
India: The Next Global Automotive Hub?
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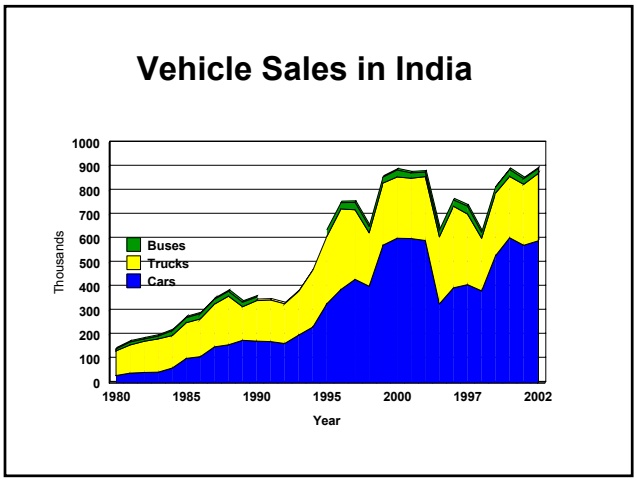
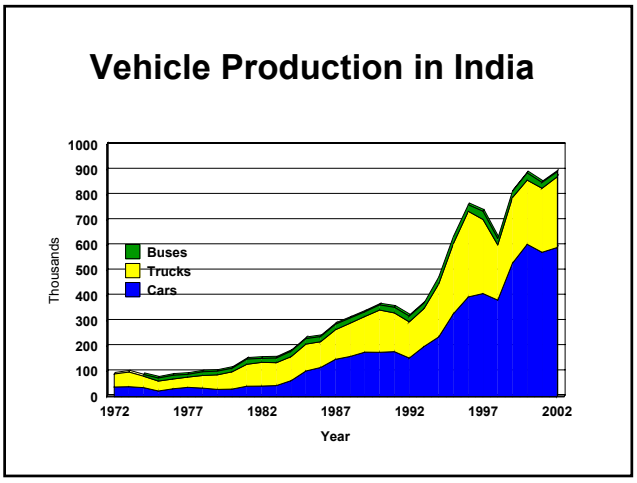
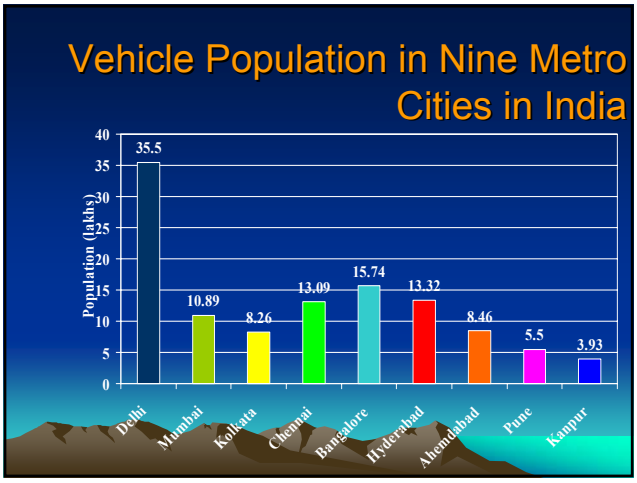
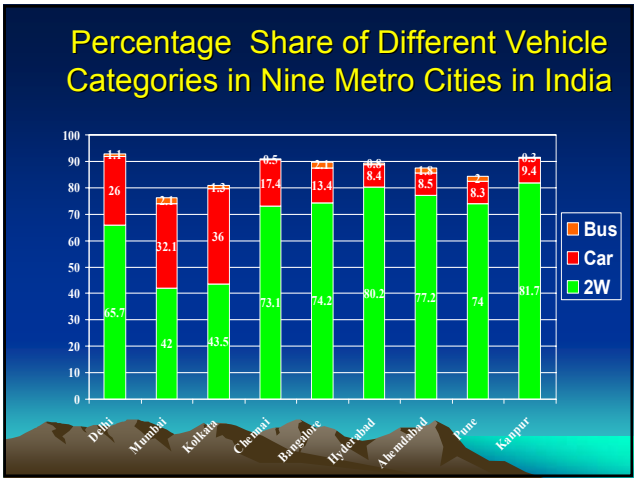
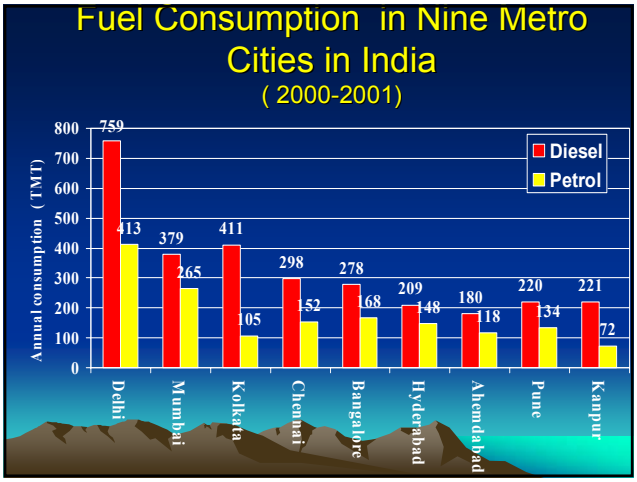
SAE 2005 Technical Innovation Forum
April 13, 2005

