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THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION

BRIEFING

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Policy Summary: India's Vehicle Emissions Control Program

In January 2013, the Ministry of Petroleum and Natural Gas (MoPNG) created an expert committee on "Auto Fuel Vision and Policy—2025", charged with establishing a roadmap for fuel quality and vehicle emission standards through 2025. The committee can also make recommendations regarding emission control measures from in-use vehicles, fiscal measures for upgrading of oil refineries, and alternative fuels. The present committee is the successor to a body that in 2002 set forth a similar policy roadmap up to 2010.

The International Council on Clean Transportation (ICCT) has just completed a comprehensive assessment of the past, present, and potential future direction of vehicle emission control measures in India, setting Indian policy options in the context of international experience and consensus best practice. That study offers a firm foundation for the expert committee's efforts to identify and recommend actions that will minimize air pollutant and greenhouse gas (GHG) emissions from vehicles.

This document summarizes the key aspects of the ICCT study.

BACKGROUND

The 2003 Auto Fuel Policy harmonized many of India's vehicle regulations with those of Europe and adopted a roadmap for progressively tighter fuel quality and vehicle emission standards through 2010. These were for the most part implemented according to the policy roadmap. As a result, vehicular emissions of particulate matter (PM_{10}) declined throughout the decade and growth in emissions of oxides of nitrogen (NO_x) slowed, even as the number of vehicles on the road doubled. As many as 21,500 premature deaths were avoided due to the reduction in $PM_{2.5}$ emissions, which are a leading cause of cardiopulmonary disease.

Figures 1 and 2 below show annual vehicular PM_{10} and NO_X emissions, respectively, and vehicle stock from 2000 to 2015.

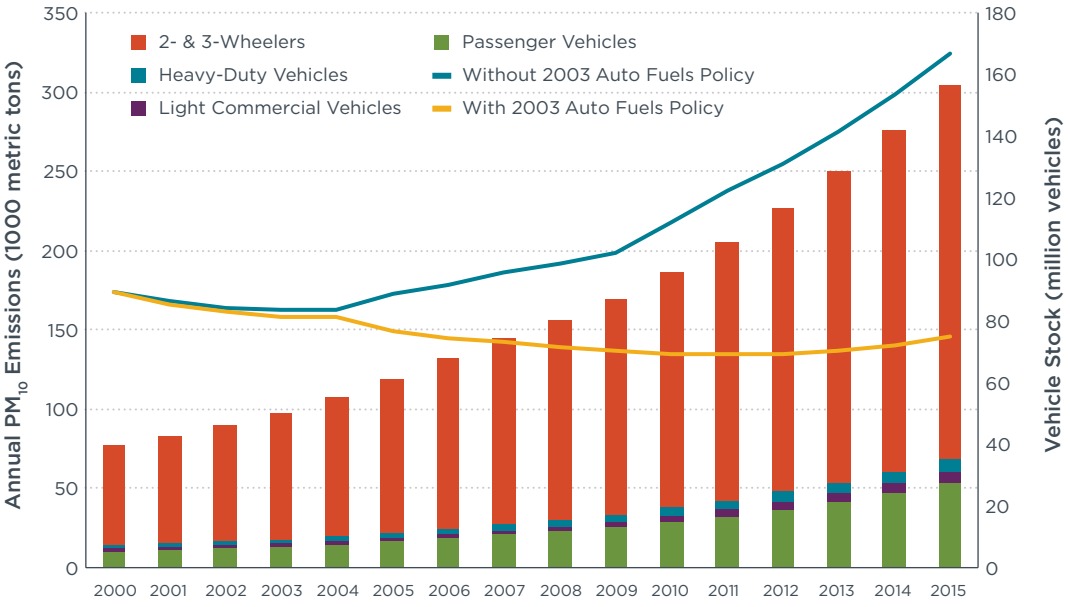

Figure 1: Annual vehicle stock and vehicular PM_{10} emissions from 2000 to 2015.

