CAR FUEL ECONOMY

Automobile Industry Perspective

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Workshop Series on Transport and Climate
New Delhi, 24th July 2013

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Contents

1. Challenge for India

2. Industry Initiatives and Improvements

3. Fuel Efficiency Regulation for India

4. Need for an All round improvement – Integrated Approach

Challenges before Auto Industry

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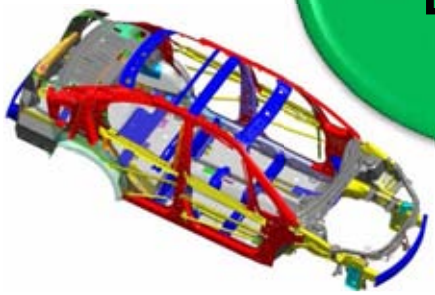
1. Global Warming

4. Customer Demands

Challenges

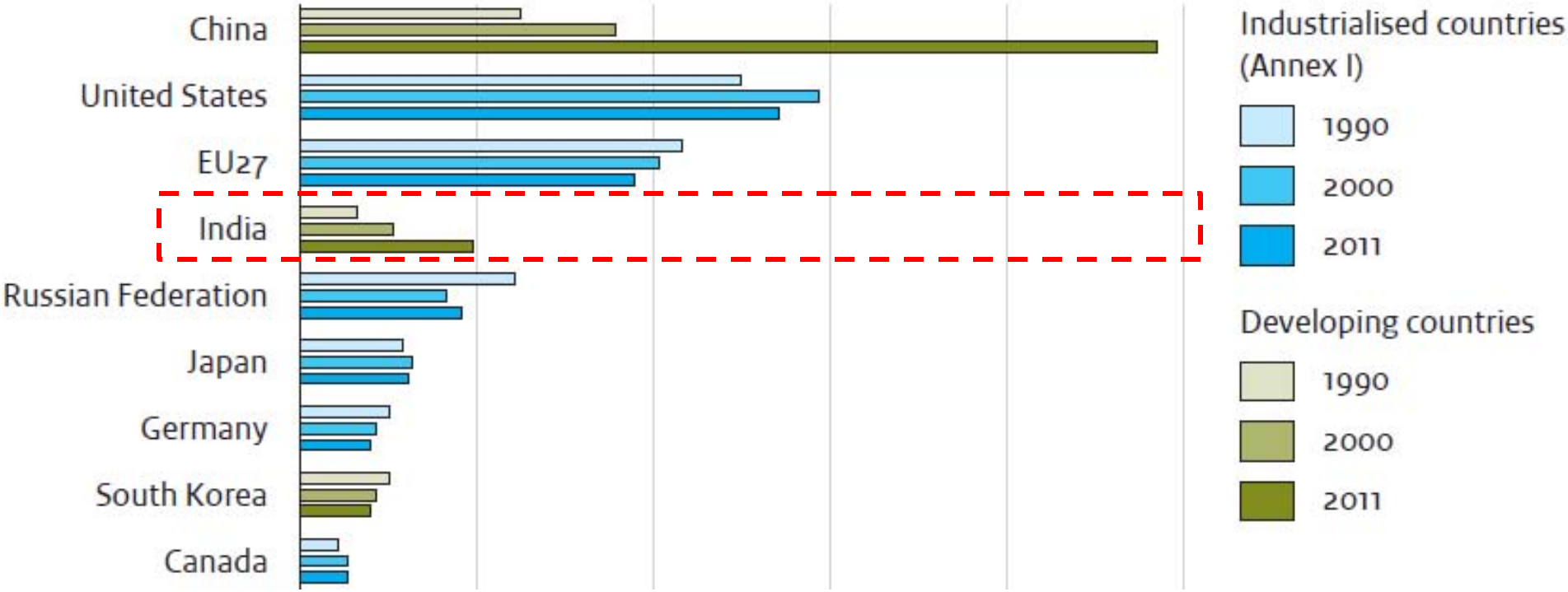
2. Energy Security



3. Local Emissions

Challenges before Auto Industry

CO_2 Emission: Global Trends



Source :PBL – Netherland Environmental Assessment Agency

CO_2 Emission trends per country from fossil fuels

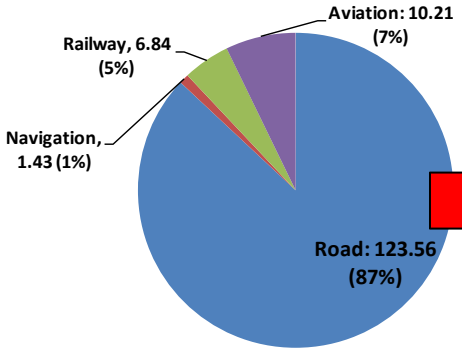
India is the 3rd largest emitter for the CO_2

CO_2 Emission : India's Position

SECTOR	CO_2 (Million Tons)
Electricity	715.83
Transport	138.86
Other Energy Activities	138.15
Cement	129.92
Iron & Steel	116.96
Other Manufacturing Industries	158.98
Total	1398.7

9.8 %

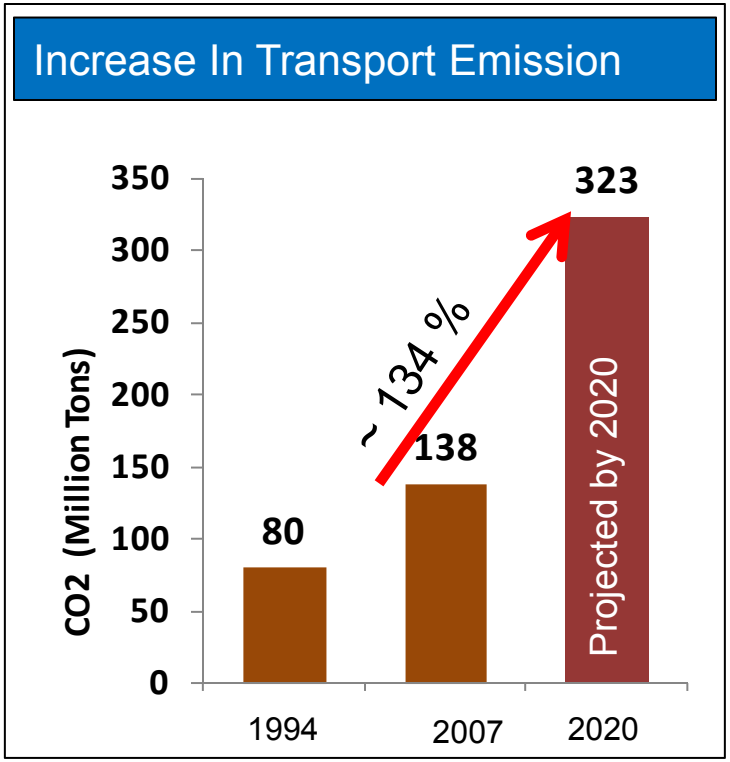
Source :Kirit Parikh report



87 %

Road Transport is the Largest CO_2 Emitter

Source: Central Road Research Institute, Delhi

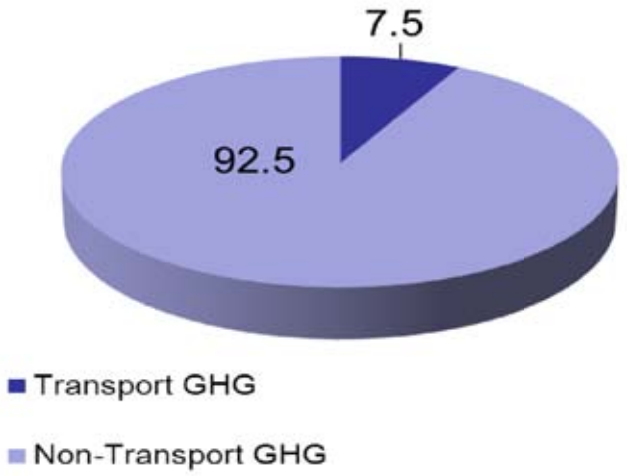


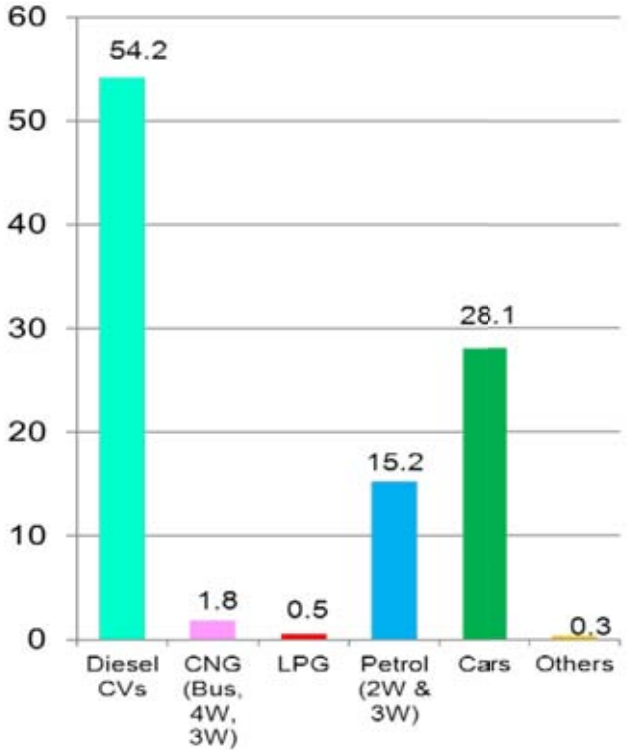
Source: Internal estimates of MSIL based on Fuel consumption estimates of PPAC

