

BRIEFING

SERIES: GLOBAL TRANSPORTATION ROADMAP

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The Impact of Stringent Fuel and Vehicle Standards on Premature Mortality and Emissions: Placing India within the Global Context

Approximately ten percent of all years of life lost from exposure to vehicle emissions around the world occur in India. Without new limits on vehicle emissions and fuel sulfur content, the number of early deaths caused by emissions of fine particles in urban areas will nearly quadruple by 2030. New emission limits on vehicles in India could cut the number of early deaths by 84 percent compared to business-as-usual in 2030, adding 6.2 million years of life cumulatively through 2030.

These are among the findings detailed in a forthcoming ICCT report, *The Impact of Stringent Fuel and Vehicle Standards on Premature Mortality and Emissions*, to be published as part of the ICCT's Global Transportation Roadmap series¹. The report finds that on a global scale the health impacts from vehicle emissions in urban areas will increase early deaths by 150% in 2030, or 4.4 million years of life lost, unless governments act to curb those emissions. India alone could potentially realize about one quarter (6.2 million) of the cumulative 25 million years of life that could be gained from all new vehicle emission and fuel quality controls throughout the world.

The Auto Fuel Vision and Policy Committee of India is currently deliberating over vehicle-emission and fuel-quality standards through the year 2025. The rate of progress toward implementing world-class limits on new vehicle emissions and fuel sulfur levels in India will determine whether national trends in the health impacts associated with vehicle emissions worsen or improve.

¹ The first report in the Roadmap series of global analyses of the impacts of clean transportation policies on health, energy, and climate was the Global Climate Energy and Transportation Roadmap, <http://www.theicct.org/global-transportation-energy-and-climate-roadmap>. Another forthcoming ICCT study, India's Vehicle Emissions Control Program, provides an assessment of the benefits of emission reductions in India from past, present, and future emission control policies that emphasizes these findings in greater detail. That study is summarized in "Policy Summary: India's Vehicle Emissions Control Program," <http://www.theicct.org/policy-summary-indias-vehicle-emissions-control-program>.

STUDY APPROACH

The Impact of Stringent Fuel and Vehicle Standards on Premature Mortality and Emissions assesses the impacts of tighter emission limits on vehicles and new standards on fuel sulfur content in each of sixteen major regional groups through the year 2030. This approach enables cross-regional comparisons of trends in vehicle activity, emissions, and related health outcomes under baseline and alternative policy scenarios. The report quantifies the health benefits of a global policy roadmap for cleaner vehicles and fuels that represents an aggressive but pragmatic timeline for new policies, taking into account administrative and technical considerations in each region. Table 1 shows the two policy scenarios considered for India.

Table 1. Baseline versus accelerated policies for controlling vehicle emissions

SCENARIOS	EMISSION STANDARDS	FUEL STANDARDS	ENFORCEMENT AND COMPLIANCE ¹	CHANGE IN FUEL TYPE
Baseline	Bharat IV in 50+ cities by 2015 (25% of passenger VKT), Bharat III in rest of India; Bharat III for 2- and 3-wheelers nationwide	Low-sulfur fuel (50 ppm) in 50+ cities by 2015, 350 ppm sulfur diesel in rest of India	17% of vehicle fleet have minimal or no emission controls in 2010	50% of new LDV sales diesel by 2020, increasing to 60% by 2030
Accelerated	Bharat V by 2016, Bharat VI by 2020, and US Tier 3 equivalent by 2025 for passenger vehicles	Low-sulfur fuel (50 ppm) nationwide by 2015; ultra-low sulfur diesel (10 ppm) nationwide by 2020	No change in gross emitters	No change in fuel type

¹ Gross emitters are defined as vehicles with minimal (Bharat I) or no emission controls. The share of gross emitters is estimated based on the historical progression of emission standards.

VEHICLE AND FUEL REGULATIONS COMPLEMENT ACTIVITY MEASURES

From 2000 to 2010, the number of vehicle-kilometers traveled (VKT) in India grew at nearly a 9% annual rate. Other countries with high growth rates include China at 12% and both Brazil and Mexico at 5% (see Figure 1) (ICCT Roadmap Model). Vehicle activity in these countries is projected to increase through 2030, although at a declining rate. The high growth rates forecast in India are driven by trends in population and income.

