

# Environmental Challenges Facing the Indian Commercial Vehicle Industry

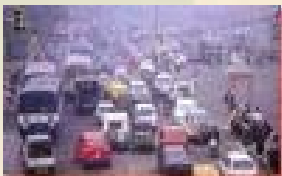
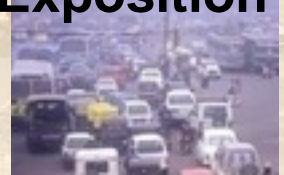
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# Objective

- **Factors contributing to environmental issues**
- **Steps/initiatives considered so far**
- **Conclusions – strategy development and implementation**

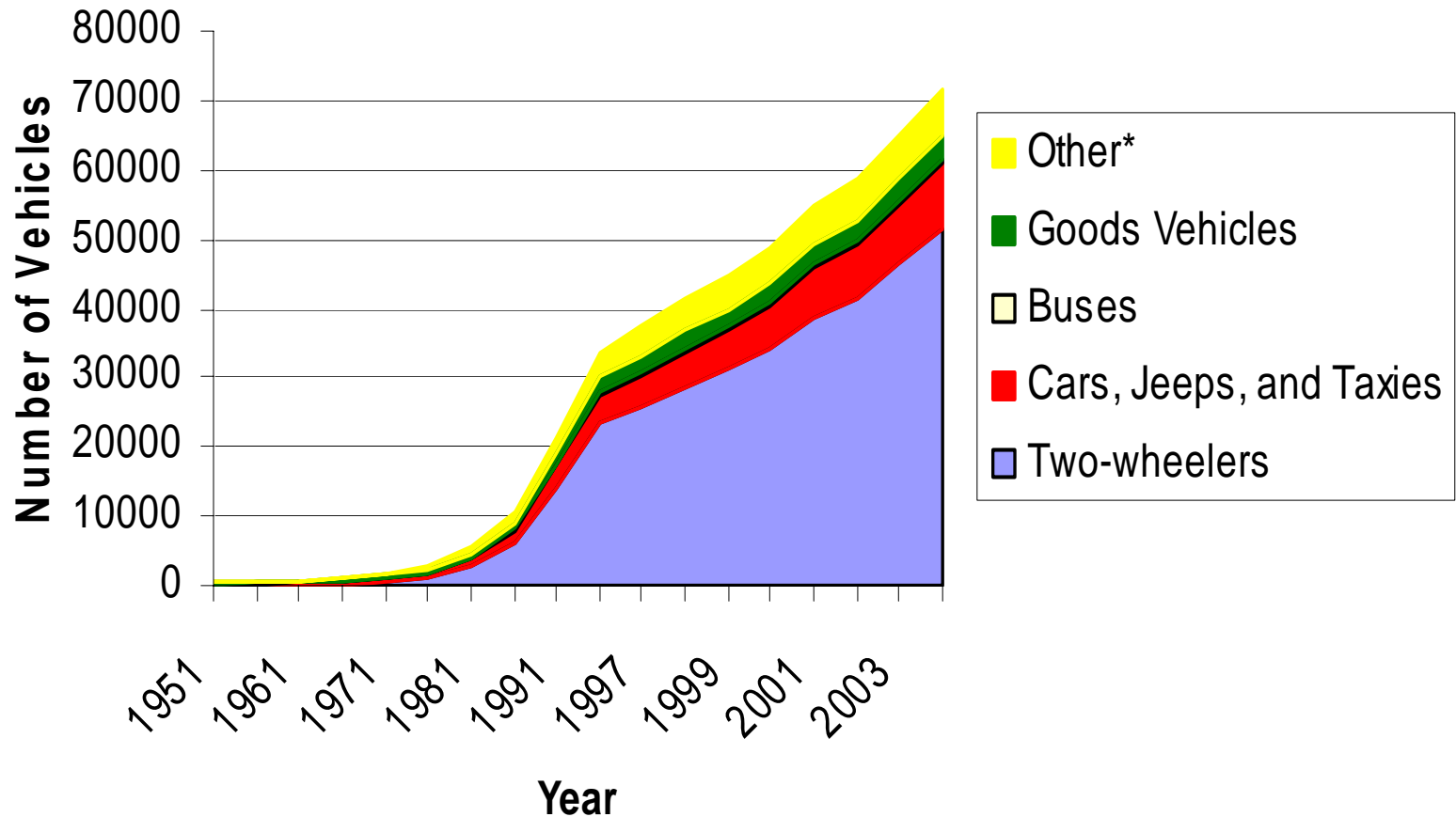


# Factors Contributing to Environmental Challenges

- **Economic growth combined with favorable freight rates has spurred growth in the commercial vehicle industry (22% compared to 18% for passenger vehicles in '04-'05)**