CO_2 Contributor in Transport Sector

Road Transport Sector contributes – 8.5 % of the total CO_2 emissions

Passenger Vehicle Contribution





Source : Central Road Research Institute

- **CO_2 emitted by all cars running in India ~ 2.1%**
- **Estimated CO_2 emitted by new cars in one year is about 0.32%**

New Passenger Vehicles contributes – 0.32 % of the total CO_2 emissions

Challenges before Auto Industry

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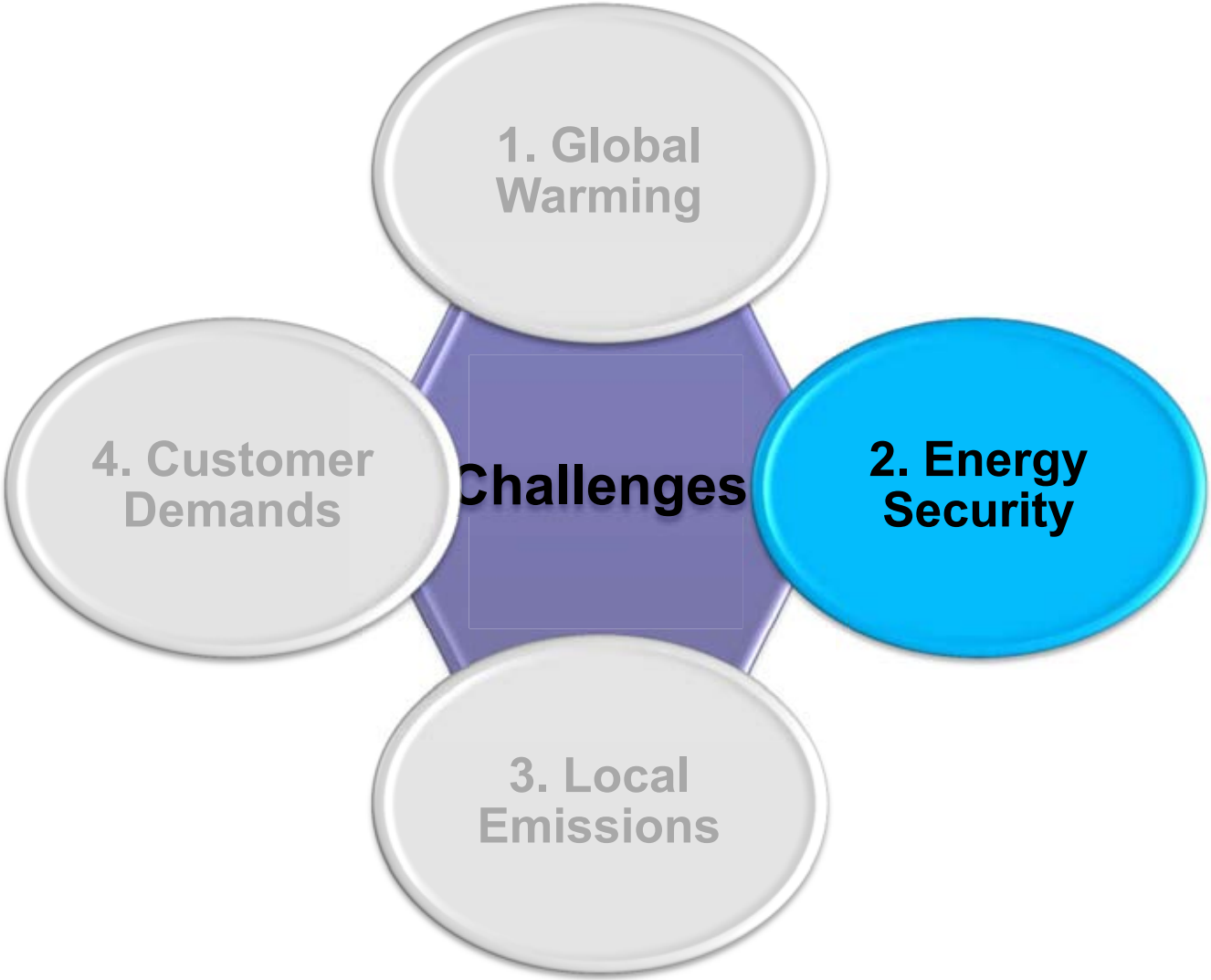

Energy Security : Indian Fuel Scenario

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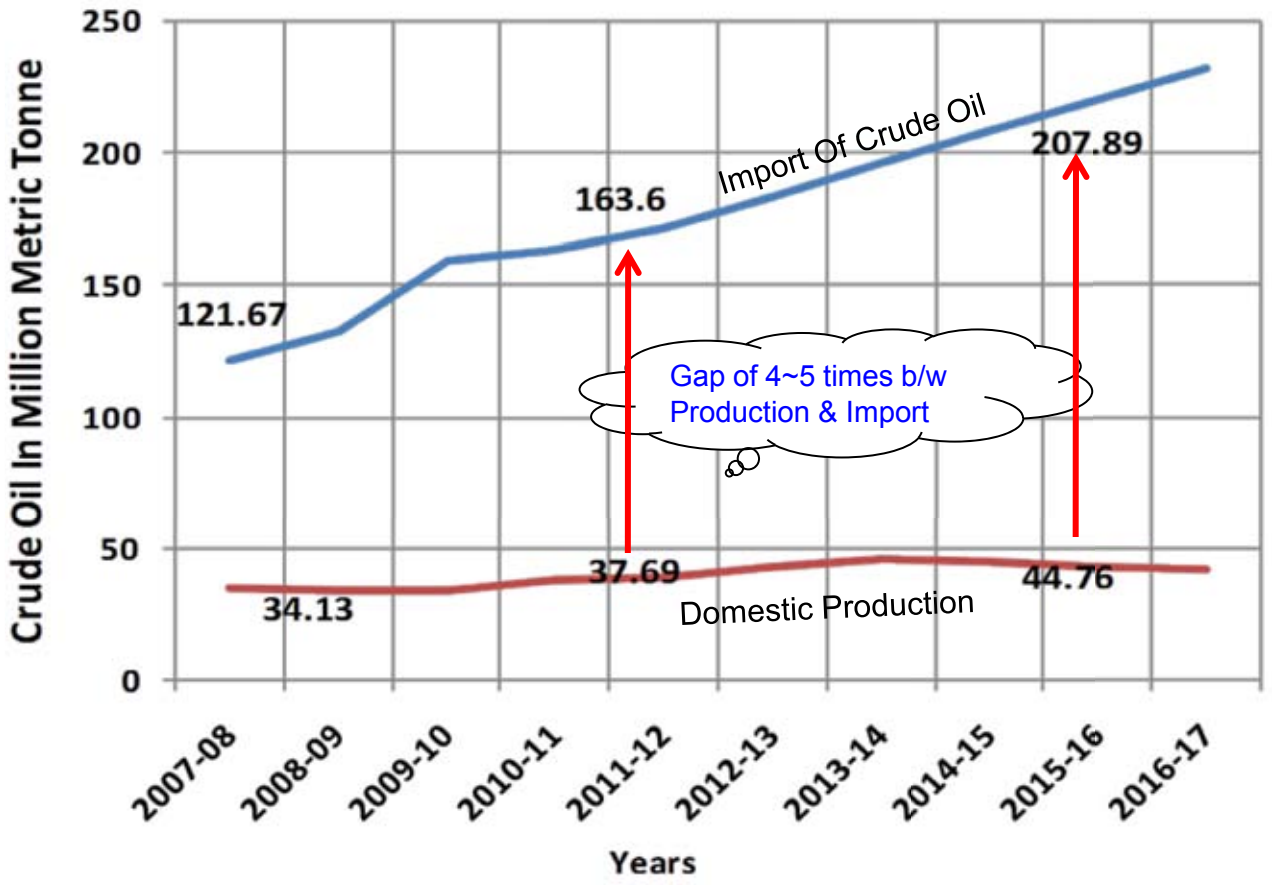
Is The Growth in Automotive Sector in line with Our Domestic Oil Production?