Without improvements in vehicle emission controls, growth in passenger and freight vehicle activity, combined with continued urbanization, could drive significant increases in emissions and associated health impacts. Advanced emission controls combined with effective compliance and enforcement can cut per-vehicle-km particulate emissions by 99%, enabling major emission reductions in spite of rapid growth in vehicle activity. Emission limits for new vehicles and fuel-quality standards also complement measures designed to increase the livability of cities, reduce congestion, and promote transit, walking, and bicycling through reductions in exposure to pollution on and near roadways. Preserving the

attractiveness and convenience of alternative transportation modes by reducing exposure to vehicle emissions in urban areas is important for enabling economic development, maintaining equitable access to destinations, and improving quality of life (ADB 2012).

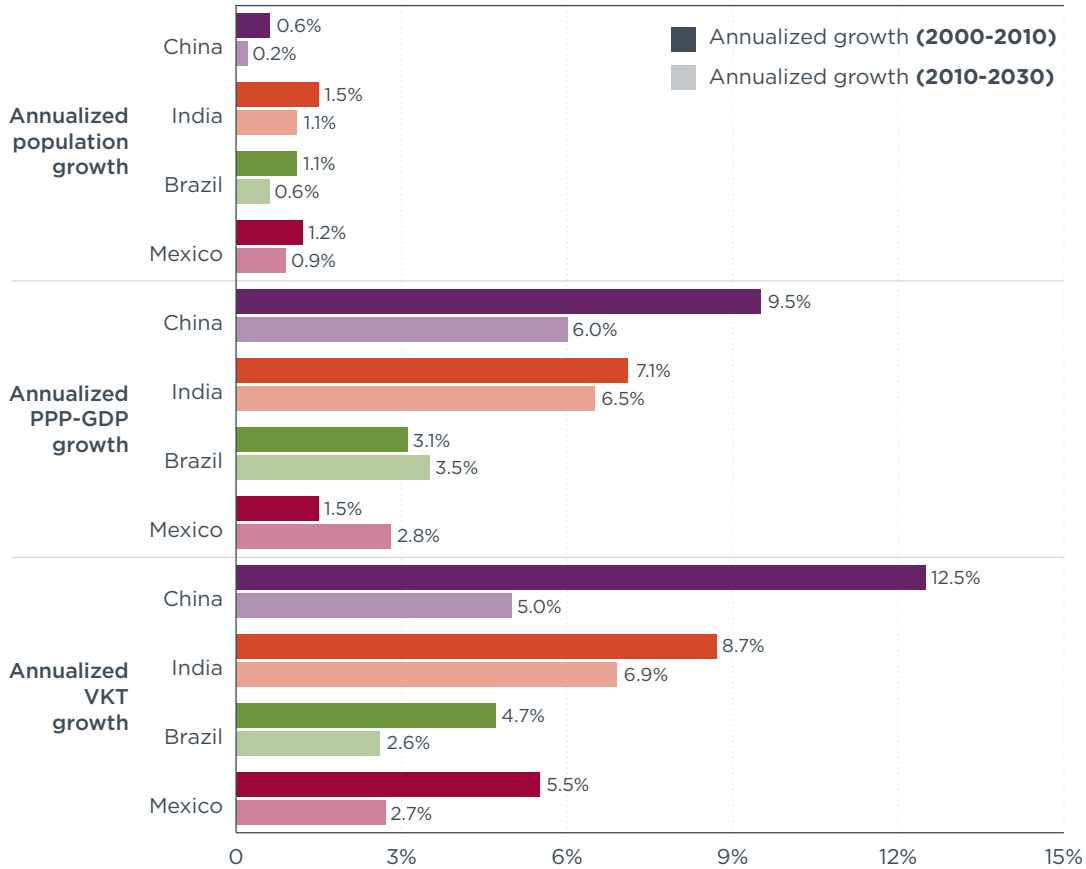


FIGURE 1. Annualized historical and projected growth in population, PPP-GDP, and VKT

TRENDS IN VEHICLE EMISSIONS

Diesel vehicles, primarily heavy-duty trucks and buses in most regions, are major sources of fine particulate pollution and therefore prime targets for policies aimed at reducing PM_{2.5} emissions. Uncontrolled diesel engines tend to emit high levels of tailpipe PM relative to petrol vehicles. Diesel emissions also tend to have smaller particles, and therefore to be more harmful to human health, than PM emissions from other sources.