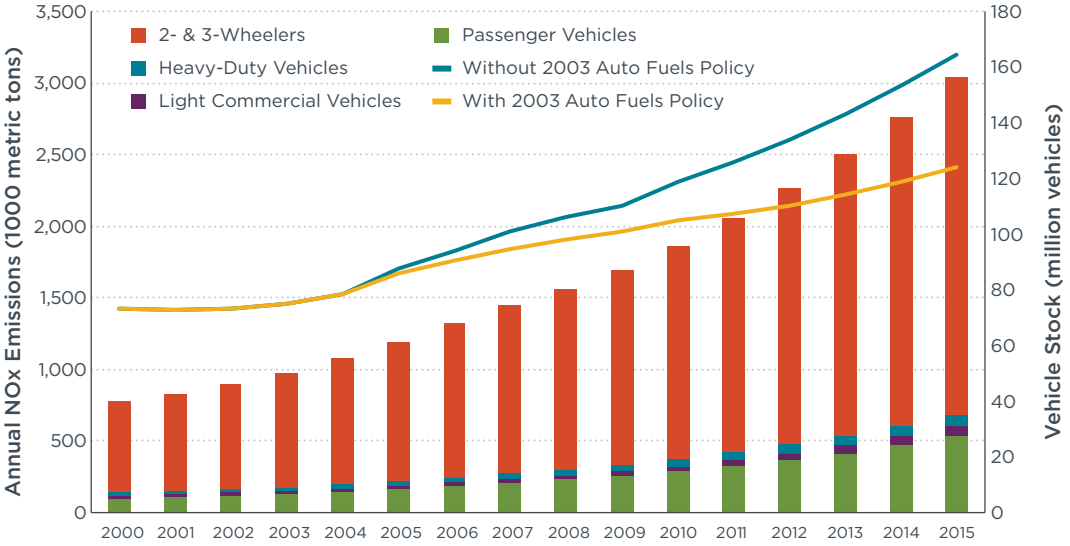

Figure 2: Annual vehicle stock and vehicular NO_X emissions from 2000 to 2015.

Despite the reduction in harmful vehicle emissions over the past decade thanks to the 2003 Auto Fuel Policy, greater and more rapid progress is urgently needed. Air pollution in India remains a deadly problem, especially in urban areas. The World Health Organization (WHO) estimates that over 700,000 people die each year in South Asia as result of ambient particulate matter pollution, making $PM_{2.5}$ emissions the sixth largest killer in the region.[1] Many Indian cities fail consistently to meet National Ambient Air Quality Standards (NAAQS).[2]

1 Health Effects Institute. Outdoor Air Pollution Among Top Global Health Risks in 2010. December 2012. Available online at: http://www.healtheffects.org/International/GBD-Press-Release.pdf

2 Central Pollution Control Board. National Ambient Air Quality Status 2009. January 2011. Available online at: http://cpcb.nic.in/upload/Publications/Publication_514_airqualitystatus2009.pdf

Vehicles account for over half of all NO_x emissions and about a quarter of fine particulate matter ($PM_{2.5}$) emissions—the two most problematic air pollutants—in Indian cities.[3] Annual vehicle sales, about 17 million today, are on a path to more than double by 2030. If per-vehicle emissions are not reduced significantly, the progress toward reducing emissions in India that has been made since 2003 will be erased in less than a decade.

Growth in India's transport sector is also driving greenhouse gas emissions rapidly upward and making the national economy ever more dependent on imported fossil fuels. These trends put the livelihoods of millions of people at ever-increasing risk.[4] Aggressive fuel-efficiency regulations for all vehicle types are needed to slow and eventually reverse them.

POLICY TARGETS

One of the primary barriers to progress toward effective vehicle-emission standards (viz. Euro 5/V and 6/VI) in India is the high sulfur content in the diesel fuel and gasoline (petrol) sold in the country: up to 350 parts per million (ppm) in diesel and 150 ppm in gasoline. At such concentrations, sulfur inhibits the proper functioning of advanced aftertreatment technologies, ranging from diesel particulate filters to lean NO_x traps, that could reduce vehicle emissions by more than 90%.

Fuel quality and vehicle emission standards in India lag international leaders by more than a decade, and India is at risk of falling behind other developing countries as well. China, Brazil, Mexico, Thailand, and South Africa all have plans to reduce fuel sulfur content and tighten emission standards beyond what India has in place.