- **Antiquated vehicle technology (dominant 2-stroke engines for 2- and 3-wheelers; 2- and 3-axle rigid trucks with a smaller cab) -- structure of truck ownership and lack of incentives**
- **Old aging vehicle population (exacerbated by overloading)**
- **Fuel quality and emission norms**
- **Vehicle inspection & certification**
- **Congestion/Traffic control (lack of effective channeling, mode segregation, or speed control)**
- **Infrastructure (low capacity, inadequate maintenance, and poor quality)**



# Registered Motor Vehicles in India



\*Include tractors, trailers, 3-wheelers, and other miscellaneous vehicles

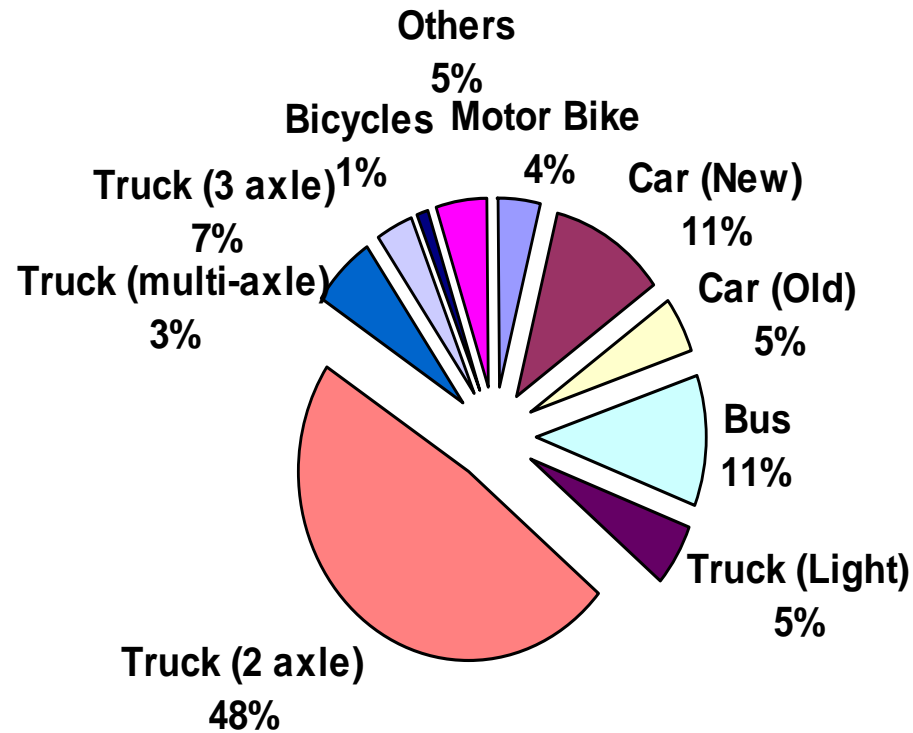
Source: Ministry of Road Transport and Highways



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# Average Daily Traffic Flow On Main National Highways