In 2010, diesel commercial vehicles accounted for over 80% of emissions of PM_{2.5} from vehicles worldwide, and over 70% of PM_{2.5} emissions in India. While passenger vehicles in India contributed only a small share of transportation-related PM_{2.5} emissions in 2010, diesel passenger vehicles are the fastest-growing source of emissions within the transportation sector. Without tighter controls, diesel passenger vehicle emissions will increase about four times the rate of diesel commercial vehicles by 2030 (Figure 2). Accelerated adoption of vehicle emission controls could reverse

all trends in vehicle emissions, reducing tailpipe PM_{2.5} emissions by 86% in 2030 – equivalent to 70% below 2010 levels.

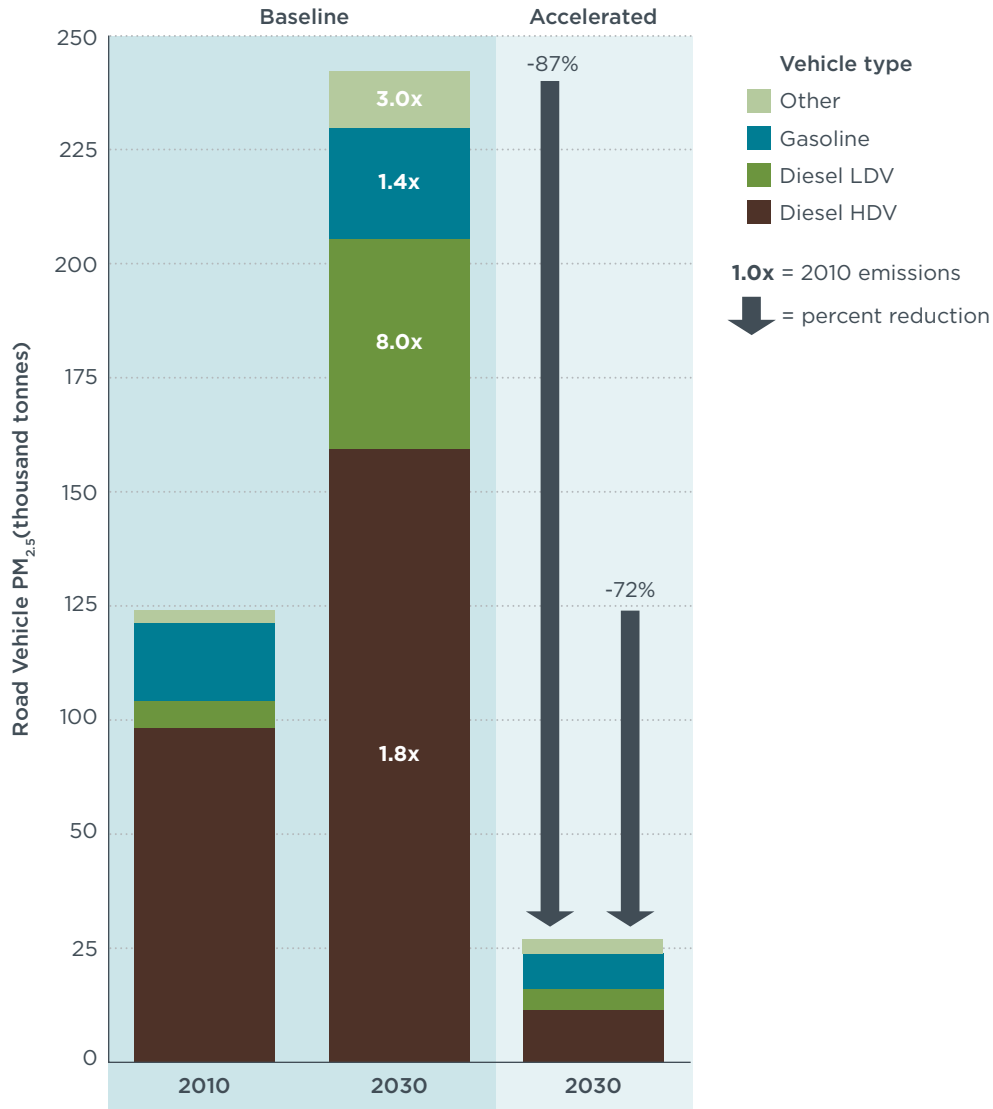


Figure 2. India's road vehicle PM_{2.5} in 2010 and in 2030 with baseline and accelerated policies

Emission control technologies required for the transition from Euro I to Euro III standards achieve significant cuts in PM_{2.5} emissions from diesel vehicles; these technologies have been deployed throughout the passenger- and commercial-vehicle fleet in India and perform effectively with 350-ppm sulfur diesel. Technologies required by Euro IV can reduce PM_{2.5} emissions of diesel commercial vehicles by over 75% from Euro III levels (see Figure 3). Euro IV controls yield optimal emission reductions using low-sulfur diesel (less than 50 ppm), though some designs have been demonstrated to be durable at sulfur levels of up to 350 ppm. Euro 5 and Euro VI standards for diesel passenger- and commercial vehicles, respectively, require diesel particulate filters (DPFs), which effectively eliminate tailpipe PM_{2.5} emissions. Importantly, vehicles equipped with DPFs require ultra-low sulfur diesel (less than 10 ppm) to yield optimal emission reductions.

