Greenhouse Gas Mitigation Options for Pakistan: Transport Sector

This factsheet provides a summary of the mitigation option analysis in the transport sector, for more details on methodology and sources, please refer to the corresponding technical report.

Key Facts

The transport sector contributes 13.7 per cent of Pakistan's gross domestic product (GDP) and 5 per cent of employment. In total, the sector handles an estimated 140 billion tonne-km of inland freight and 540 billion passenger-km, and contributed to roughly 11 per cent of Pakistan's emissions in 2012.

The transport infrastructure in Pakistan is overwhelmed by long wait and travel times, high costs and poor reliability that hinder the country's economic growth and reduce the competitiveness of exports. The poor performance of the sector is estimated to cost the economy as much as 4 per cent of GDP each year.

GHG Baseline

Projected greenhouse gas (GHG) emissions from the transport sector by source, to the year 2030 are indicated below in Figure 1 and Table 1. Emissions are projected to rise by 128% between 2012 and 2030. Emissions are forecast to grow from approximately 35.4 $MtCO_2e$ in 2012 to approximately 80.7 $MtCO_2e$ in 2030.

Figure 1: Transport Emissions by transport Mode (Mt CO2e)

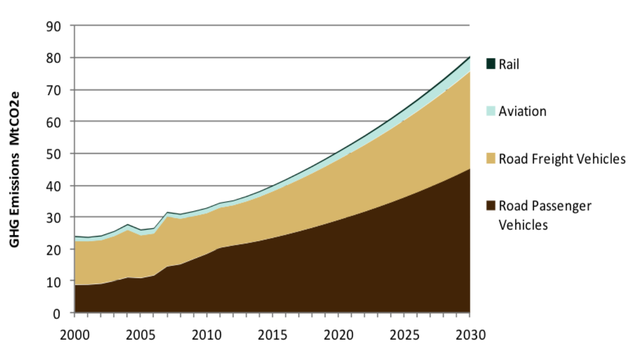

TABLE 1: PROJECTED GREENHOUSE GAS EMISSIONS IN TRANSPORT SECTOR (MT CO_2E)

Major Emission Source Category	2012	2015	2020	2025	2030
Road Passenger Vehicles	21.1	23.5	29.1	36.1	45.2
Road Freight Vehicles	12.6	14.5	18.9	24.2	30.6
Aviation	1.5	1.7	2.4	3.2	4.3
Rail	0.2	0.3	0.4	0.5	0.7

Mitigation Options

Options were identified from a review of existing policies and strategies, independent studies and key improvements in the transport sector that have demonstrated their success in similar contexts. The methodology for calculating emissions reductions, as well as more detail on assumptions and figures, can be found in the corresponding technical report for the transport sector.
Several options were identified based on their GHG abatement potential, sustainable development benefits, cost effectiveness, evidence of existing action and barriers to implementation:

- Passenger cars, taxis and vans efficiency norms
- Road to rail transfer
- Bus Rapid Transit (BRT) systems
- Car maintenance
- Electrification of railways
- Fuel switching to CNG/LNG
- Switch to biofuels
- Promotion of non-motorized transport
- Road freight switch to pipeline
- Tendering of public transport routes
- Fuel efficient aircrafts

- Switch from 2- to 4-stroke engines in motorcycles
- Proper maintenance of existing roads

The first four measures were selected as high priority options, as they offer significant abatement potential, are politically and technologically feasible, are cost-effective and can be implemented without substantial barriers.

TABLE 2: EMISSION MITIGATION MEASURES AND IMPACTS

Emission Mitigation Measure	GHG Emission Reductions in 2030 (MtCO2e)	GHG Emission Reductions from Sector BAU in 2030
Passenger cars, taxis, and vans efficiency norms	7.45	9.2%
Road to rail switch	2.25	2.8%
Road to BRT Switch	0.19	0.2%
Car maintenance	0.17	0.2%

Efficiency Standards for Passenger Cars, Taxis, and Vans

The passenger cars market in Pakistan is small, with 10 registered cars per 1000 inhabitants. Yet, the number of cars is rapidly growing, with a 44 per cent increase in registration compared to 2001. Passenger cars in Pakistan are quite inefficient, with a fleet emissions intensity of about 185 gCO2e/km in 2013. Lastly, Pakistan is the largest user of compressed natural gas (CNG) vehicles in the world, with CNG accounting for 49 per cent of the energy use of passenger cars in 2013. Natural gas vehicles typically have lower GHG emission intensities than gasoline cars (166 gCO2e/km versus 203 gCO2e/km), however the performance of the Pakistani car fleet in terms of vehicle efficiency remains low.

Scenario Definition

There is a large potential for improving efficiency, by gradually replacing part of the current fleet of cars, vans and light-duty trucks with more efficient vehicles, which in turn would have a large impact on emissions. This market-inherent process can be accelerated by regulation, through required emission standards for new vehicles, possibly supplemented by instruments such as emission permit trading, low-emission vehicles quotas or super credits. The main obstacle for this measure might be the extra purchase price of vehicles, even if it offset by lower fuel costs. While this might be addressed by shifting taxes/subsidies from car purchases to fuels, the actual price increases are often not as high as feared. Conservatively, the payback time for drivers could range from three to four years and certainly within the useful lifetime of the vehicle.

