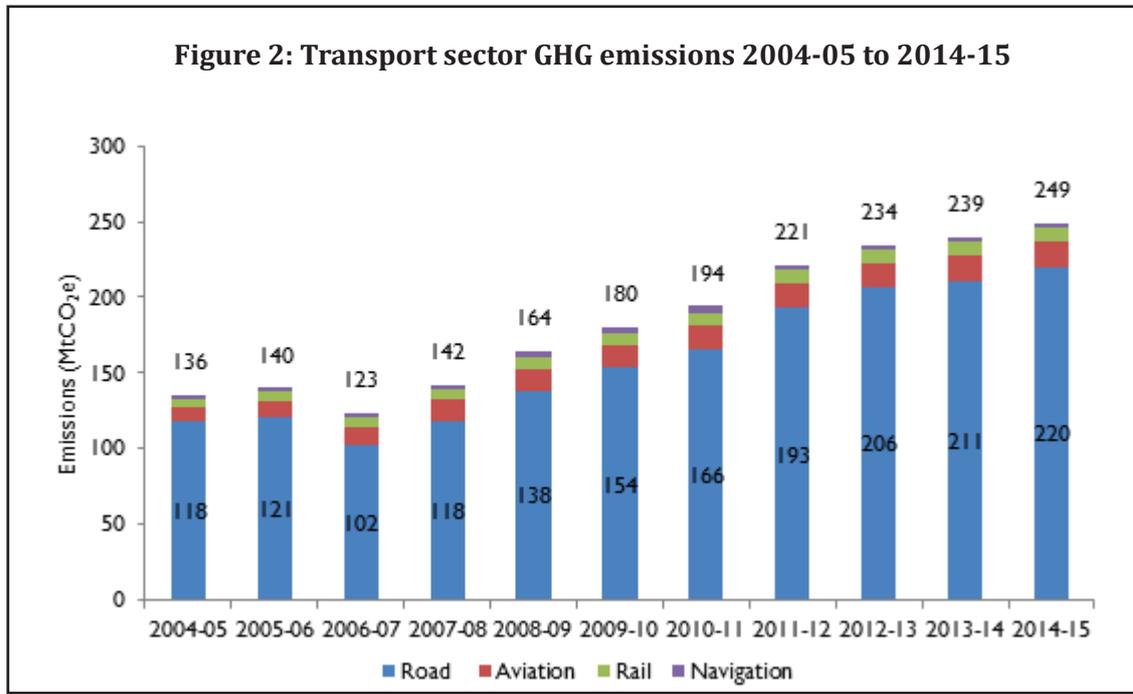
Petroleum Gas (A-LPG). Of these, HSDO retail has the highest share of total fuel consumption. For the inventory period 2005 to 2014, the consumption of Motor Spirit and HSDO (retail) increased at a Compounded Annual Growth Rate (CAGR) of 8% and 5% (Refer Figure 1). Substantial increase in disposal income, coupled with the desire towards a better quality of life, has resulted in noticeable increase of vehicular growth rate, especially cars, taxis and two wheelers in 2005-2015.

It can be observed that emissions from transport sector for the period 2004-05 to 2014-15 witnessed an increasing trend, due to increase in service demand and associated fuel consumption (Refer Figure 2). The road transport emissions increased for the period 2004-05 to 2014-15 at a CAGR of 6%, from 118 MtCO₂e to 220 MtCO₂e.

Further these trends are associated with adverse implications on the economy– pushing up import dependency and increasing social costs from externalities such as deteriorating air quality and associated health impacts. With the available data on road transport sector in this period, modal share related assessments were conducted and emission reduction potential was examined for two decarbonisation strategies: a) Modal shift to public transport; b) Shift to Electric Vehicles (EV).