Source: Ministry of Petroleum

Over Dependence on import is a threat for Energy Security

Challenges before Auto Industry

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Emissions: Need to look at all sources

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Emissions from domestic Sources – Heavy Health Penalty

Radical Changes required in our lifestyle & methods to do business needed

According to ICAP Study Auto industry not a major contributor of PM10 Emissions

Challenges before Auto Industry

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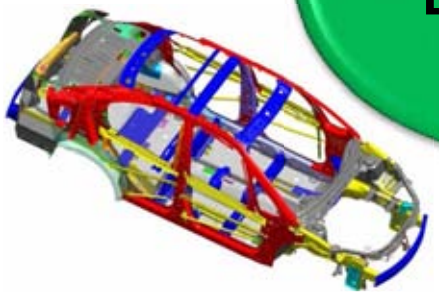

Mobility Requirement In India

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Mobility Requirement

① Urban Need

② Rural Need

Public Transportation

BRT Corridor
(Delhi, Ahmadabad)

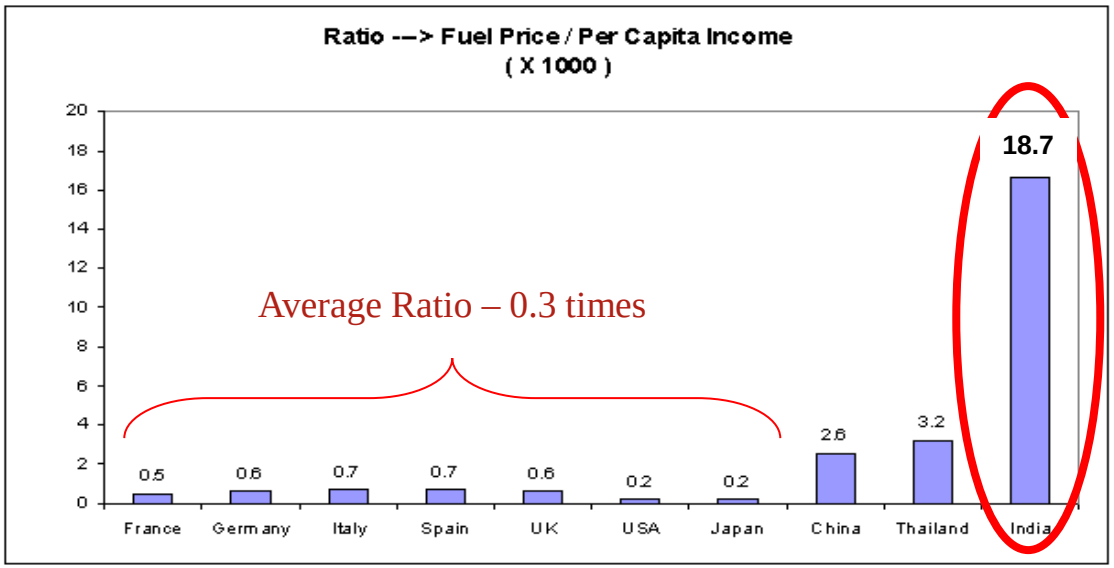
State Roadways

Cost Effective Solution

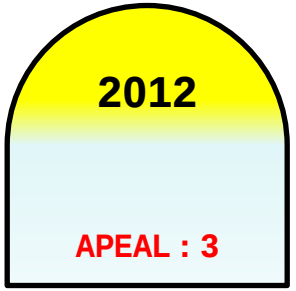
Personal Mobility

Public Transport must to Balance Urban & Rural India's Growth..
But Demand of Personal Mobility Can't be Ignored !!!

Consumers Perspective



In India Fuel price as a Pocket Pinching factor is highest.



Fuel Efficiency is consistently among top reasons that affect the

"BUYING DECISION IN INDIA"

Fuel Efficiency is already a strong competitive development parameter

SOURCE : Fuel Price - SIAM Data

Per capita Income - World Bank Data

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Industry Initiatives and Improvements

1. Technology Focus

2. Consumer Focus

Industry Initiatives - Vehicle Technology Focus

New Model Fuel Efficiency Improvements

Engine Efficiency

Transmission Efficiency

Vehicle Weight & Shape

Rolling Resistance of Tires

Alternative Fuel

Alternate Fuel Vehicles

Industry improved CO2 performance by 8 % from 2007 to 2010

Vehicle Weight Reduction: Industry Initiative

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Commitment Towards Weight Reduction

2% Weight reduction

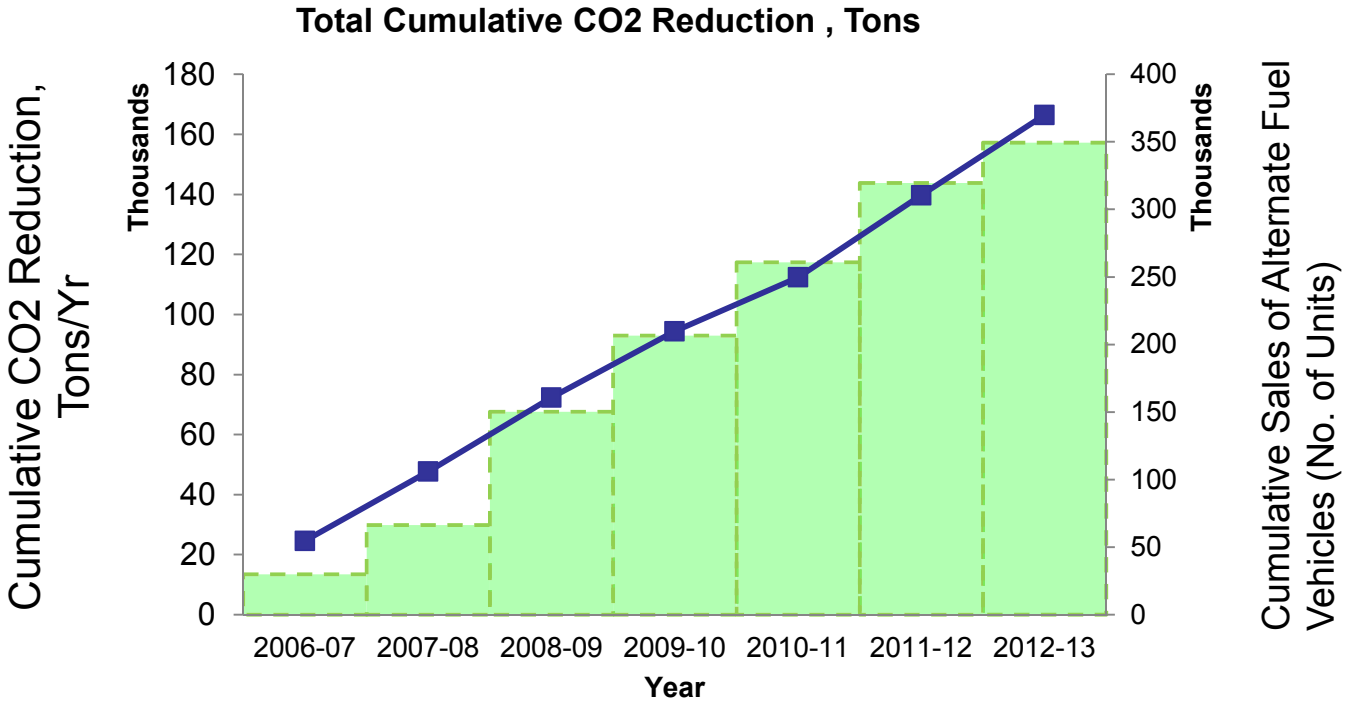
2.4% Weight reduction

7% Weight reduction

Weight Reduction makes business sense to reduce cost !