Benefits and Impacts

Reducing fuel consumption reduces exposure to oil price volatility and shocks, increasing energy security. Inefficient fuel combustion increases levels of SO2 and particulate matter in ambient air. Reducing air pollution in turn reduces serious health impacts on local population, including respiratory symptoms, ear-nose-throat problems, cardiovascular diseases and lung cancer. The annual costs of health impacts of ambient particulate air pollution in Pakistan are estimated at PKR 62-65 bn.

Road to Rail Transfer

This option is about shifting some of the passenger and freight traffic from the road (cars, (mini)buses, taxis, vans, trucks) to passenger and freight trains. This would reduce GHG emissions, as trains typically emit less per passenger-km or ton km. The national target is to increase the share of rail in freight from 4 to 20 per cent, meanwhile however, the share has dropped to under 1 per cent. Currently, 96 per cent of inland freight and 92 per cent of passenger traffic rely on the road network in Pakistan, leading to productivity loss through traffic congestion and inefficient goods transport.

Scenario Definition

In Pakistan, rail traffic in general, and freight traffic in particular, has declined significantly in the last few years (with a share of under 1 per cent), mostly due to maintenance and reliability issues. Interventions to upgrade and modernise passenger and freight rail service include elements such as modernising the rail stock or improving the signalling system. Even with this considerable effort, the part of rail in freight would only reach about 3.5 per cent in 2025 and 7 per cent in 2030. The main aim would be to restore the use of rail to previous peak levels by 2025 and further develop the rail system to accelerate a shift from road to rail beyond 2030. Capital costs for upgrade, construction, and modernisation of the system are around USD 3.45 billion.

Benefits and Impacts

Shifting road to rail transport, e.g. for goods traffic, can lead to fuel savings of up to 80 per cent compared to road freight. Shifting transport from road to rail can reduce congestion and boost economic productivity through faster and more efficient transportation of goods, reducing post-harvest losses of perishable products and increasing import and export. An improved infrastructure reduces health risks and increases mobility and safety with positive effects on social development.

Bus Rapid Transit (BRT) Systems

The public transport system in Pakistani cities are inefficient or non-existent, relying mainly on a system of low capacity (mini)buses unfitting for a rapidly growing urban population. A BRT system can deliver fast, comfortable, and cost-effective urban mobility and are cheaper than modern rail-based transit systems. They typically involve segregated lanes with exclusive right-of-way and modernised bus technology. Pakistan is planning a number of BRT systems in several cities, including the Karachi Metrobus (109 km for a daily ridership of 350,000 passengers), Lahore (27 km, active), Rawalpindi-Islamabad (22.5 km, active), and Multan systems (32 km, in progress).

Scenario Definition

Taking into account existing BRT systems, their size and passenger capacity, we assume that 300 km (~3 times the Karachi Metrobus system) will be built by 2030, with similar characteristics. This allows for about 9.6 billion passenger-km travelled per year, added to the system progressively (linearly). Based on the Karachi Metrobus, GHG savings are estimated at 47 per cent, in line with fuel savings compared to minibus technology. Based on existing systems, costs to are around USD 4 million per km of BRT system.

Benefits and Impacts

Developing BRT systems may have the most striking impact on economic, social and environmental development, improving quality of life, productivity, public health and safety, especially in urban areas, creating employment and improving equitable mobility. An integrated urban transport system can reduce travel times and end-user cost significantly. It reduces local air pollutants such as citywide smog and exposure to harmful pollutants at stations or in traffic, reduces the number of traffic accidents and injuries, and improves health through increased physical activity. Access to safe and affordable public transport systems such as railways and BRT can improve the connectivity between rural and urban areas and improve the mobility of social groups who may not have access to private modes of transportation such as the urban poor and women in particular.

Car Maintenance

Inefficient vehicles can reduce their fuel consumption with proper maintenance, including tuning the vehicle engine and proper tire inflation. Such maintenance (especially for engine tuning) needs to be performed by professionals at garages (or similar facilities), using special equipment. Efforts to deploy such equipment have already been started in Pakistan, with a successful (subsidised) deployment of equipment in demonstration projects, with indication that this can lead to a sustained market, providing direct benefits to customers. Regular vehicle inspections and maintenance can increase participation, awareness and driver knowledge. At the moment, such a requirement exists only for commercial vehicles. Establishing a proper testing system is important in order to ensure that this measure is followed with actual emission reductions.

Scenario Definition

There are two parameters that will determine the savings that proper car maintenance can bring: the potential per vehicle and amount of vehicles reached. Assuming a 7 per cent savings potential per vehicle and a higher participation rate for taxis (25 per cent) that undergo mandatory inspections than for passenger cars (10 per cent), this option leads to savings of 0.7 per cent for passenger cars, and of 1.75 per cent for taxis. Payback periods for car owners are low, around three to four months, and higher for workshop owners, around 3-10 years.

Benefits and Impacts

Increasing efficiency and reducing fuel consumption of road vehicles through car maintenance improves energy security and reduces harmful emissions that affect urban air quality and health. Regular maintenance reduces fuel spending and can lead to fewer accidents.

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