Union Budget 2017-18: Outlook

Vehicular Pollution in Indian Cities: What can the Central Budget do?

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Indian cities are facing the problem of severe air pollution and vehicles are a major source. The economically vibrant cities like Delhi, Bengaluru, Chennai, Hyderabad, Mumbai provide numerous job opportunities and hence have a large vehicle population. These cities thus contribute the largest share in emissions of pollutants. Other growing cities like, Jaipur, Pune, Coimbatore are also emitting a lot of pollutants.

The role of transportation becomes very important in the situation of rapid urbanization, to provide for both passenger and freight mobility within the sprawling urban areas and for external connectivity. (Gupta, 2007)

Owing to rapid urbanization and consequent rise in vehicles to meet the increased mobility needs, developing countries like India are facing problems of congestion and pollution. Vehicles are a major source of pollution. In developing countries the ambient concentrations of pollutants such as particulate matter, carbon monoxide, nitrogen oxide, etc. are quite high compared to developed countries. High incidences of illness and premature deaths are the economic impacts of air pollution.

In India for the metropolitan cities like Kolkata, and Delhi, maintaining urban air quality and protecting their sustainable urban commuting practices are some of the toughest challenges. (http://www.cseindia.org/content/kolkata-city-dialogue-air-quality-and-transportation-challenge-agenda-action-0 accessed in April 2011) Most of the cities have taken steps to improve their air quality like phasing out of age-old vehicles, compulsory “pollution under control” certificates for vehicles, crackdown on adulterated fuel etc, but a lot still needs to be done.

Website of the Ministry of Road Transport and Highways provide data from which emissions of five pollutants namely CO, HC, PM, NOx and SO_2 were calculated for India as well as for 24 million plus cities of India. The emissions have been calculated using the emissions equation:-

$$E = \sum (V_i * D) * e_i$$

where E is the emissions of pollutants, V_i is the number of vehicles of ith category, D is the distance travelled in kilometres and e_i is the emission factor for the pollutant of the ith vehicle category. (Chakrabartty, A. and Gupta, S. (2016)).

Vehicular Air Pollution in India

The transport sector is the major source of air pollution in the metropolitan cities of India. There are a number of reasons for the increase in vehicular pollution in the Indian cities. (i) Increasing volume of traffic. (ii) Excessive increase in private/ personal vehicles. (iii) Improper maintenance of vehicles. (iv) Growing traffic bottlenecks. (v) Adulterated fuel use. (vi) No proper development of public transport as an alternative means of mobility. (Kumar, 2009)

The main pollutants that are found in the urban air include: suspended particulate matter (SPM) which can cause damage to lungs, bronchitis and asthma; sulphur dioxide (SO_2) which can cause acid rain, damage to lungs, eyes and skin; nitrogen oxide (NO_X) which forms smog which can damage the respiratory system and cause eye irritation; carbon monoxide (CO) which is toxic and can cause blood poisoning; hydrocarbons (HC) which can cause cancer and lead (Pb) which affects the nervous system, retarding brain development. (Kumar, 2009)

Environmentalists claim that living in an Indian metropolitan city is like smoking 10-20 cigarettes every day. More than 40,000 people die pre-maturely every year because of air pollution, says a World Bank Report, of which Delhi's share is the highest (19%) (Sagar et. al., 2007).

The total number of registered vehicles in India has increased tremendously. In 1951 there were 0.3 million vehicles, this number increased to 159.5 million in 2012. Between 2002 and 2012, total registered vehicles grew at the CAGR of 10.5%.