Impact of using low carbon Alternate fuels

Cumulative CO_2 Reduction From Maruti's Alternate Fuel Vehicles



Sales of CNG Vehicles from MSIL alone saved over 1.50 lakh Ton of CO_2

Source: internal data

Emissions: Future Roadmap required

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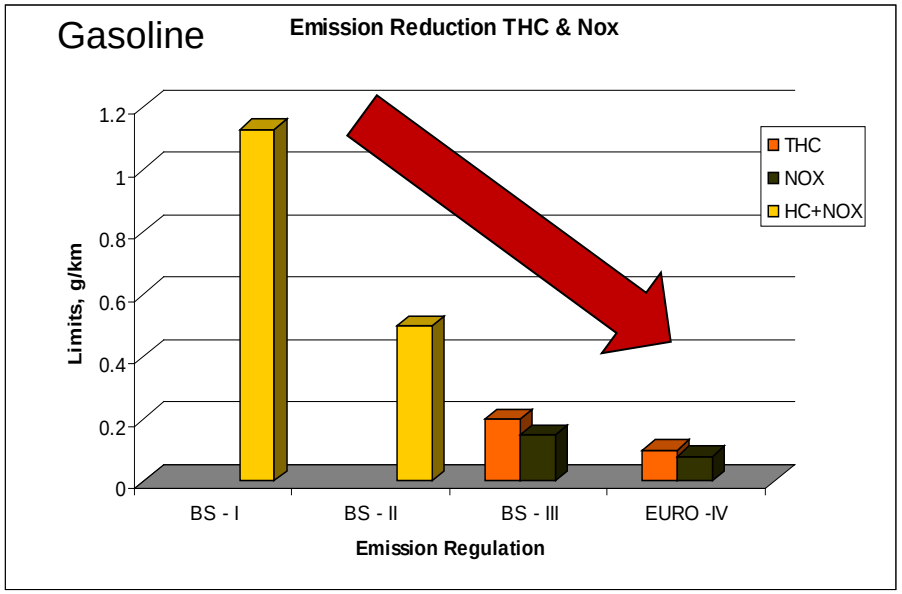

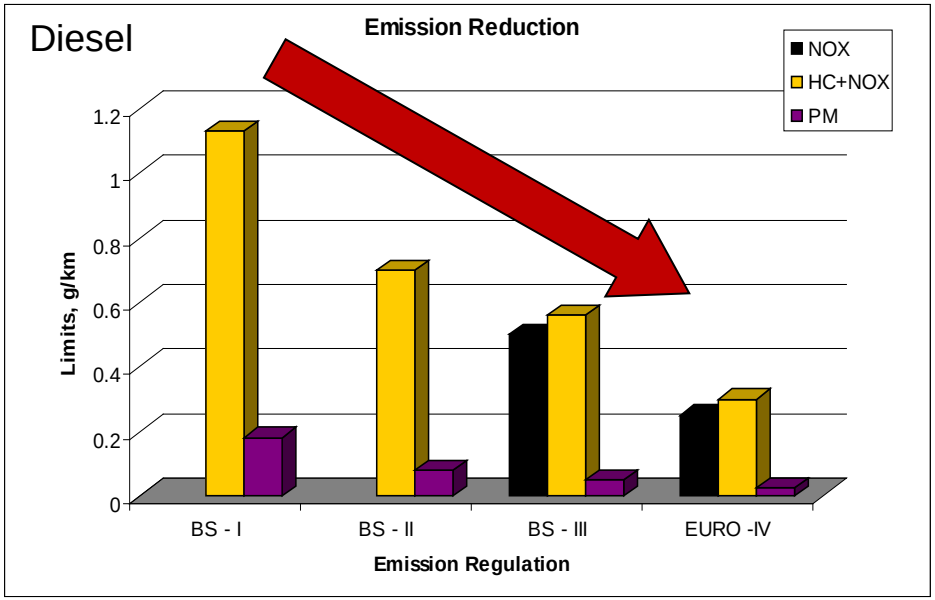

80 % Reduction of emissions from vehicles from 2000 till 2010
Adoption of OBD Regulations from 2013 for all categories of vehicles

Beyond 2013 no Roadmap is available for the Oil and Auto Industries to follow

Industry Initiatives – Consumer Focus

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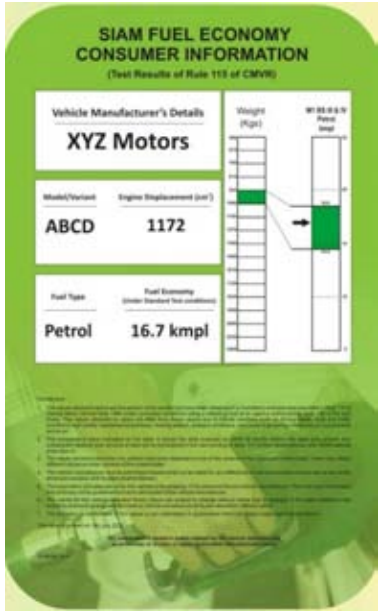
Consumer Information

- Fuel efficiency Consumer information Label started from Jan 2009
- Comparative label started from 2010



Driver Training

- Driver's can influence Fuel Efficiency on road by upto 30%
- Driver education

Consumer information and education is key to achieve fuel savings in actual road conditions

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Fuel Efficiency Regulation for India

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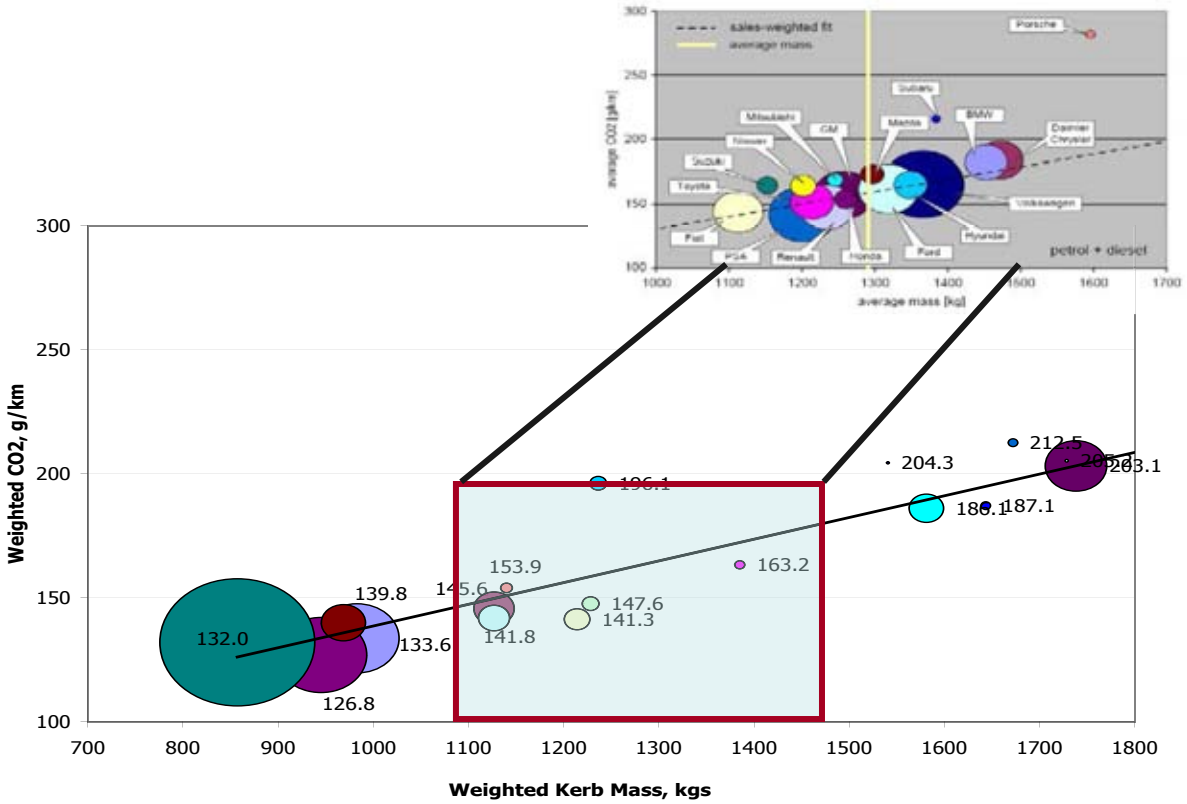
Industry supports the Fuel Efficiency Regulation for India

But the regulation has to:

- Consider the uniqueness of Indian Industry
- Consider the differences of Indian testing procedure
- Consider Indian Road and Infrastructure Conditions
- Consider that India adopts technology from Japan/Korea/Europe
- Consider the acquisition cost and Price sensitivity of customers

Indian Industry - Polarization



- Polarization of Manufacturers / Classes of vehicles/ Fuel Technologies
- Indian Auto industry needs to mature

Initial Target definition in India should consider this polarization.