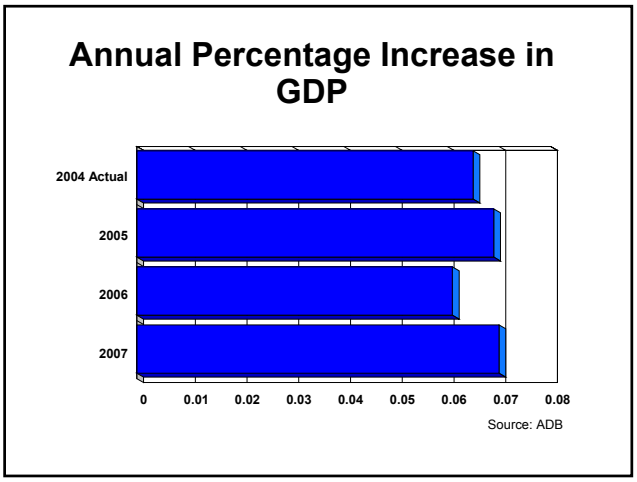

Vehicle Sales in India
Thousands
Buses
Trucks
Cars
1000
900
800
700
600
500
400
300
200
100
0
1980
1985
1990
1995
2000
1997
2002
Year

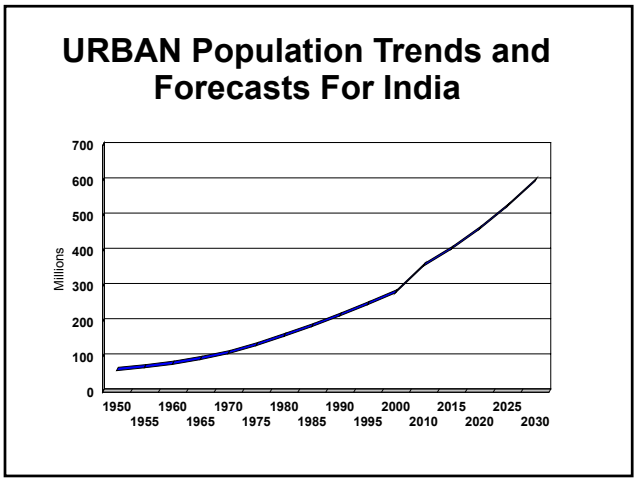

Vehicle Production in India
Thousands
Buses
Trucks
Cars
1000
900
800
700
600
500
400
300
200
100
0
1972
1977
1982
1987
1992
1997
2002
Year


Vehicle Population in Nine Metro Cities in India
Population (lakhs)
40
35
30
25
20
15
10
5
0
35.5
10.89
8.26
13.09
15.74
13.32
8.46
5.5
3.93
Delhi
Mumbai
Kolkata
Chennai
Bangalore
Hyderabad
Ahemdabad
Pune
Kanpur

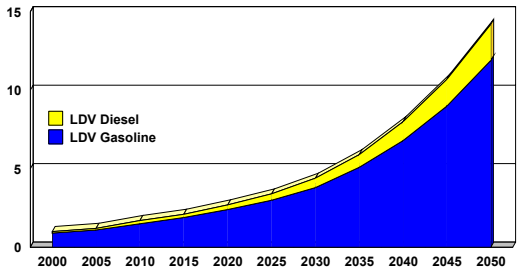

Percentage Share of Different Vehicle Categories in Nine Metro Cities in India
Bus
Car
2W
Delhi
Mumbai
Kolkata
Chennai
Bangalore
Hyderabad
Ahemdabad
Pune
Kanpur