1. MoEFCC. (2015). India First Biennial Update Report to the UNFCCC. New Delhi: GoI.

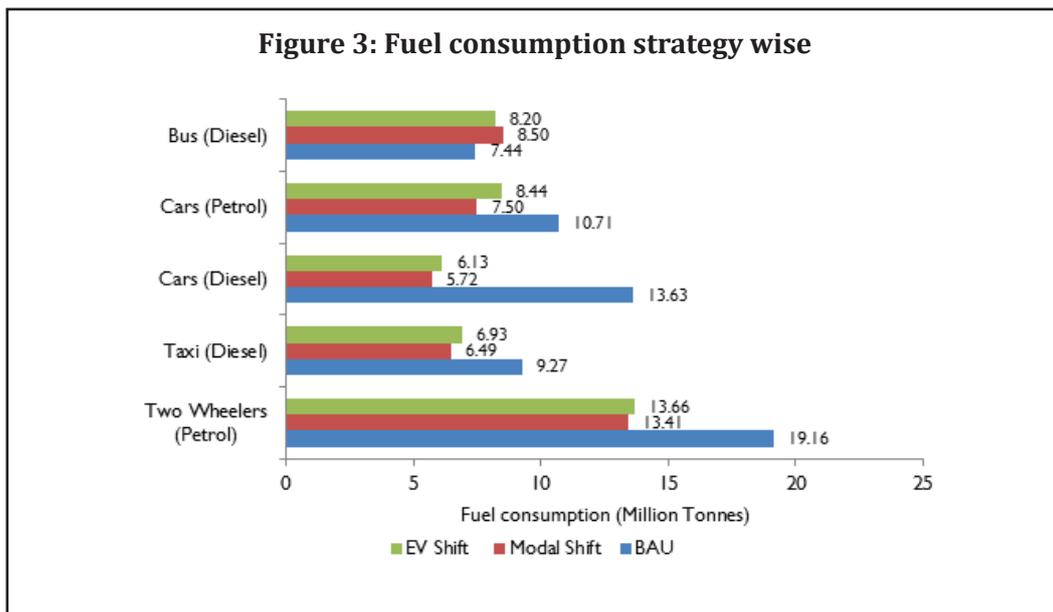


Decarbonisation strategy analysis

Given the increasing share of road transport emissions to the Transport related emissions, it is important to understand the role of decarbonisation strategies to reduce emissions from road transportation. India has committed, through its Nationally Determined Contribution (NDC), to reduce emission intensity of GDP to 33-35% of 2005 levels by 2030. Amongst many mitigation strategies proposed, the transport sector strategies include promotion of clean energy (EV vehicles), improving energy efficiency and lowering emission intensity per passenger and freight movement². A few specific strategies for reducing road transport emissions

include introduction of better fuel economy standards, electric vehicles adoption, bio-diesel blending and promotion of mass rapid transit system³

The analysis focusses on two strategies: a) modal shift from two wheelers, cars and taxis to public transport; b) adoption of electric two wheelers, cars, taxis and buses and assessing its impact on emission reduction for the year 2017-18. In the Business As Usual (BAU) scenario, the modal share and EV penetration is assumed to remain similar to current year (2014-15). Passenger kilometres and fuel consumption are modified⁴ to assess the impact of emissions reduction in EV Shift and Modal Shift



2. MoEFCC. (2015). India's Intended Nationally Determined Contribution: Working towards climate justice. <http://www4.unfccc.int/submissions/INDC/Published%20Documents/India/1/INDIA%20INDC%20TO%20UNFCCC.pdf>
 3. MoEFCC. (2015). India First Biennial Update Report to the UNFCCC
 4. Nielson. (2013). All India Sectoral Demand of Diesel and Petrol. PPAC,MoPNG,GoI.

scenarios. These scenarios are constructed and emissions are estimated based on the IPCC methodology.

The results indicate that with a 30% shift in passenger kilometres from two wheelers, cars and taxis to public transport, fuel consumption can be reduced by 31% and CO₂ emissions can be reduced by 24%, compared to BAU (Refer Figure 3). The EV shift strategy (30% shift in passenger kilometres from hydrocarbons to EV) resulted in 28% reduction of fuel consumption and therefore 11% reduction in CO₂ emissions, from BAU scenario. However, as the electricity CO₂ emission factor is high compared to conventional fuel emission factors, reduction in CO₂ emissions⁵ are not significant. When renewable sources (solar, wind, biomass) is assumed to cater the entire fleet of EV, the reduction in CO₂ emissions was noted to be 34% higher than the emissions reductions from simply shifting modes to public transport.