Comparison of Key Test Parameters

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	EU	Japan	India	Effects
Road Load	Measured values due to: a) Lower test mass b) lower rolling tyres		Higher test mass Higher rolling tyres	Higher Emissions Higher CO_2 Emissions
Inertia Simulation	Kerb Weight + 100kgs	Kerb Weight + 110kgs	Kerb Wt + **150kgs**	Test with higher road load (due to 50kg extra) Inertia Weight Category may increase (~110kgs or higher) Higher emissions, CO_2
Driving Cycle	NEDC Max Speed 120kph	JC08 Max speed **82kph**	Mod. IDC Max Speed 90kph	The two cycles of EU and India are equivalent. In fact Higher inertia in Indian cycle poses greater challenges
Weightage of Cold and Hot Tests	Cold: 100%	**Cold :25%** **Hot: 75%**	Cold: 100%	European and Indian CO_2 test values are higher than Japan

Cycles are not comparable. Need to rationalize before comparing targets

Infrastructure : Constraint For Technology

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1.Fuel Quality: Lack of High Octane Value

Due to non-availability of high quality fuel, OEMs can not develop high compression ratio engine

Impact on CO_2 (Per Vehicle): 4.76 g/km

2. Low Resistance Tire

Lack of right infrastructure is bottlenecks for low resistance tyres in India

Impact on CO_2 (Per Vehicle): 2.83 g/km

3. Aerodynamic Design: Improve Drag (C_d)

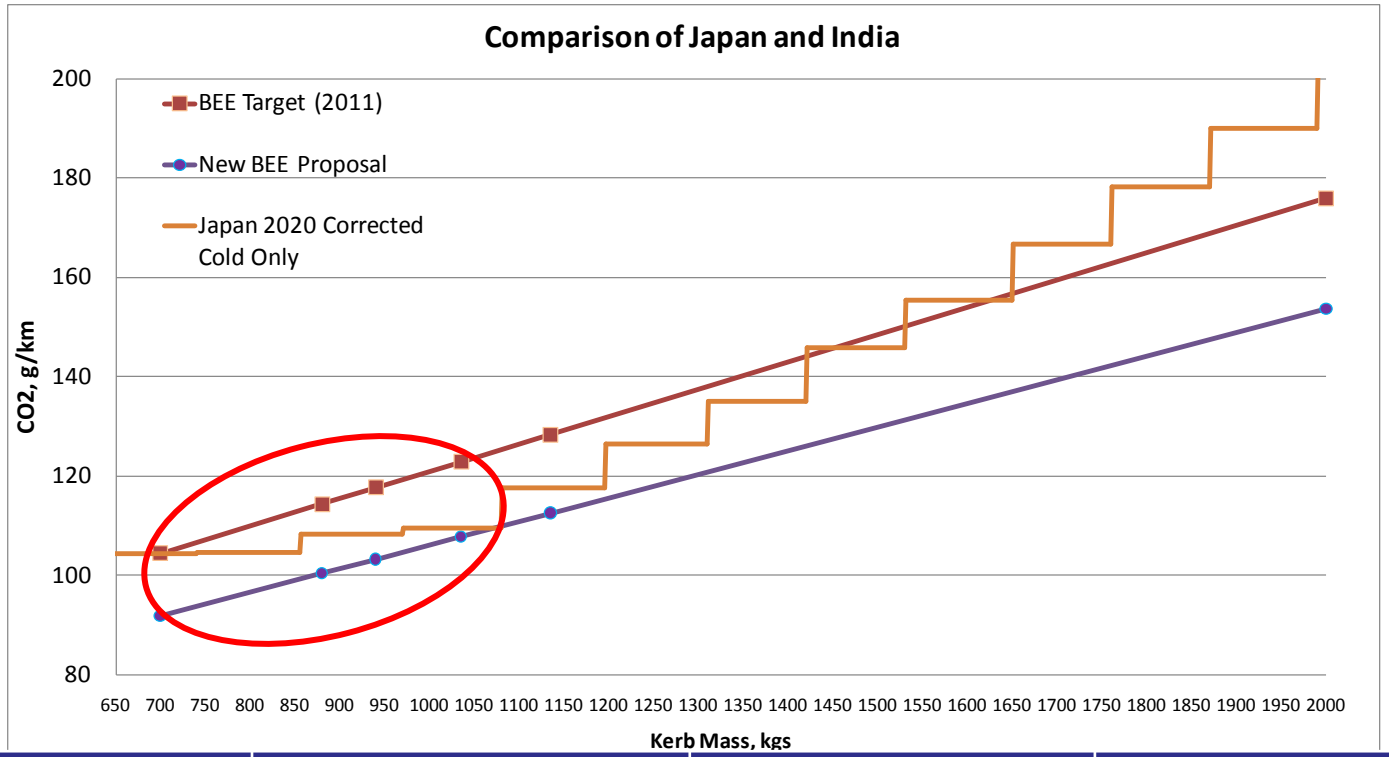
Less Aerodynamic Vehicles due to higher ground clearance

Impact on CO_2 (Per Vehicle): 1.41 g/km

Fuel Quality, Road Infrastructure limit improvements in India significantly

Source: SIAM Internal Result

Comparison of India and Japan Targets



Type of Vehicle	New BEE Proposal CO_2 , g/km	Japan Target Corrected for Cold Emission CO_2 g/km	BEE Proposal 2011 CO_2, g/km
700kgs Gasoline Vehicle	**91.9**	104.3	104.5
1700kgs Diesel Vehicle	**141.7**	166.6	162.3

Targets set for India are more stringent as compared to Japan 2020 targets

Technology Acquisition Cost

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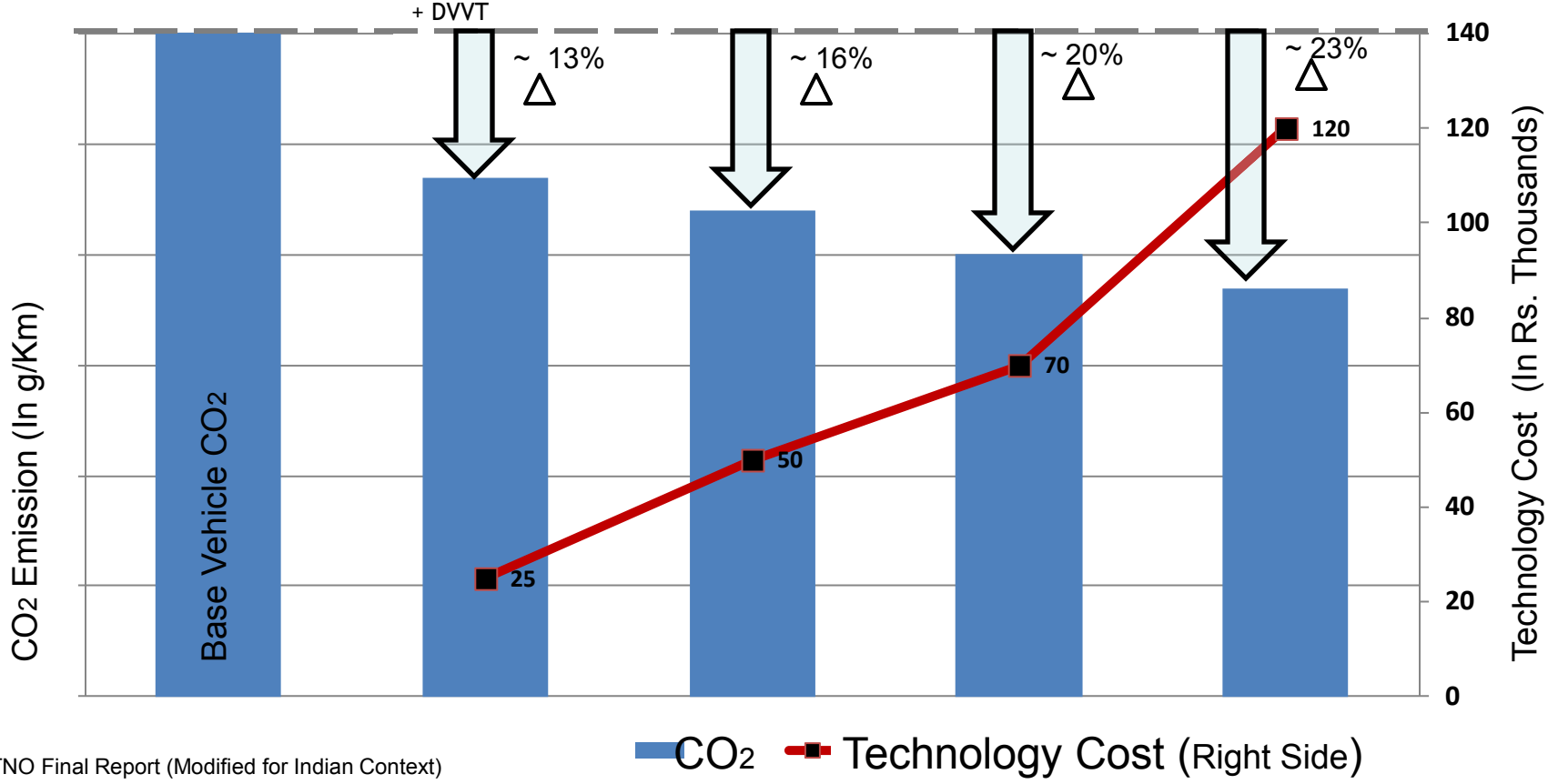
Technology Over Base Engine