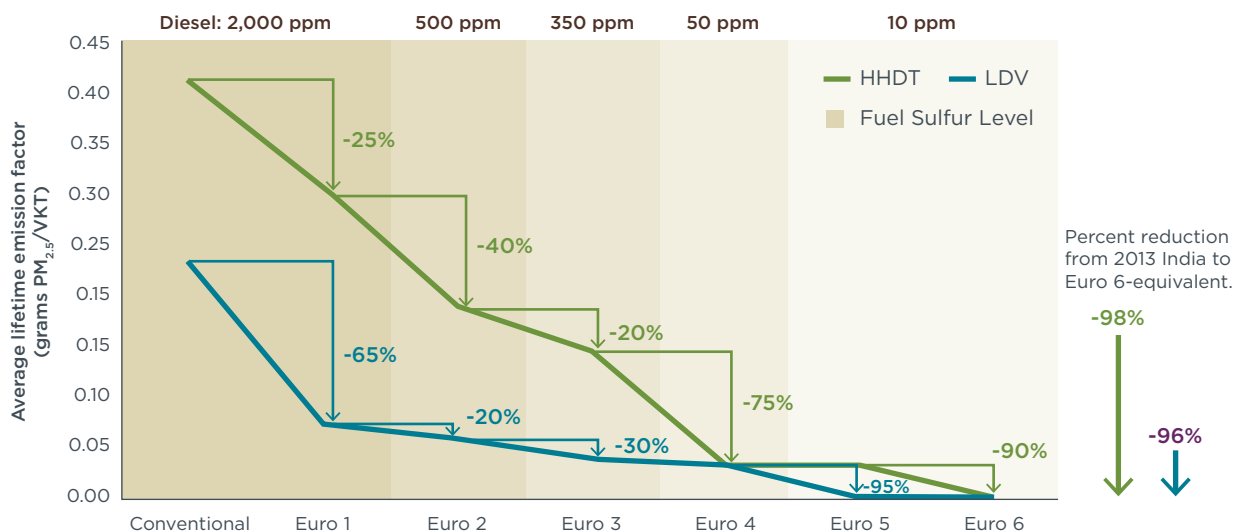


Figure 3. Representative fine particulate emission factors for diesel vehicles by emission standard and sulfur content. Emission factors of $PM_{2.5}$ (g/km) are shown for heavy trucks and light-duty diesel vehicles. Data labels indicate percent reduction in emissions from the previous standard, with the arrows on the right depicting total percent reduction from Euro III (India 2013 levels) to Euro VI.

TRENDS IN HEALTH IMPACTS

At a global scale, implementation of new limits on vehicle emissions and fuel sulfur content could avoid 210,000 early deaths in 2030, near the center of the range (120,000 to 280,000) estimated by other recent studies (Shindell et al, 2011).

As vehicles in countries with advanced standards have become much cleaner, the dominant share of global health impacts from road vehicles is shifting to other regions with more rapid vehicle fleet growth and higher-emitting vehicles. Under present trends, nearly half of the global increase in early deaths in 2030 will occur in India, as that nation overtakes China as the single country with the most years of life lost from road $PM_{2.5}$ exposure. An accelerated timeline for cleaner vehicles and fuels could avoid 49,000 early deaths and save 900,000 years of life in India in 2030 alone (see Figure 4).

Many countries in Latin America at similar levels of socio-economic development to India's have a more favorable baseline as a result of recent policy progress. There are relatively few light-duty diesel vehicles, and new heavy-duty trucks in Brazil are required to meet Euro V standards ([TransportPolicy.net](https://www.transportpolicy.net)). Ultra-low-sulfur fuel is available in some parts of Brazil and Mexico, though Mexico has not yet adopted a timeline for nationwide availability ([TransportPolicy.net](https://www.transportpolicy.net)). In Mexico, pathways to nationwide ultra-low sulfur fuel and harmonization with the US EPA 2010 standards for heavy-duty vehicles are key components of the accelerated policies scenario. Chile has made 50 ppm sulfur diesel and 15 ppm gasoline (petrol) available since 2012 ([TransportPolicy.net](https://www.transportpolicy.net)), and requires that urban buses in Santiago Metropolitan Region be equipped with factory-installed diesel particulate filters (SDC & MMA).