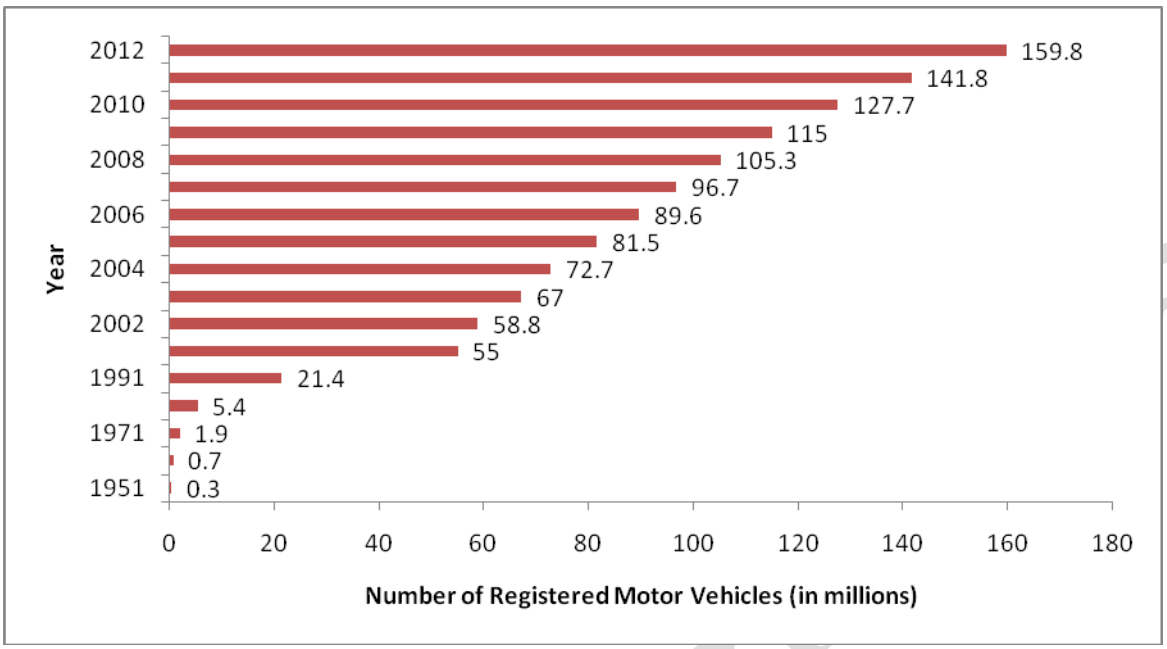

Figure 1 Total Number of Registered Motor Vehicles in India: 1951-2012

Source: Statistical Handbook, 2013

Traffic composition of six mega cities of India (Delhi, Mumbai, Bangalore, Hyderabad, Chennai and Kolkata) shows that there is significant shift from the share of slow moving vehicles to fast moving vehicles and public transport to private transport (Jalihal et al., 2005).

The emissions calculated for different type of road transport vehicles in 2012-13 are summarized below in Table 1. Two-wheelers are the major contributor of CO followed by three-wheelers or autos and then buses. HC emissions are highest for two-wheelers followed by autos. NOx is mainly contributed by buses. Two-wheelers contribute as much PM as buses. Taxis lead in the contribution of SO_2. The proliferation of two-wheelers in the cities of India is increasing the health risk of individuals emitting a lot of CO and HC.

Table 1Emissions from different vehicle categories in India

Mode	Emissions of Pollutants (in Tonnes)				
	CO	HC	NOx	PM	SO_2

Buses	1073.28	291.80	3689.40	80.50	476.27
Taxis	469.10	40.44	363.96	40.44	1051.44
Autos	2097.16	641.99	102.72	68.48	24.82
Two-wheelers	2423.80	2285.30	138.50	86.56	22.51
Cars	224.85	24.26	19.41	3.24	8.57

Source: Authors' Calculation

In Table 2, the total emissions of CO, HC, NOx, PM and SO_2 from passenger vehicles in million plus cities are enumerated. Table 3 shows contribution to total emissions and ranks accordingly of the cities. Delhi tops in emitting three of the pollutants out of five considered.