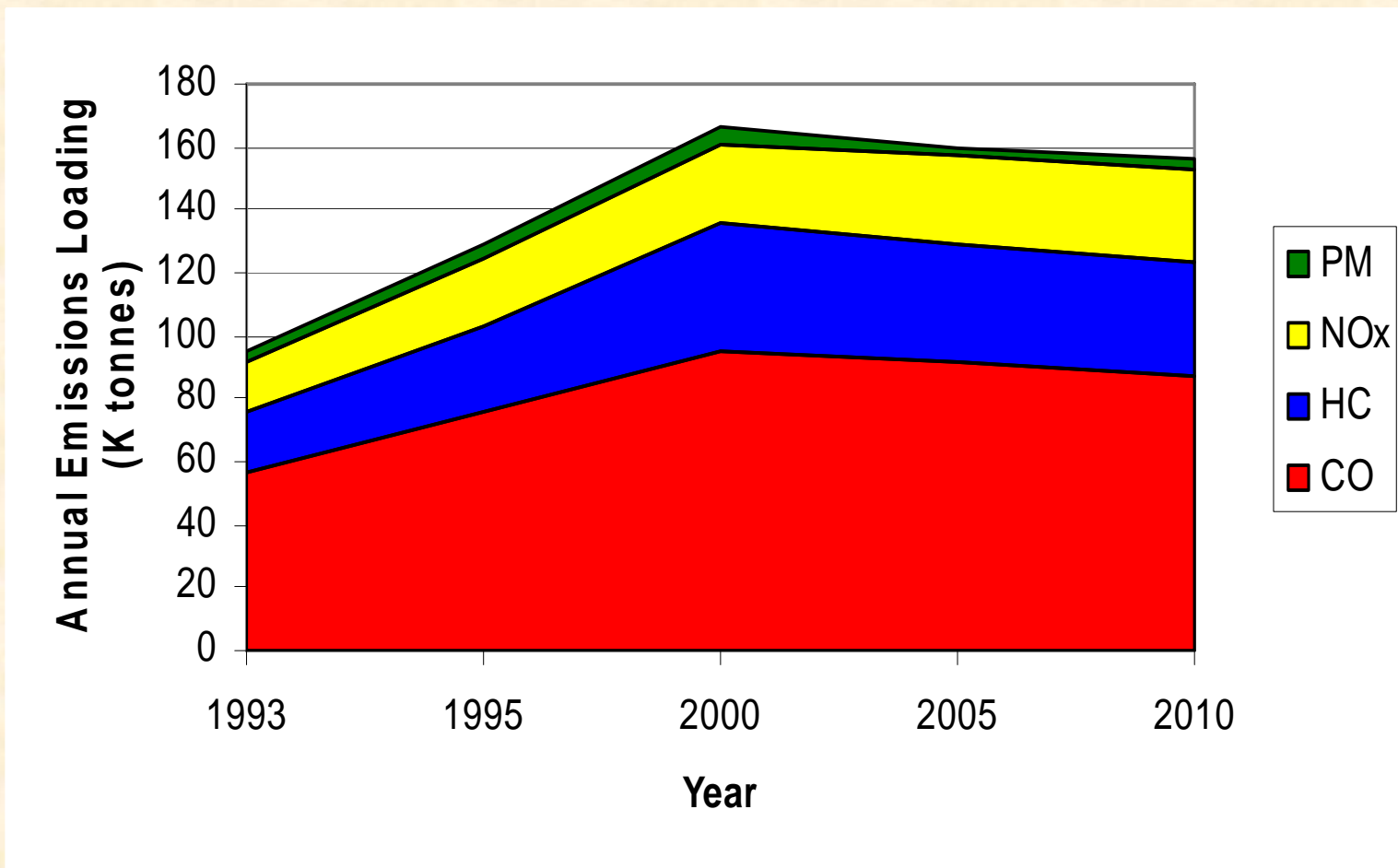
Source: World Bank (2005)



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# Projected Vehicular Emissions in Mumbai