Evolutionary Path

+ RR Improvement
+ Engine Friction
+ Weight Reduction
+ Aerodynamic
+ DVVT

Revolutionary Path

+ Start Stop
+ CVVL
+ GDI
+ Micro Hybrid with Regenerative Braking



Source: TNO Final Report (Modified for Indian Context)

Acquisition Cost is High For Revolutionary Technology, Not Relevant For Developing Country

Lead Time and Rates of Reduction in Japan

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2. Fuel efficiency standard 2015

Planning state of goal standards for vehicle fuel efficiency

▲ Base year ▲ Enforcement notification ★ Target year

Improvement possibility compared to base year

			'95	'96	'97	'98	'99	'00	'01	'02	'03	'04	'05	'06	'07	'08	'09	'10	'11	'12	'13	'14	'15	Improvement*
P'nger vehicle	Petrol	1st	▲				▲											★						22.8%
	Diesel	1st	▲				▲						★											14.9%
	Petrol Diesel	2nd										▲			▲								★	23.5%
	LPG	1st							▲		▲							★						11.4%

Target year : Year when goal standards have to be accomplished after that
Base year : Year which is adopted for example selection of top runner when goal standards were planned

Source: JAMA

Industry needs lead time to develop vehicles/Engines to meet the regulation targets

Lead time of around 9 Years has been the norm in Japan and EU

Regulation Roadmap

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2007	2009	2011	2013	2015	2017	2019	2021

Attempt 1 — Target – Define Targets for 2010, 2015 and 2020

Attempt 2 — Target – Define Targets for 2012, 2015 and 2020

- Targets for 2010 and 2012 could not be defined.
- Considering Lead times for development, India is loosing time to get its first Fuel Efficiency regulation

- FE Regulation definition is not a one time affair
- Should conclude the first phases of Regulation

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More than 70% of fuel consumption can be attributed to :

Driver behavior

Road infrastructure and driving conditions

Infrastructure – Impact on Vehicle Efficiency

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Road Infrastructure
(In million Km)

2000 2009

1.3 times

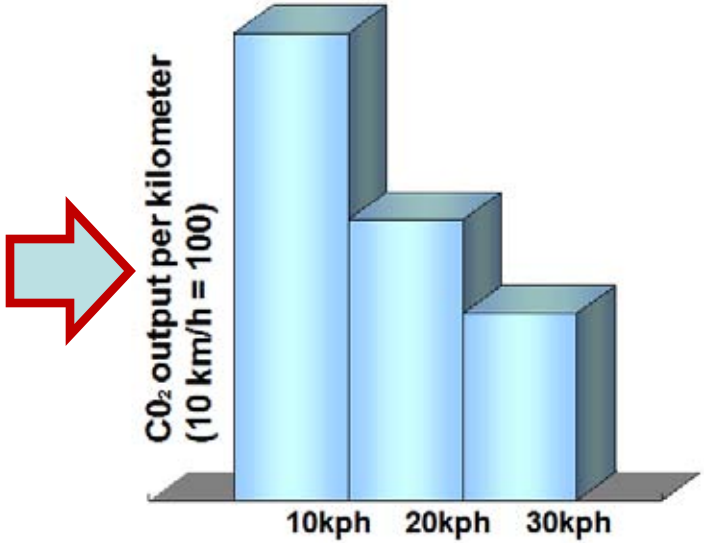
2.52 → **3.32**

Vehicles on Road (In million)

3.1 times

38.6 → **119**

Average Vehicle Speed and CO_2 Emissions

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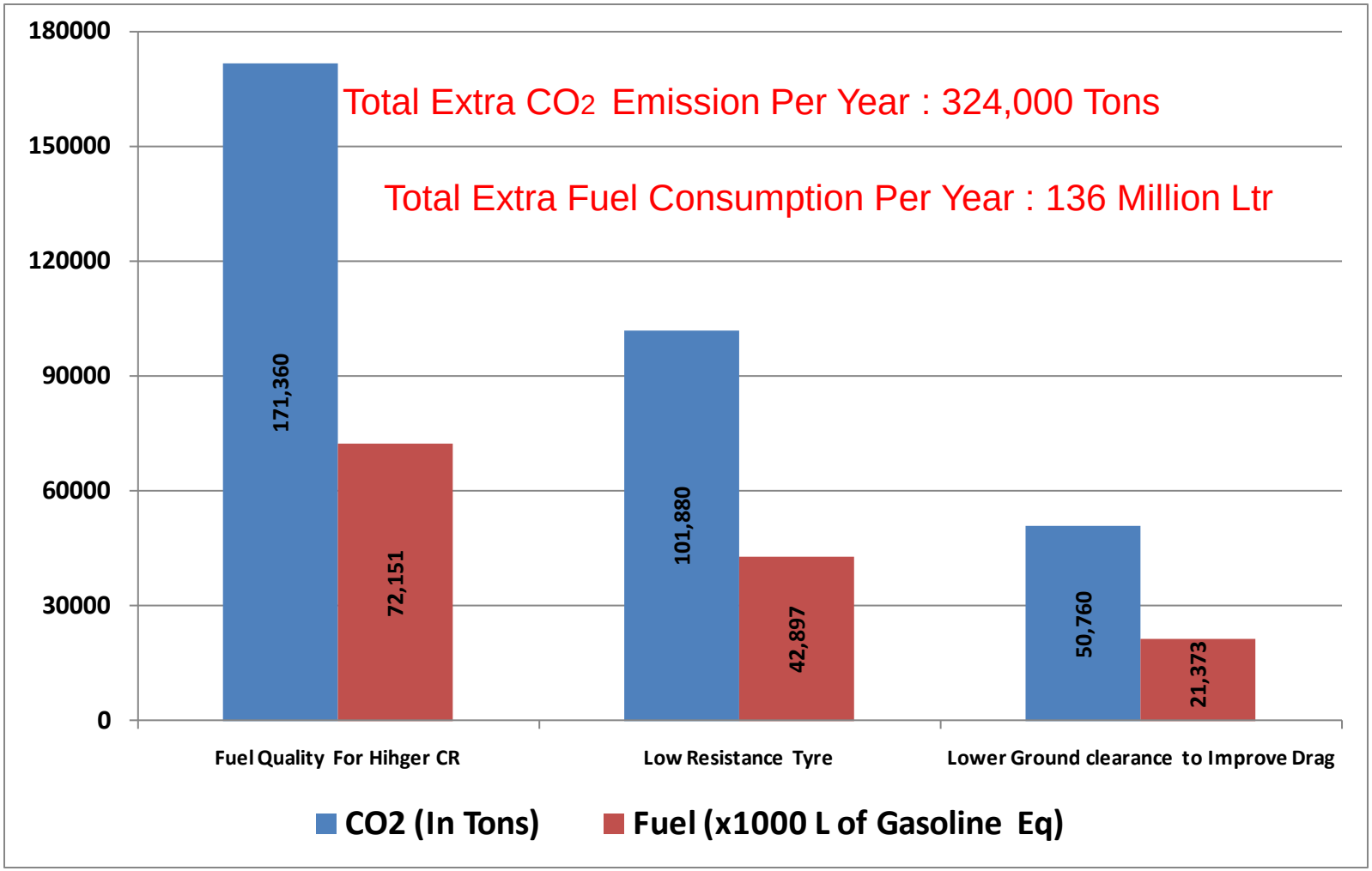
You are here: Home » City » Delhi