Table 2 Emissions in a few cities of India

Million Plus Cities	**Emissions of Pollutants (in tonnes)**				
	CO	**HC**	**NOx**	**PM**	**SO_2**
Ahmedabad	81.07	43.49	61.25	3.26	14.73
Bengaluru	169.55	94.23	75.12	5.97	46.58
Bhopal	29.33	19.52	10.74	1.08	16.95
Chennai	156.44	86.87	94.70	5.98	76.70
Coimbatore	46.95	32.84	16.99	1.70	15.27
Delhi	266.94	142.85	63.74	7.88	59.29
Hyderabad	140.36	78.93	69.51	5.12	35.27
Indore	45.99	30.38	20.22	1.75	30.05
Jaipur	71.18	43.29	55.48	2.92	25.51

Kanpur	32.84	25.13	3.54	1.07	0.96
Kochi	23.47	10.33	16.97	0.89	10.35
Kolkata	24.91	8.70	12.04	0.82	26.31
Lucknow	42.23	29.80	9.56	1.40	6.30
Ludhiana	42.92	29.43	9.37	1.42	3.93
Madurai	25.87	17.18	13.94	1.04	12.59
Mumbai	96.74	43.17	35.93	3.19	47.24
Nagpur	40.94	29.84	13.66	1.48	4.20
Patna	31.43	17.46	15.23	1.17	10.36
Pune	85.54	52.89	44.22	3.16	15.43
Surat	44.31	28.21	7.84	1.47	2.77
Vadodara	30.88	19.95	5.95	1.04	5.54
Varanasi	20.18	13.92	7.18	0.74	4.58
Vishakhapatnam	27.73	16.87	6.08	0.96	7.83
Vijaywada	20.34	14.04	1.99	0.68	0.80

Source: Authors' Calculations

Table 3 Contribution of the Cities to Total Emissions in India

Cities	Contribution to total emissions and ranks accordingly of the cities				
	CO	**HC**	**NOx**	**PM**	**SO_2**
Ahmedabad	1.3% ***(7)***	1.3% ***(6)***	1.4 ***(5)***	1.2 ***(5)***	0.9 ***(12)***
Bengaluru	2.7% ***(2)***	2.9% ***(2)***	1.7 ***(2)***	2.1 ***(3)***	2.9 ***(4)***
Bhopal	0.5% ***(18)***	0.6% ***(17)***	0.2 ***(16)***	0.4 ***(16)***	1.1 ***(9)***
Chennai	2.5% ***(3)***	2.6% ***(3)***	2.2 ***(1)***	2.1 ***(2)***	4.8 ***(1)***
Coimbatore	0.7% ***(9)***	1.0% ***(9)***	0.4 ***(10)***	0.6 ***(10)***	1.0 ***(11)***
Delhi	4.2% ***(1)***	4.4% ***(1)***	1.5 ***(4)***	2.8 ***(1)***	3.7 ***(2)***
Hyderabad	2.2% ***(4)***	2.4% ***(4)***	1.6 ***(3)***	1.8 ***(4)***	2.2 ***(5)***
Indore	0.7 ***(10)***	0.9% ***(10)***	0.5 ***(9)***	0.6 ***(9)***	1.9 ***(6)***
Jaipur	1.1% ***(8)***	1.3% ***(7)***	1.3 ***(6)***	1.0 ***(8)***	1.6 ***(8)***

Kanpur	0.5% ***(15)***	0.8 ***(15)***	0.1 ***(23)***	0.4 ***(17)***	0.1 ***(23)***
Kochi	0.4% ***(22)***	0.3 ***(23)***	0.4 ***(11)***	0.3 ***(21)***	0.7 ***(15)***
Kolkata	0.4% ***(21)***	0.3 ***(24)***	0.3 ***(15)***	0.3 ***(22)***	1.7 ***(7)***
Lucknow	0.7% ***(13)***	0.9 ***(12)***	0.2 ***(17)***	0.5 ***(14)***	0.4 ***(17)***
Ludhiana	0.7% ***(12)***	0.9 ***(13)***	0.2 ***(18)***	0.5 ***(13)***	0.2 ***(21)***
Madurai	0.4% ***(20)***	0.5 ***(19)***	0.3 ***(13)***	0.4 ***(19)***	0.8 ***(13)***
Mumbai	1.5% ***(5)***	1.3 ***(8)***	0.8 ***(8)***	1.1 ***(6)***	3.0 ***(3)***
Nagpur	0.7% ***(14)***	0.9 ***(11)***	0.3 ***(14)***	0.5 ***(11)***	0.3 ***(20)***
Patna	0.5% ***(16)***	0.5 ***(18)***	0.4 ***(12)***	0.4 ***(15)***	0.7 ***(14)***
Pune	1.4% ***(6)***	1.6 ***(5)***	1.0 ***(7)***	1.1 ***(7)***	1.0 ***(10)***
Surat	0.7% ***(11)***	0.9 ***(14)***	0.2 ***(19)***	0.5 ***(12)***	0.2 ***(22)***
Vadodara	0.5% ***(17)***	0.6 ***(16)***	0.1 ***(22)***	0.4 ***(18)***	0.3 ***(18)***
Varanasi	0.3% ***(24)***	0.4 ***(22)***	0.2 ***(20)***	0.3 ***(23)***	0.3 ***(19)***
Vishakhapatnam	0.4% ***(19)***	0.5 ***(20)***	0.1 ***(21)***	0.3 ***(20)***	0.5 ***(16)***
Vijaywada	0.3% ***(23)***	0.4 ***(21)***	0.0 ***(24)***	0.2 ***(24)***	0.1 ***(24)***