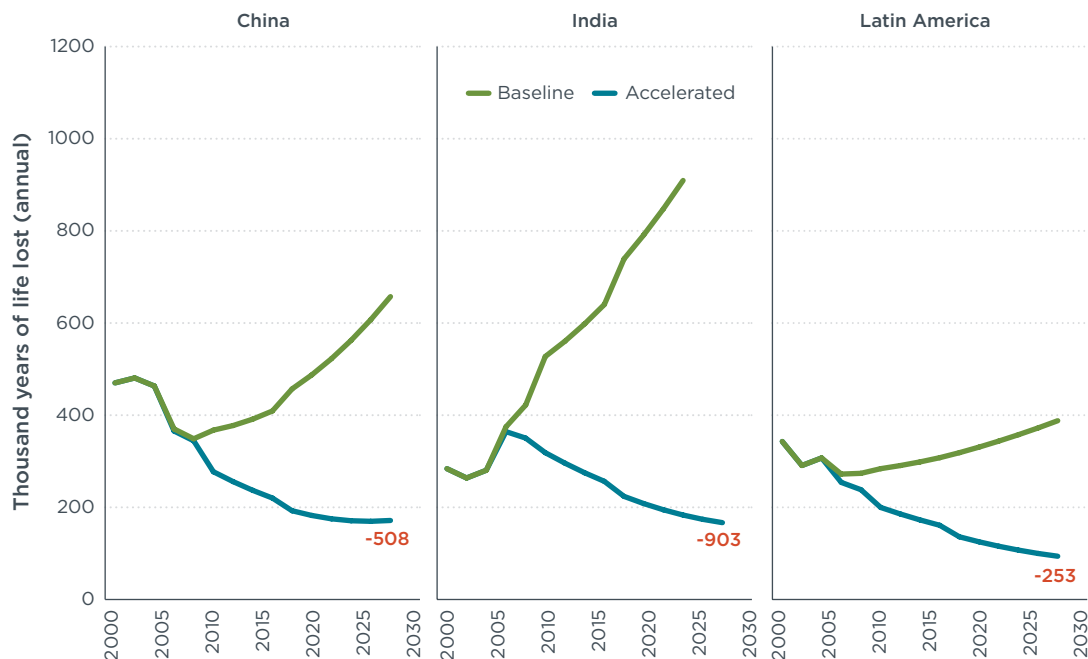


Figure 4. Annual years of life lost from premature mortality due to road PM_{2.5} exposure, and annual years of life gained in 2030 with accelerated policies

POLICY IMPLICATIONS

The Impact of Stringent Fuel and Vehicle Standards on Premature Mortality and Emissions highlights the benefits of dramatically reducing health impacts from vehicle emissions in India. Since 350-ppm sulfur diesel is already widely available, there is no need to wait for improvements in fuel quality to implement Bharat IV nationwide. China faced a similar situation in July 2013, choosing to go ahead with China IV implementation even though the nationwide diesel fuel sulfur limit was still 350 ppm (MEP 2011; ICCT 2013). China has already taken the next step ahead of India and established a national roadmap to low-sulfur fuel (less than 50 ppm) by the end of 2014 and ultra-low sulfur fuel (less than 10 ppm) by the end of 2017 (ICCT 2013), which will match the strategies currently in place in the United States and Europe. If India can set itself on an accelerated pathway to ultra-low sulfur fuel, it will unlock the 90%–95% emission reductions achievable with Euro 5 standards for the growing fleet of passenger diesel vehicles, and Euro VI standards for commercial diesel trucks and buses.

Expanding the availability of low- and ultra-low sulfur diesel will yield immediate fleetwide benefits because emission controls on diesel vehicles function better with higher-quality fuel. Moreover, upgrading refineries to produce ultra-low sulfur fuel will have far-reaching benefits at a very low cost to consumers. Compared with China, Brazil and Mexico, India has among the lowest projected per-liter costs of producing 10 ppm sulfur diesel fuel (0.8–1.1 cents per liter). (ULSF study) By taking advantage of these low costs, India can rapidly move to the cleanest vehicles and fuels to protect the public health of future generations.²

² Specific policy recommendations for India are described in more detail in the forthcoming ICCT study *India's Vehicle Emissions Control Program*.