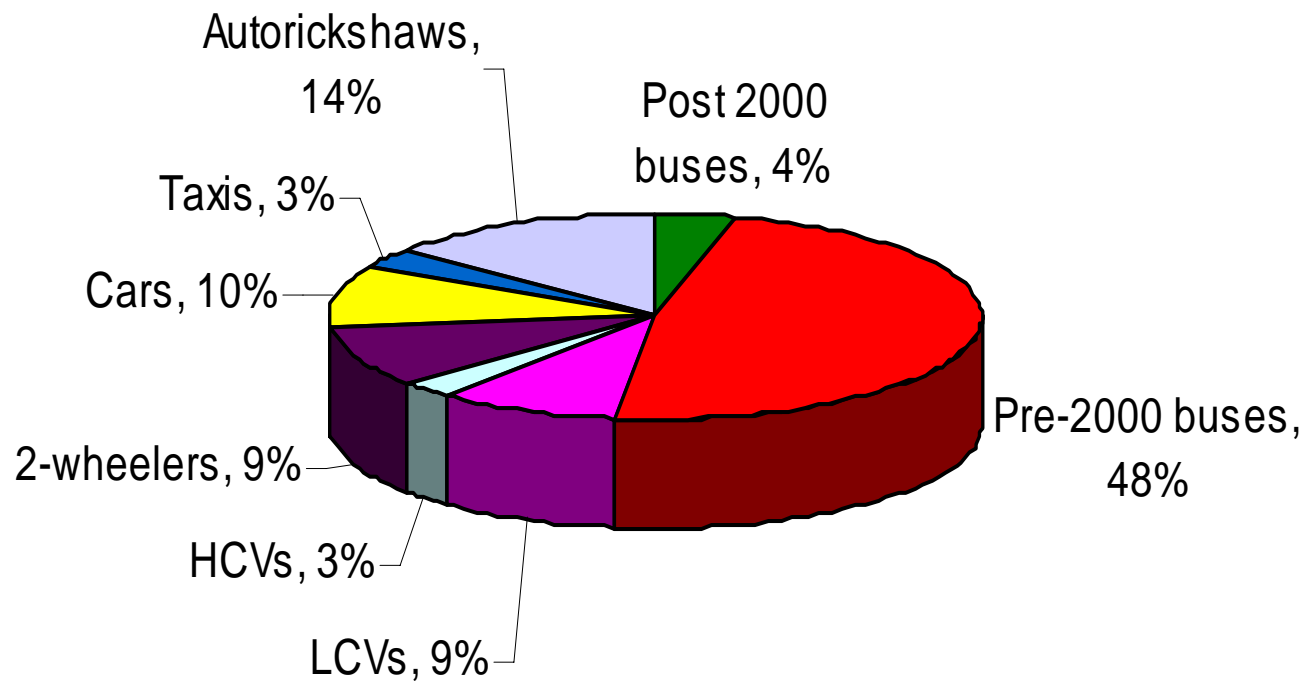
Source: TERI (2002)



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# Projected 2010 PM Vehicle Emissions In Mumbai



Source: TERI 2002



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# Approach Towards Vehicular Emission Norms

- **Introduction of level of emission norms and auto fuel quality in cities based on the severity of air pollution problems**
- **Bring about improvements, in stages, in the vehicular emission norms, and auto fuel quality throughout the country**
- **Adopt city-specific measures to reduce pollution from old in-use vehicles in cities having very high vehicular pollution**



# Emission Norms Consistent with European Union

European Union		India		
Norms	Implementation	Norms	Heavy-Duty Vehicle Norms (g/kWh)	Implementation
Euro II	1996-1997	Bharat Stage II	CO=4.0 NOX = 7.0 PM = 0.15	Identified cities* – '00, '01, and 04/03 Entire country – 04/05
Euro III	2000	Bharat Stage III	CO=2.1 NOX = 5.0 PM = 0.10	Identified cities* – 04/05 Entire country – 04/10
Euro IV	2005	Bharat Stage IV	CO=1.5 NOX = 3.5 PM = 0.02	Identified cities* – 04/10

\*Cities include Delhi, Mumbai, Kolkata, Chennai, Bangalore, Hyderabad, Ahmedabad, Pune, Surat, Kanpur and Agra