Delhi wastes Rs 11.5cr in traffic jams daily

Source: MSIL's Internal Test Result

60% Reduction in CO2 If Avg. Speed is Improved From 10 km/h to 30 km/hr

Infrastructure: Constraint For Technology



Source: MSIL's Internal Test Result

Assumption: Avg. 12000 Km for 3 Million 4-Wheelers per Year

India Can Save 136 Million Liters of Fuel Per Year

Example: Japanese Approach To Reduce CO_2

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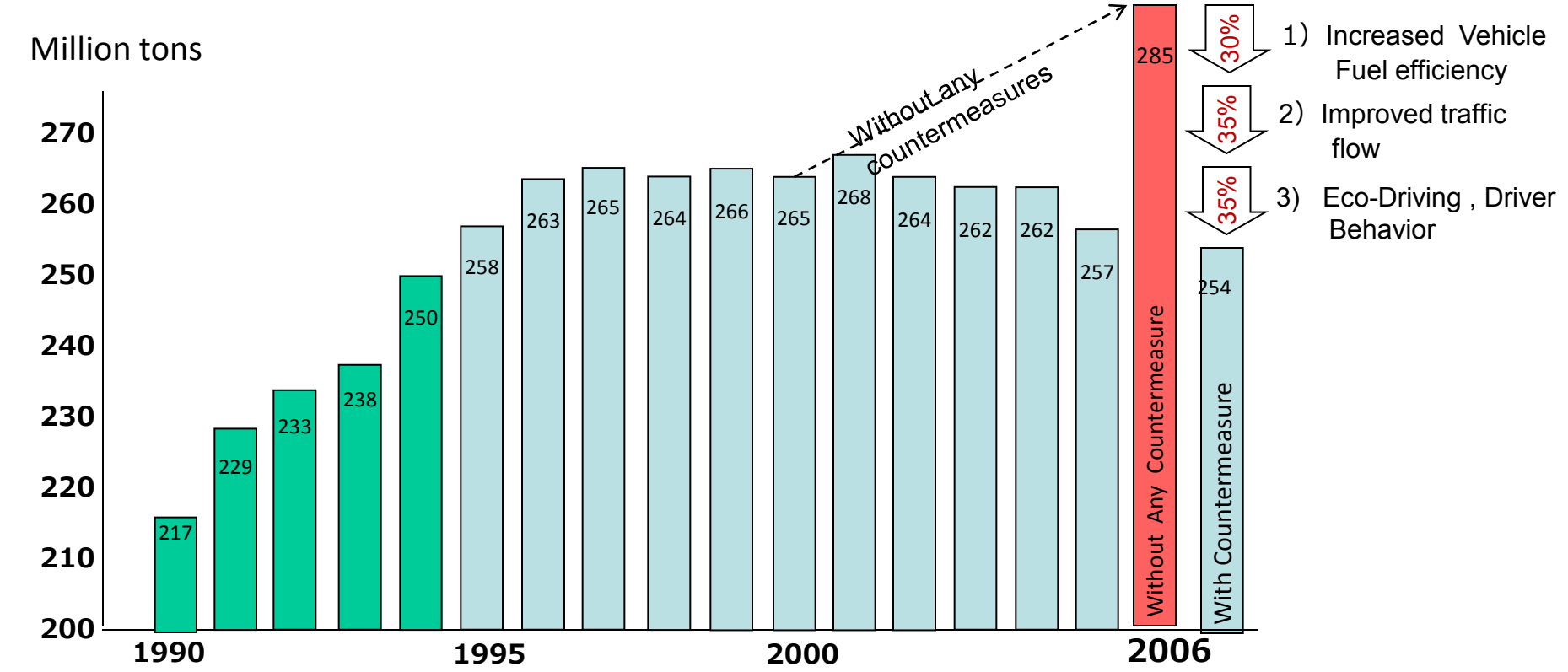
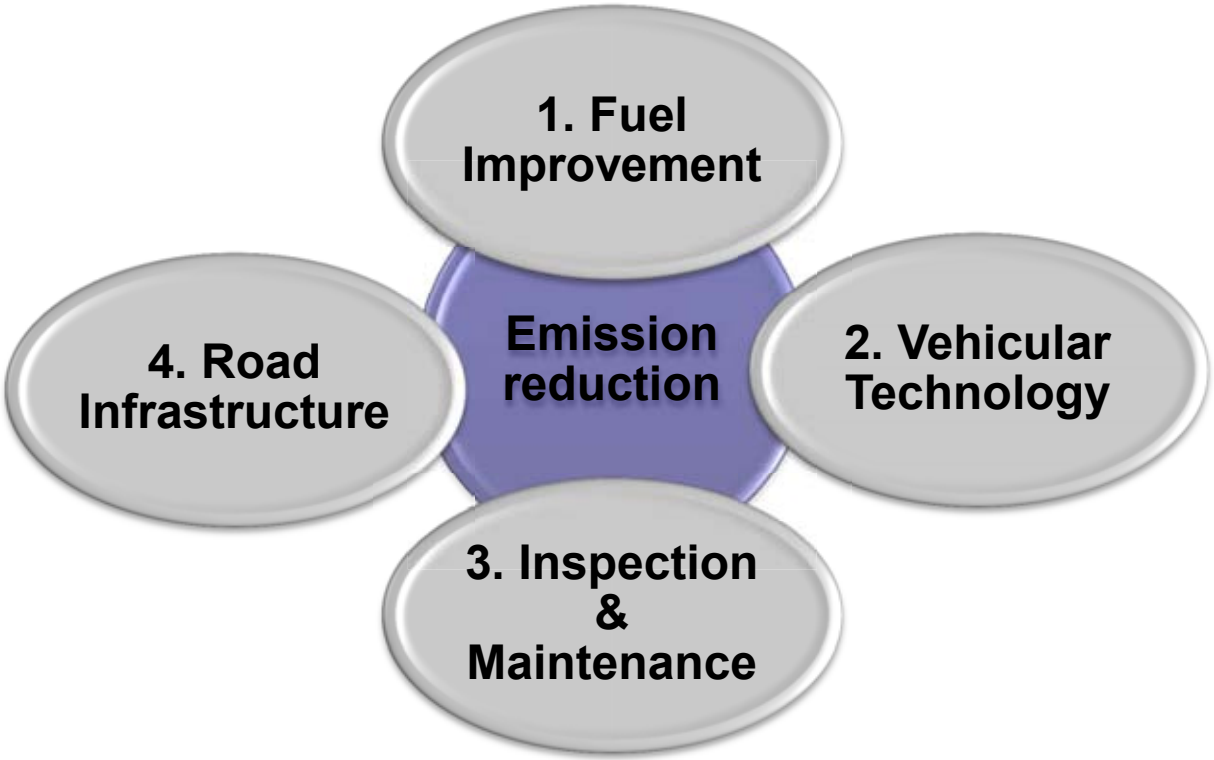


Source: Ministry of the Environment, JAMA

Note: About 90% of CO_2 emissions generated by Japan's transport sector are caused by road transportation. JAMA had set a Target of 31 Mtons CO_2 reduction from 2000 to 2006.

Japan Achieved 70% of CO_2 Reduction by Road Infrastructure (Improved Traffic Flow & Eco Driving)

Emissions Improvement Roadmap



Vehicular Technology is becoming highly sensitive to Fuel Specifications

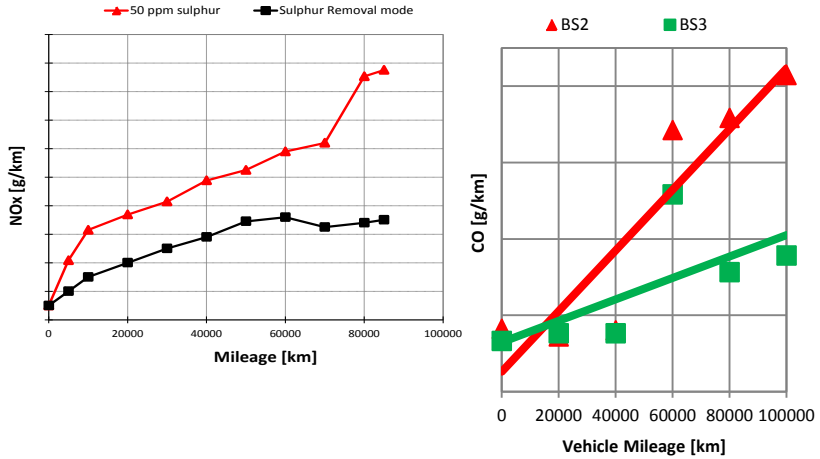
10ppm Sulfur is required for ensuring durability of Engine and After Treatment systems