Fuel Consumption in Nine Metro Cities in India
(2000-2001)
Annual consumption (TMT)
Diesel
Petrol
759
413
379
265
411
105
298
152
278
168
209
148
180
118
220
134
221
72
Delhi
Mumbai
Kolkata
Chennai
Bangalore
Hyderabad
Ahemdabad
Pune
Kanpur


Annual Percentage Increase in GDP
2004 Actual
2005
2006
2007
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
Source: ADB

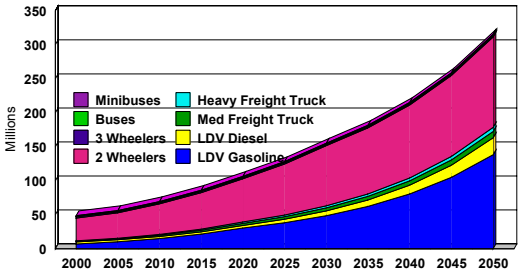

URBAN Population Trends and Forecasts For India
Millions
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2010
2015
2020
2025
2030

New Light Duty Vehicle Sales Forecast



Source: WBCSD

Forecast of Vehicle Stock in India



Source: WBCSD

Non-Attainment Areas

$$\text{Exceedence Factor} = \frac{\text{Observed Annual Mean Concentration of a Criterion Pollutant}}{\text{Annual Standard for the Respective Pollutant and Area Class}}$$

The Four Air Quality Categories are:

- Critical Pollution (C): When EF is more than 1.5;
- High Pollution (H): When EF is between 1.0 - 1.5;
- Moderate Pollution (M): When EF is between 0.5 - 1.0;
- Low Pollution (L): When the EF is less than 0.5.

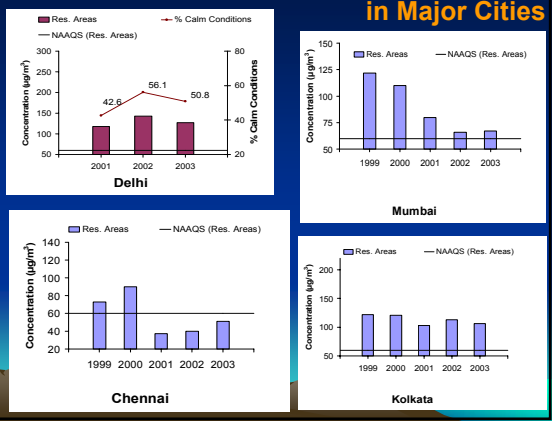
Air Quality Status of India During 2003

Pollutants	Industrial				Residential			
	L	M	H	C	L	M	H	C
Sulphur dioxide	98 %	2 %	-	-	98 %	2%	-	-
Nitrogen dioxide	85 %	12%	3%	-	70%	25%	5%	-
Respirable Suspended Particulate Matter	13 %	37%	28%	22%	2%	17%	28%	53%
Suspended Particulate Matter	31%	46%	18%	2%	5%	17%	26%	52%

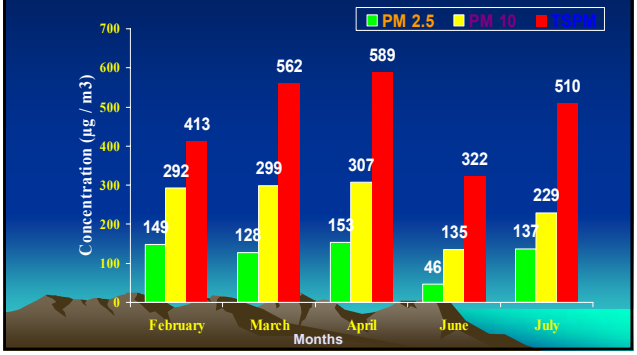
Major Air Pollution
Issues in India

1. Major Cities (53 non-attainment areas mainly due to vehicular pollution)
2. 24 – Critically polluted areas (Industrial Air Pollution)
3. Indoor Air Pollution (Rural Area) and Air Pollution in work zone area