# Road Map for Emission Norms for In-Use Vehicles

Activities	Applicable for Major 8 Cities
New PUC checking system for all categories of vehicles	April 2004
I&M system for all categories of vehicles	April 2006
Performance checking of catalytic converters and conversion kits installed in vehicles	April 2005
Augmentation of city public transport system	Not later than April 2004
Emission norms for city public service vehicles (From April 2004)	<p><u>City Buses and Taxis</u> Applicable norms for vehicles registered after April 1996 – otherwise 1996 emission norms</p> <p><u>Three Wheelers</u> Applicable norms for vehicles registered after April 2000 – otherwise 1996 emission norms</p>
Emission norms for all inter state buses Minimum India 2000 Minimum Bharat Stage II	<p><i>From April 2004</i> for vehicles registered after 04/00</p> <p><i>From April 2008</i> for vehicles registered after 04/05</p>

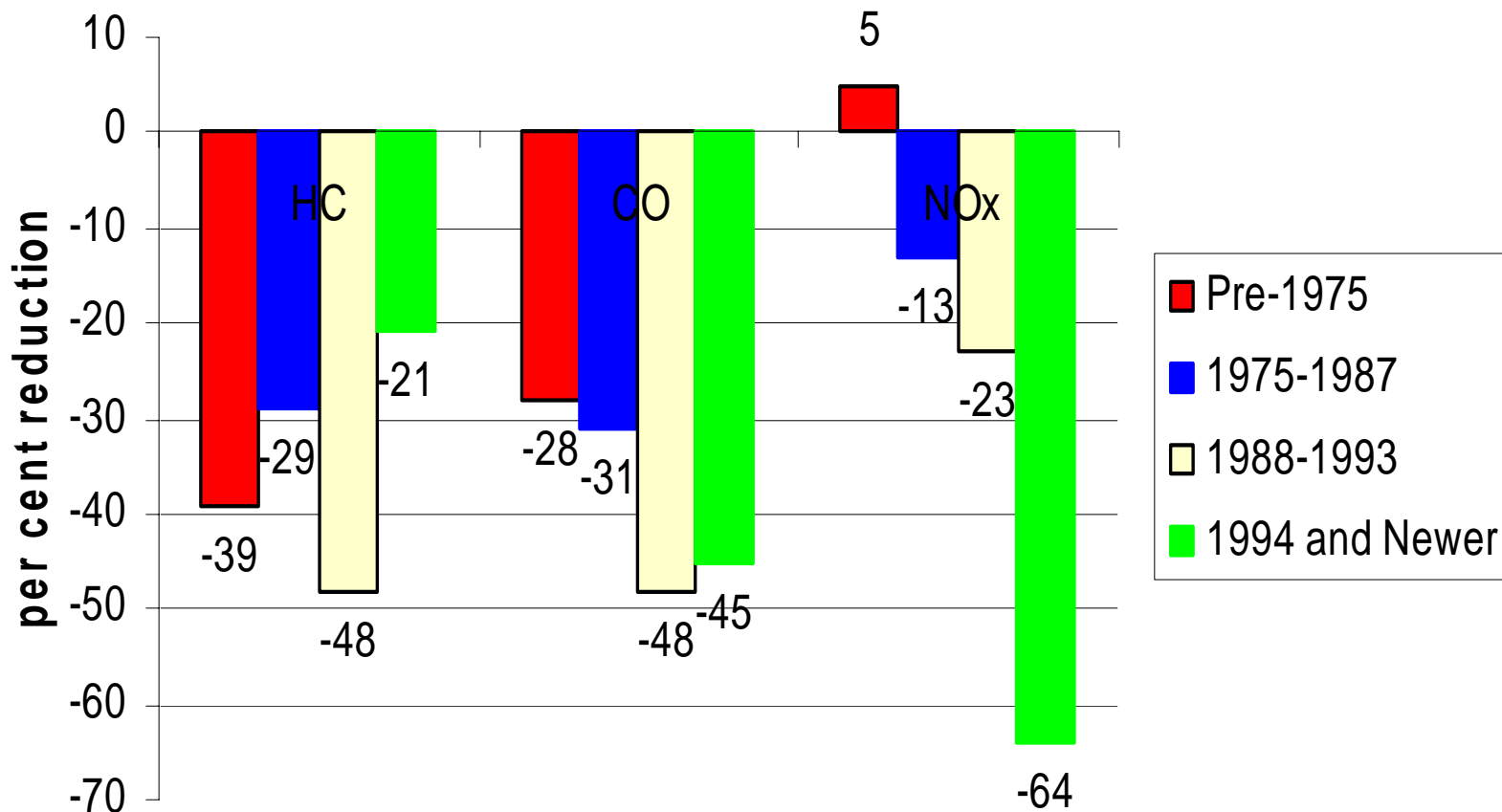


# I&M Program in India

- **Nationwide inspection program – Pollution Under Control (PUC)**
- **Implementation by state – twice a year vehicle testing reqt. in most cases**
- **PUC center ownership is unrestricted – testing & repair done at the same location in some cases**
- **Limited enforcement on vehicle and the operation quality**
- **Lack of standard testing procedures**
- **Major overhaul of the program is underway – SIAM**