Source: Authors' Calculations

As is evident from Table 3, the metropolitan cities of Delhi, Chennai, Bengaluru and Hyderabad are leading in vehicular pollution. They rank from 1st to 5th in terms of emissions of all the pollutants under study. The high level of economic activity in these cities is the reason for a greater number of vehicles plying in these cities and also more personalized vehicles. Surprisingly, Mumbai which is the financial capital of India has lower emissions than the above mentioned cities. The reason for this maybe the suburban railways which fulfills the mobility needs of a huge section of the population in Mumbai. The other cities that are ranked within the first 10 include Jaipur, Coimbatore, Pune and Indore.

How to Control Vehicular Pollution through budgetary provisions

To control vehicular pollution, the following measures can be undertaken, for which, money should be earmarked. More investment in curbing pollution through Union budgets may help improve the situation.

- Phasing out of old vehicles.
- Augmentation of public transport system.

- Incentive and regulations affecting vehicles with a view to reducing the rate of growth in personal vehicles.
- Traffic planning and management.
- Taxes on fuels and vehicles.
- Further tightening of emission norms and fuel quality specifications.
- Greater promotion and use of alternative fuels like CNG.
- Curbing fuel adulterations.
- Strengthening of inspection and maintenance system.
- Strengthening of monitoring networks and expansion of stations to monitor pollutants such as RPM, CO, HC etc.
- Use of state of the art technology for wider dissemination of environmental information like airing of pollution bulletins and air pollution forecasts on a regular basis.
- Mass awareness programmes to be undertaken involving students, residents, NGOs etc.
- Formulation of a comprehensive urban air quality management strategy that includes information related to urban planning, ambient air quality etc.
- Economic instruments need to be in place to encourage a shift from curative to preventive measures, energy conservation, prevention of environmental degradation, and increase in green cover.
- Segregated bicycle lanes should be constructed to encourage this mode which is pollution free.

- To introduce and enhance the operation of nonpolluting vehicles like trams, metro rail, monorail etc.

Indian cities are facing the problem of severe air pollution and vehicles are a major source. The economically vibrant cities like Delhi, Bengaluru, Chennai, Hyderabad, Mumbai provide numerous job opportunities and hence have a large vehicle population. These cities thus contribute the largest share in emissions of pollutants. Other growing cities like, Jaipur, Pune, Coimbatore are also emitting a lot of pollutants. Air pollution imposes a cost on society as it increases both morbidity and mortality. There is thus an urgent need to deal with the problem of vehicular pollution. Advanced emission norms, Bharat IV and V and now VI are being adopted to deal with the problem. Awareness has to be created among people to undertake measures to keep their vehicles well maintained to reduce emissions. However, the greatest benefit can be had if public transport usage is increased as it will reduce the number of vehicles on Indian city roads at the same time meeting the mobility needs of the people. Mass public transport vehicles like buses also pollute. Measures should be taken to run public transport vehicles on fuels which pollute less such as Compressed Natural Gas, so that emissions from these vehicles can be minimized.

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