Policy Recommendations

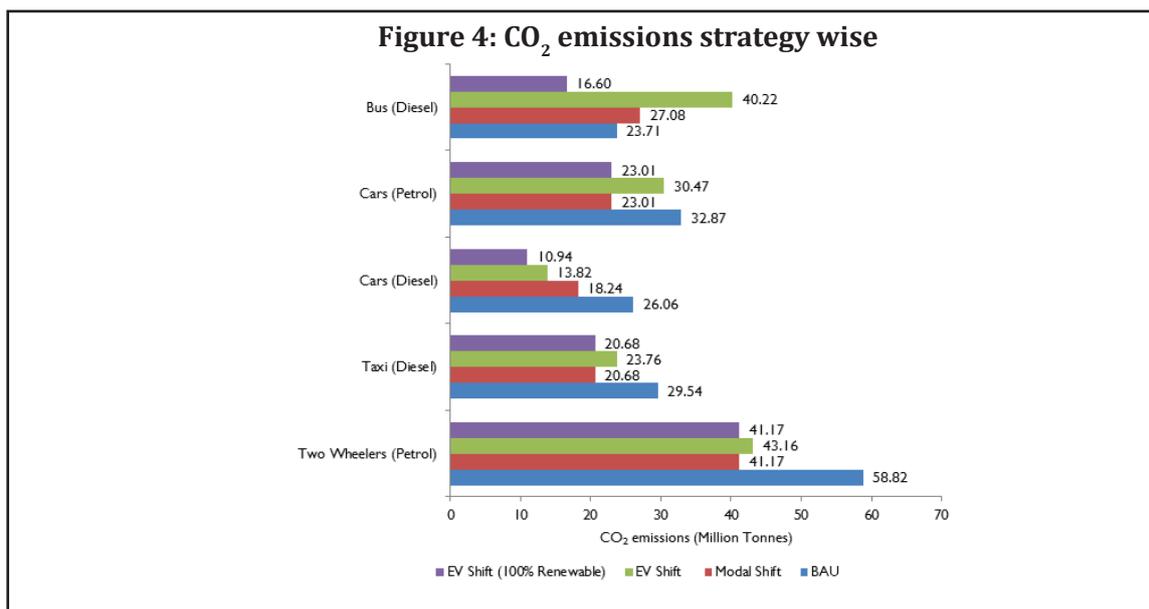
Decarbonisation strategies to reduce emissions from road transport can be attempted by targeting each mode of transport or ownership (public/private). It is important to note that each strategy plays a vital role in formulating short, medium and long term policies for decarbonising the transport sector.

a) Modal shift strategy from two wheelers, cars,

taxis to public transport will reduce CO₂ emission effectively, when compared to EV shift based on the current electricity mix, which is predominantly coal based shift based on the current electricity mix, which is predominantly coal based

b) There is an opportunity to achieve significant reduction in CO₂ emissions with EV shift, when renewable energy is used for the additional energy requirement to power electric vehicles.

At present, the current fleet of vehicles are powered by hydrocarbons, mostly petrol and diesel. The opportunity for electric vehicles, when bolstered with seamless infrastructure, to dominate an economic powerhouse like India is enormous; however, owing to fledgling market conditions and business environment, the sector has witnessed very little progress. Similarly, strengthening the public transport with last mile connectivity and enabling ICT (Information and Communication Technology) for transport can minimise the rate of vehicular growth, notwithstanding the increase in service demand; thereby, minimising mobile combustion of hydrocarbons. It is imperative that a combination of many such strategies must be implemented in parallel to increase the decarbonisation rate in transport sector. Other associated benefits such as energy independency and job creation can also drive these strategies in the near time horizon.



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5. CO₂ emissions in transport sector is 98% of the GHG CO₂e emissions