  - **Redesigning of test centers**
  - **Testing procedures**
  - **More government role (resources, enforcement, and standards)**



# Emissions Reduction Benefits of I/M



Source: Erlandsson and Walsh (2003)



# Mitigation Strategies beyond Emission Norms Varied Across Major Cities Since 2000

- **Replacement of all pre- and post-1990 3-wheelers and taxis with new vehicles on clean fuels**
- **All diesel buses phased out/converted to CNG**
- **Closure of hazardous industries**
- **Mandatory use of cleaner fuels in industrial boilers**
- **Age-based phase out of taxis and 3-wheelers unless converted to LPG/CNG**
- **Phasing out of commercial vehicles above 15 years in age**
- **No fuel without PUC**
- **Construction of by-pass roads for heavy vehicles**
- **Stopping of permit to new auto rickshaws**
- **Restriction in entry of old buses into the city center**



# Road Map for Fuel Quality Improvement

<b>NORMS</b>	<b>Year of Implementation</b>
<b>0.5% S – Diesel</b>	<b>1996</b>
<b>0.25% S – Diesel</b>	<b>2000</b>
<b>0.05% S – Diesel</b>	<b>2003</b>
<b>0.035% S – Diesel</b>	<b>2005</b>
<b>Unleaded Petrol</b>	<b>2000</b>
<b>Low Smoke 2T Oil</b>	<b>1998</b>



# Several Alternative Fuel Options Considered

- **Fuel Cell**
- **CNG**
- **LPG**
- **Ethanol**
- **Ethanol mixed with Petrol**
- **Unleaded Petrol**
- **Petrol**
- **Low sulfur diesel**
- **Diesel**