Indian policy on air quality and vehicle efficiency is undermined by its reliance on two parallel standards, Bharat Stage (BS) IV for a handful of cities and BS III for the rest of the nation. This creates confusion, and treats consumers and businesses outside of major cities inequitably. Further, it weakens the logic of the policy overall, since all heavy-duty trucks meet BS III standard only, and nothing prevents BS IV vehicles requiring low-sulfur fuels from refueling in high-sulfur fuel areas.

While stricter fuel-quality and vehicle-emission standards nationwide are needed to reduce pollution over the long-term, in-use vehicle-emission control measures can have a more immediate impact, as they can address emissions from the entire fleet, and in particular the gross emitters. Indian policy should ensure that vehicles already on the road are operating to their design specifications and not emitting excess pollutants. This means enhancing, or perhaps replacing, the current Pollution Under Control (PUC) program with an in-use emissions testing program that selects vehicles off the road and tests them according to their original emission standard.

Durability requirements should also be toughened, because Indian vehicles are frequently kept in service for much longer than the assumptions concerning typical length of service on which emission control standards are currently based. A strong I/M program could encourage earlier retirement of older vehicles as the costs of maintaining older vehicles could increase significantly.

Fuel adulteration remains a problem in India. A rigorous quality assurance program, operating throughout the fuel supply chain to monitor and enforce fuel handlers' compliance with fuel-quality standards, is needed to ensure that vehicles equipped with

3 Guttikunda S., P. Jawahar, Urban Air Pollution & Co-Benefits Analysis for Indian Cities, March 2012, Available online at: http://www.urbanemissions.info/study-air-pollution-six-indian-cities.html

4 Shindell D. et al. Climate, health, agricultural and economic impacts of tighter vehicle emission standards. 2011. Available online at: http://pubs.giss.nasa.gov/docs/2011/2011_Shindell_etal_1.pdf

high-performing emissions controls and fuel-efficient engines have adequately clean fuel to take full advantage of those technologies.

Evaporative emissions must be addressed separately from measures targeting reductions in tailpipe emissions. India currently has no regulations for evaporative emissions, which are a health hazard to those refueling vehicles as well as those living near fueling stations because they contain benzene. The volatile organic compounds (VOCs) in fuel vapors also exacerbate ozone formation. The expert committee should therefore support so-called Stage I controls to capture vapors given off when delivering gasoline fuel to underground storage tanks at retail filling stations. Additionally, regulations should be developed to require so-called Stage II controls be fitted onto pump nozzles at filling stations, to capture vapors emitted during vehicle refueling, which can be complemented with onboard refueling vapor recovery (ORVR) systems installed on new vehicles.

If India were to take a holistic approach and act in a coordinated manner on all the elements described above, vehicular emissions could be reduced by more than 80% from where present trends would place them in 2030. Table 1 outlines differences between a business-as-usual and an alternative scenario in which India would aggressively adopt international best practices to reduce vehicle emissions. Figure 3 shows modeled emissions of the most important air pollutants under these scenarios.

Table 1: Business as usual versus international best practice in controlling vehicle emissions.

SCENARIOS	EMISSION STANDARDS	FUEL STANDARDS	ENFORCEMENT AND COMPLIANCE[1]	CHANGE IN FUEL TYPE[2]
BAU	Bharat IV in 50+ cities by 2015, Bharat III in rest of India; Bharat III for 2/3-wheelers nationwide	Low-sulfur fuel (50 ppm) in 50+ cities by 2015, 150 ppm sulfur gasoline and 350 ppm sulfur diesel in rest of India	15% of vehicle fleet are gross emitters	60% of new LDV sales diesel by 2020
World Class	Bharat V by 2015, Bharat VI by 2017, and US Tier 3 equivalent by 2020 for all vehicles	Low-sulfur fuel (50 ppm) nationwide by 2015; ultra low-sulfur fuel (10 PPM) nationwide by 2017	By 2020, only 3% of vehicle fleet are gross emitters	15% of LDV sales CNG and 10% LPG by 2030; 75% bus sales CNG by 2030; 50% of 3-wheeler sales CNG by 2030

1. Gross polluters are defined as vehicles where emission controls are non-functional
2. LDV means PC and U&MPV. Increases in CNG and LPG vehicle market share are assumed to happen at the expense of diesel market share.