Enactment of Inspection and Maintenance centers to ensure compliance

Overall Improvement of Emissions : Fuel Improvement

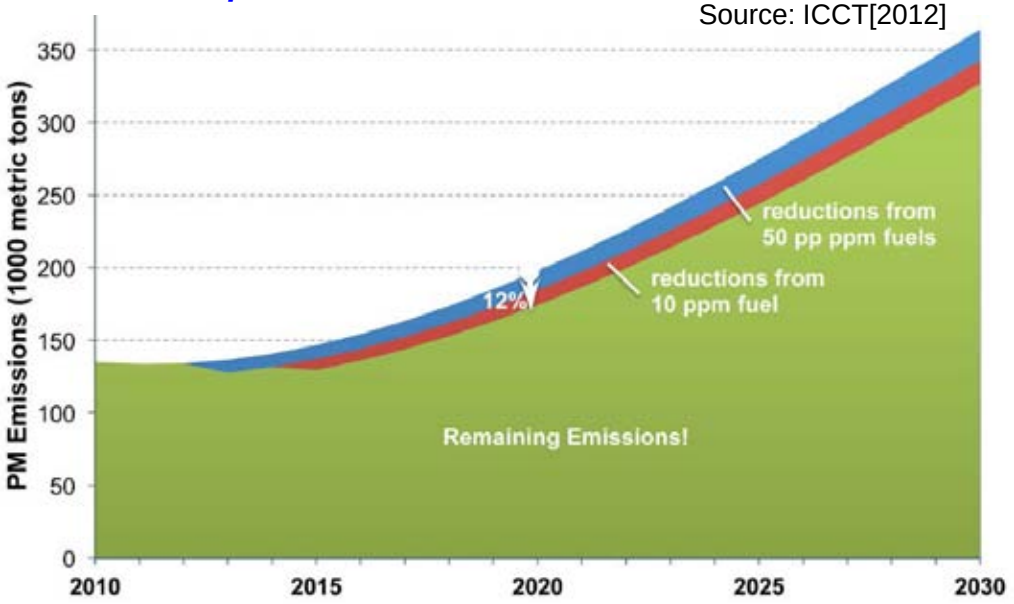
- *Improvement of Emissions from Existing vehicle Fleet*
  - *Early adoption of 10ppm Sulfur Fuel*
  - *Vehicle retirement policy*
  - *Strong Inspection and Maintenance setup*

Source: MSIL Internal



Deterioration of Emissions with Higher Sulfur

Source: ICCT[2012]



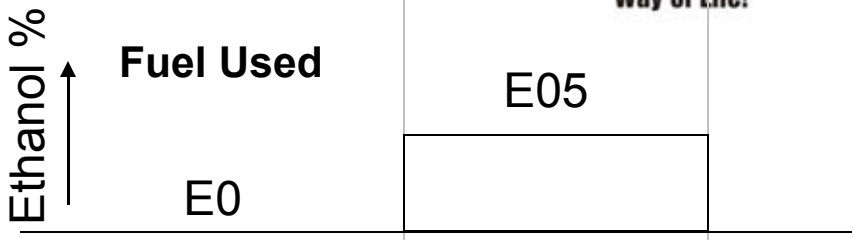
Improvement of Fleet Emissions with only Fuel Sulfur Reduction

- *Consumer Awareness*
- *Vehicle Maintenance and OBD awareness*

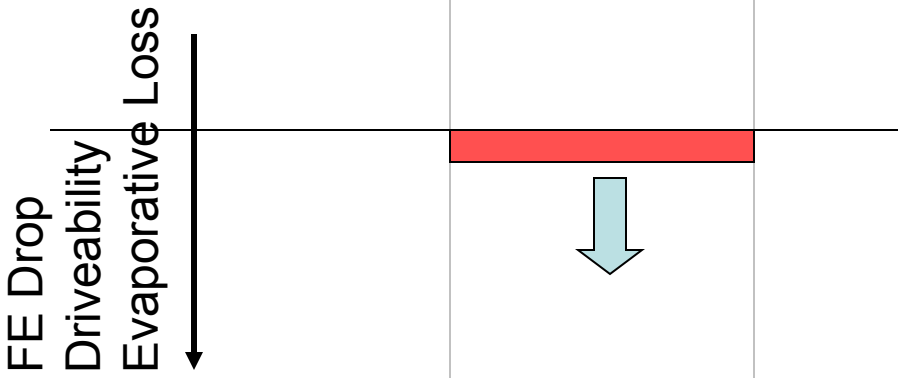
12% Improvement per year in PM emissions is possible from existing vehicles with ULSF

Ethanol : Challenges

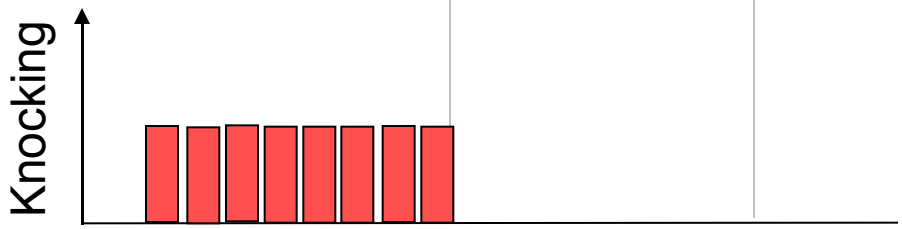
- Blending not mandatory in all places.
- Blending dependent on Supply condition of Ethanol
- Supply condition not favorable for even 5% blend.



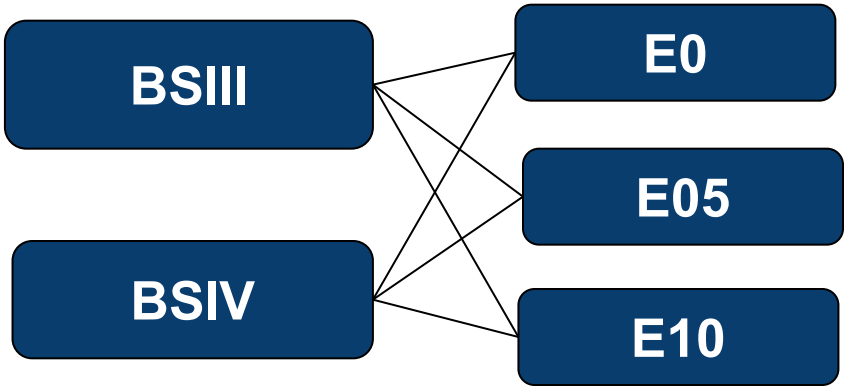
Vehicle calibrated with E0



Vehicle calibrated with E5



Fuel Variations for Manufacturers



In-consistent Ethanol content = Compromise on vehicle performance

E10 Case Study

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Fuel	Drive, kms	Fuel Eff., kpl	Fuel Consumed, lit
E0 (Gasoline)	1000	10	100
E10 Blend	1000	9.6	104.2

6.22% Saving of Gasoline Consumption

Gasoline	**93.78 lit**
Ethanol	**10.42 lit**

4.2% Higher Running cost for the Consumer

10 % of ethanol in gasoline will increase running cost for a consumer although it will help in reduction of Gasoline consumption by 6.2% approx.

Policy Intervention: For Future

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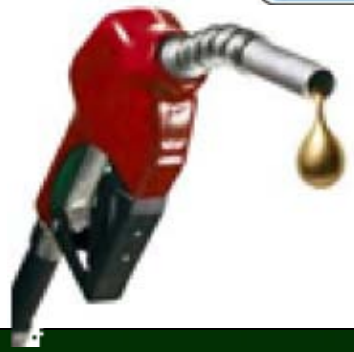
Roadmap for Diversified Fuel Type For Transportation


National Electric Mobility Mission Plan 2020 soon

NEMMP 2020
(Govt. of India)
Under Discussion



Encouragement of Hybrids

Policy for Fleet Renewal

Scrappage schemes and Policy for Fuel efficiency and Emission Improvements

Improve Public Transport

Policy Intervention is Must to Optimize the Consumption

Reduce Fuel Consumption & Emissions

Vehicle Technology

Infrastructure

Policy Intervention

Driver Behavior

Integrated Approach : Govt.'s/OEM's/End User

Working towards Sustainable mobility

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- Urban Development
- Manufacturing Processes
- Product Fuel Efficiency
- Recyclability
- Driver Education
- Infrastructure Development
  - Roads
  - Diversified Fuel
  - Inspection & Maintenance
- Modal Shift : Mass Transportation

All Stakeholders to work for a common goal of sustainable mobility

Thank You for Your Attention