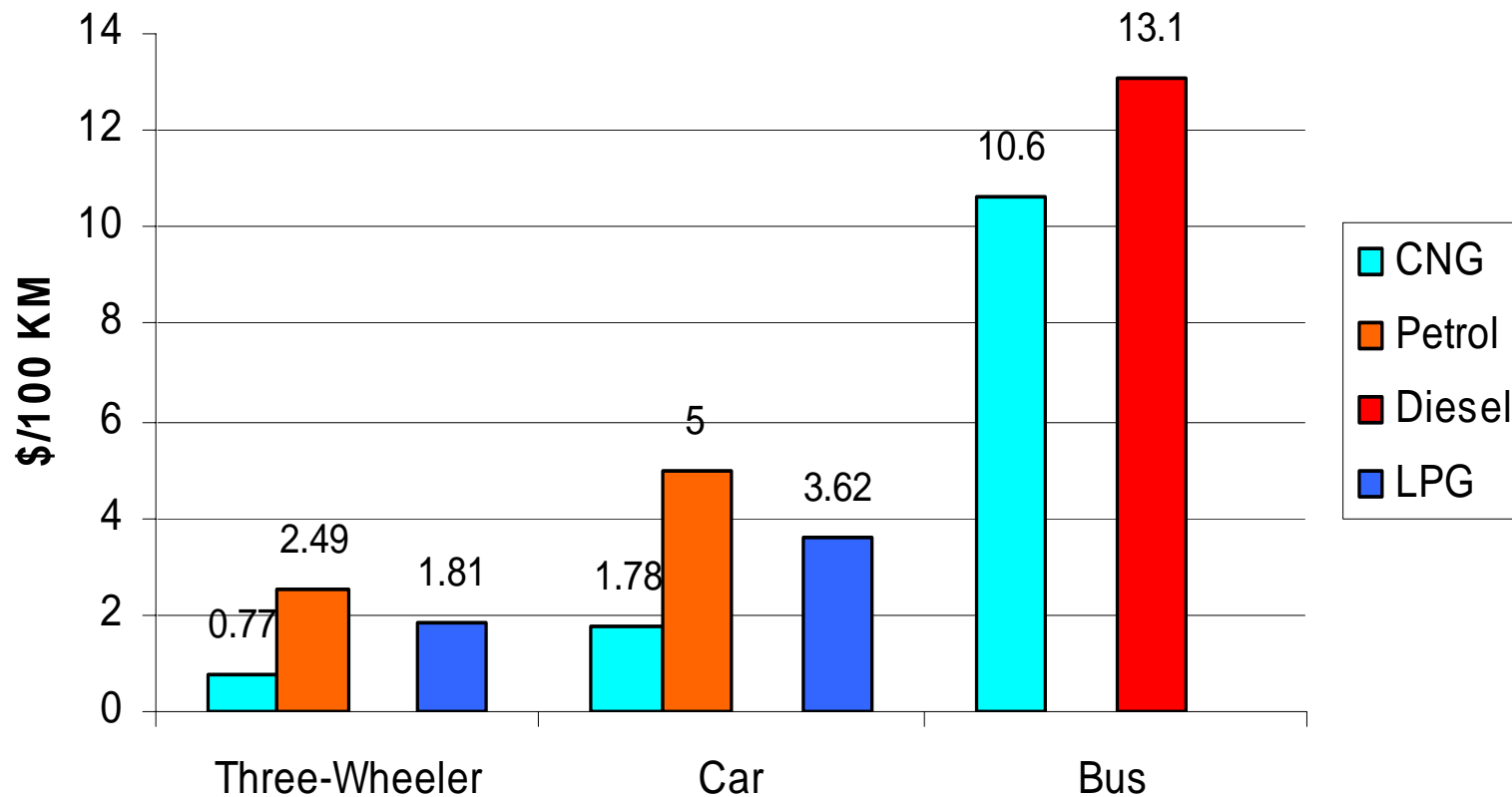
**Environment Friendliness**

# Alternative Fuel Vehicle Initiatives

- **CNG**
  - Buses, Taxis, and Three-wheelers
  - More than 112K vehicles operating in Delhi and Mumbai (entire public transport)
- **LPG**
  - Development required for heavy-duty vehicles
  - Infrastructure investment necessary
- **Ethanol**
  - 5% ethanol gasoline blends introduced in select states
  - Field trials with 10% ethanol gasoline blends undertaken
- **Biodiesel**
  - Limited to field trials (passenger train, buses)
- **Electric**
  - Developed for three-wheelers, cars, and buses (a few hundred vehicles successfully operating)
- **Hydrogen**
  - Near-Term: H<sub>2</sub>+CNG in IC Engines
  - Mid-Term: H<sub>2</sub> engines
  - Long-Term: Fuel cell in hybrid electric vehicles



# Cost-Effectiveness of Alternative Fuel Vehicles



Source: Minda Impco



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# Conclusions

- **Implementation of stringent vehicular emission and fuel quality norms has resulted a decrease in air pollution level in a limited number of major cities, but a region specific and phased approach needs to continue.**
- **Concerted and planned efforts needed for augmentation of the public transport system, improvement in traffic management and restricting increased of personal vehicle use associated with congestion and pollution problems**
- **Contribution of various sources towards air pollution load and ambient air quality – area-wise emission inventories need to be prepared and periodically updated**
- **Adoption of advanced fuel efficient technologies needs to be promoted including the use of alternative fuel vehicles while maintaining fuel price differential**
- **Enforcement of norms is critical including stringent inspection, certification, and maintenance of vehicles**