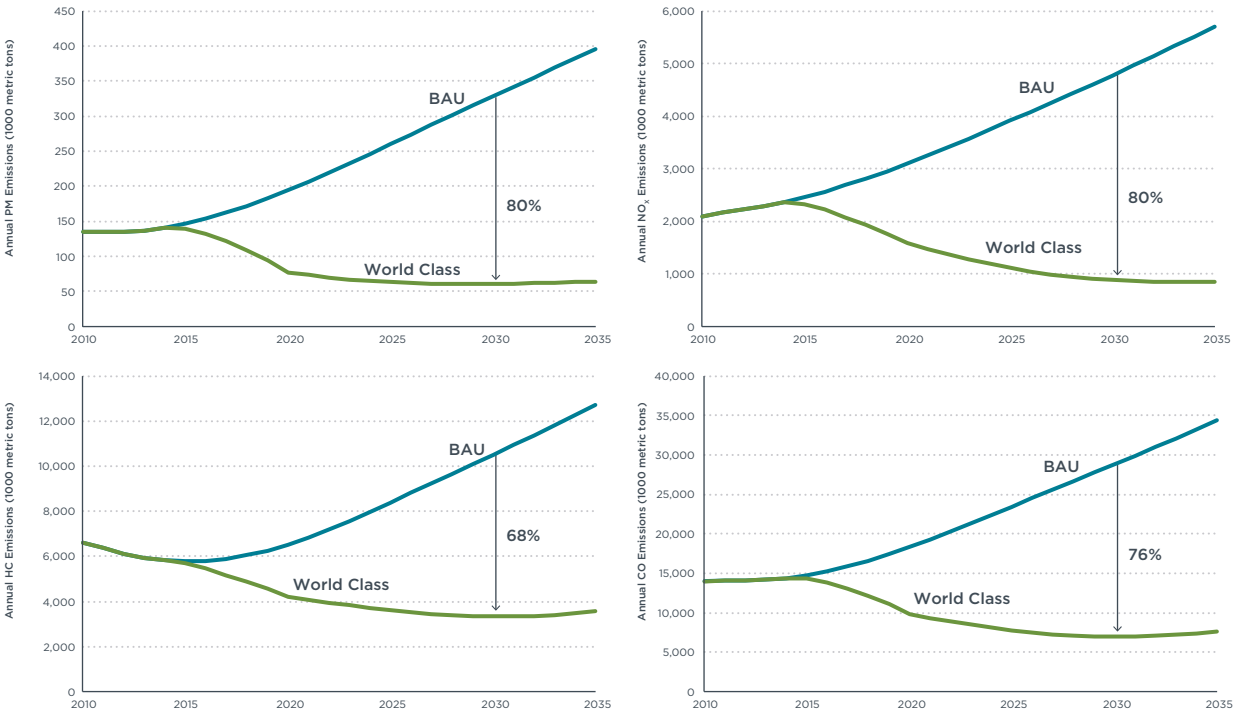

Figure 3: Annual vehicle PM_{10}, NO_x, HC, and CO emissions from 2010 to 2035.

With respect to GHG emissions and vehicle fuel economy, no regulations have been passed to date,[5] leaving India a nearly solitary outlier among the major vehicle markets in the world.[6] Nor has progress been made on regulations for commercial vehicles and two- and three-wheelers. The lack of policy direction in this area contributes to India's deepening dependence on imported oil and diverts private and public resources that could otherwise be directed at more productive investments.

POLICY RECOMMENDATIONS

Numerous specific recommendations follow from the ICCT's comprehensive analysis of the policy context and options for vehicle emissions control in India.

1. Mandate lower sulfur content (10 ppm) for all road-vehicle fuels and tighten emission standards to Euro 6/VI and beyond for all vehicle types. Table 2 below shows a feasible timeline.

5 Passenger vehicle fuel efficiency standards have been previously proposed by the Bureau of Energy Efficiency (BEE), but have not been formally notified.

6 The International Council on Clean Transportation. Global passenger vehicle standards. Available online at: http://www.theicct.org/info-tools/global-passenger-vehicle-standards

Table 2: Recommended implementation dates for fuel sulfur content and vehicle emission standards.