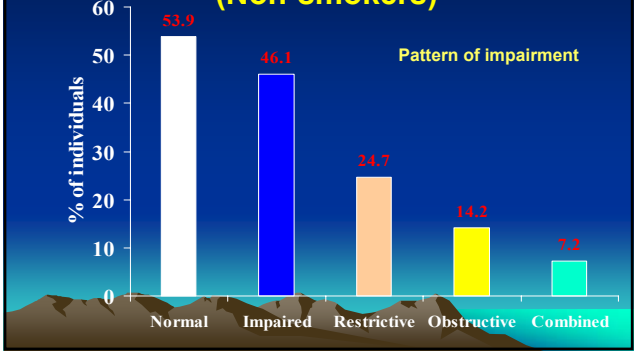
Air quality Trends of RSPM / PM_{10} in Major Cities



Concentration of $PM_{2.5}$, PM_{10}, and TSPM in Delhi
(Traffic Intersection)



Lung Function Impairment in Residents of Delhi
(Non-smokers)



Vehicular Pollution Control Initiatives

Norms	Cities of Implementation	Implementation
1991 emission norms	Throughout the country	1.4.1991/92
1996 emission norms	Throughout the country	1.4.1996
Cat converter norms (for passenger cars)	45 cities	1.10.1998
India stage 2000 norms	Throughout the country	1.4.2000
Bharat stage-II norms (Euro 2)	11 cities Throughout the country	2000-2003 1.4.2005
Bharat stage-III norms (Euro 3)	11 cities Throughout the country	1.4.2005 1.4.2010
Bharat stage-IV norms (Euro 4)	11 cities Throughout the country	1.4.2010 To be decided

Diesel Fuel Specification in India

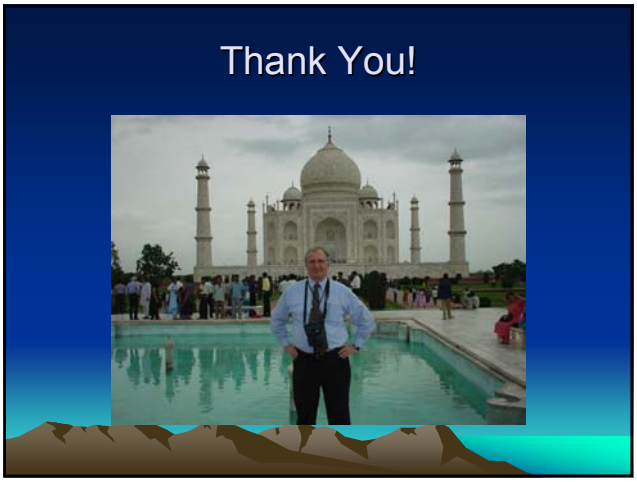
YEAR	1996	2000	2005	2010
Cetane No, Min	45	48	48	51
Sulphur % W/w, Max	0.50	0.25 0.05 (METRO)	0.05	0.035
Distillation T95	-	370	370	360
Polyaromatic	-	-	-	11

Gasoline Specification in India

YEAR	1996	2000	2005	2010
RVP at 38deg.c,kpa	35-70	-	35-60	60
BENZENE %by Vol.,Max	5.0	5.0 3.0 (metros)	3.0 (all) 1.0 (metro)	1.0
Lead G/m3, Max	0.15%(low pb), 0.013% (unleaded)	0.013	0.013	0.005
Sulphur %by Mass,max	0.10(unleaded) 0.20 (leaded)	0.10	0.05	0.015
Aromatics % v/v., Max	-	-	45	42
Oxygen %by Vol.,max	-	-	2.0	2.7

Concluding Remarks

- India is poised to be a major hub
- The Vehicle Population is Expected To Grow Rapidly Driven By
  - GDP/Capita
  - Urbanization
- Such Growth Has the Potential To Exacerbate Existing Serious Air Pollution Problems
- To Prevent This From Occurring
  - Rapidly Improve Fuel Quality
  - Upgrade Vehicle I/M Program
  - Accelerate New Vehicle Controls
  - Retrofit Appropriate Vehicles
  - Substantially Improve Public Transportation
  - Better Land Use Planning


Thank You!