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Fuel Sulfur content (ppm)	50		10								
LDV Emission Standard	BS Va		BS Vb		BS VI				Euro 7/US Tier 3 equivalent		
HDV Emission Standard	BS V				BS VI				Euro VII/US2010 equivalent		
2/3-Wheeler Emission Standard	BS IV				BS V				BS VI		

All implementation dates are for the beginning of the fiscal year (April 1)

2. Increase the durability requirements of emission regulations to match levels that manufacturers have already demonstrated the ability to meet in other jurisdictions, such as the United States. Table 3 below summarizes current and recommended emissions durability.

Table 3: Durability requirements for vehicle emission standards.

Vehicle category	Current (km)	Recommended (km)	Notes
2/3-Wheelers	30,000	50,000	Euro V standards proposal, Iyer NV, 2012
LDVs	80,000	190,000	Recommended is US Tier 2 requirement
HDVs			
N1	100,000	190,000	Recommended is US Tier 2 requirement
N2	125,000	190,000	Recommended is US Tier 2 requirement
N3 w/GVW < 16,000kg	125,000	190,000	Recommended is US Tier 2 requirement
N3 w/GVW > 16,000kg	167,000	300,000	Recommended is US MHDDE requirement
M2	100,000	300,000	Recommended is US MHDDE requirement
M3 w/GVW < 7500kg	125,000	300,000	Recommended is US MHDDE requirement
M3 w/GVW > 7500kg	167,000	300,000	Recommended is US MHDDE requirement

3. Develop, by April 1, 2015, a national program to randomly select properly maintained and used vehicles and test them against their original emission standards, along the lines of the United States Environmental Protection Agency (US EPA) programs, to be implemented starting April 1, 2017. India is already in the process of establishing more than ten vehicle testing centers around the country, which should be used for conducting such in-use vehicle testing. This will ensure that vehicles are meeting durability requirements, and noncompliant vehicle models are identified.
4. Develop a national program to test fuel quality throughout the fuel supply chain, including retail stations, by April 1, 2015. A national fuel testing lab has already been commissioned in Noida, but as planned that facility would not have authority to take action against noncompliant fuels. Regional fuel testing labs should be established

in all regions of the country and given authority to take legal action against fuel handlers dealing with noncompliant fuel.

5. Establish a National Automobile Pollution and Fuel Authority (NAPFA), as recommended by the Auto Fuel Policy Committee in 2002, with power over environmental regulations for vehicles and fuels, to ensure timely implementation of the auto fuel policy roadmap. NAPFA should have the ability and authority to work with fuel quality and vehicle emissions testing labs to issue mandatory recalls, levy fines, and take other legal action against parties dealing with noncompliant vehicles and fuels.
6. Mandate annual vehicle registration for all vehicle types across the country. Currently private vehicles need only be registered 15 years after initial purchase. Annual registration can be linked with PUC testing and proof of insurance. This will provide India more comprehensive data on its vehicle fleet and enable the government to streamline vehicle regulations.
7. Mandate Stage I and Stage II evaporative emission controls by 2017 at all urban fuel retail stations, in time for nationwide deployment of ultra-low-sulfur fuels (<10 ppm sulfur). Additionally, mandate ORVR systems for all new vehicles beginning in model year 2015.
8. Adopt the 2020 passenger car fuel economy standards, already developed jointly by the Bureau of Energy Efficiency (BEE) and Ministry of Road Transport and Highways (MoRTH), without delay, and extend the standards to 2025.
9. By 2015, have in place regulations requiring a 2% annual reduction in fuel consumption by light as well as heavy commercial vehicles between 2016 and 2025.
10. By 2017, have in place regulations requiring a 1% annual reduction in fuel consumption by two- and three-wheelers between 2018 and 2025.

POLICY IMPACT

If international best-practice policies (i.e., the World Class scenario in table 1) are adopted, over 280,000 cumulative premature deaths can be avoided in urban areas alone between now and 2030 by the reduction in fine particulate matter ($PM_{2.5}$) emissions. The estimated monetary value of these health benefits is conservatively estimated to be Rs. 3500 thousand crores (nearly US$700 billion, or 35% of India's FY 2011–12 GDP). These benefits are three times the costs of cleaner vehicles and low-sulfur fuel investments.

On the GHG emissions and fuel consumption side, implementing fuel consumption standards can save 200 million metric tons of oil, equivalent to about 750 million metric tons of CO_2 emissions, between now and 2030.[7]

7 Petroleum product domestic consumption in FY 2011–12 was 148 million metric tons of oil equivalent.