

Vehicle Emission Control Targets, Roadmaps and Near Term Impacts

November 16, 2013

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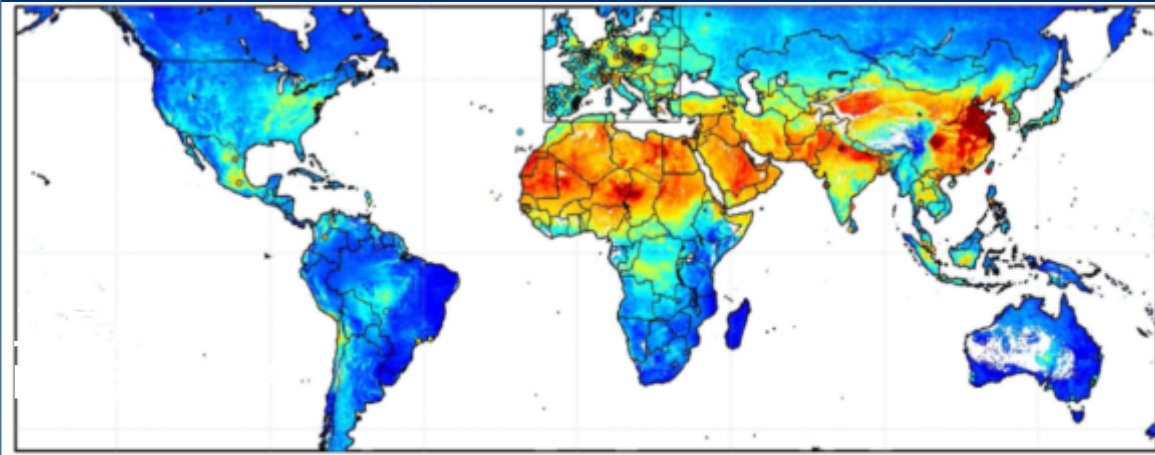
Founding Chairman
Board of Directors,
International Council on Clean
Transportation



Key Points

- Health Concerns Major Driver of Vehicle Emissions Regulations
- PM_{2.5} Remains The Most Serious Air Pollution Problem; Ozone Also Serious Concern
- After Great Progress from 2000 to 2010, Progress Stalled Due To Poor Fuel Quality
- Clean Fuels Roadmap Now in Place Removing Major Barrier to Progress
- Multiple Vehicle Emissions Roadmaps Available But Significantly Different Impacts

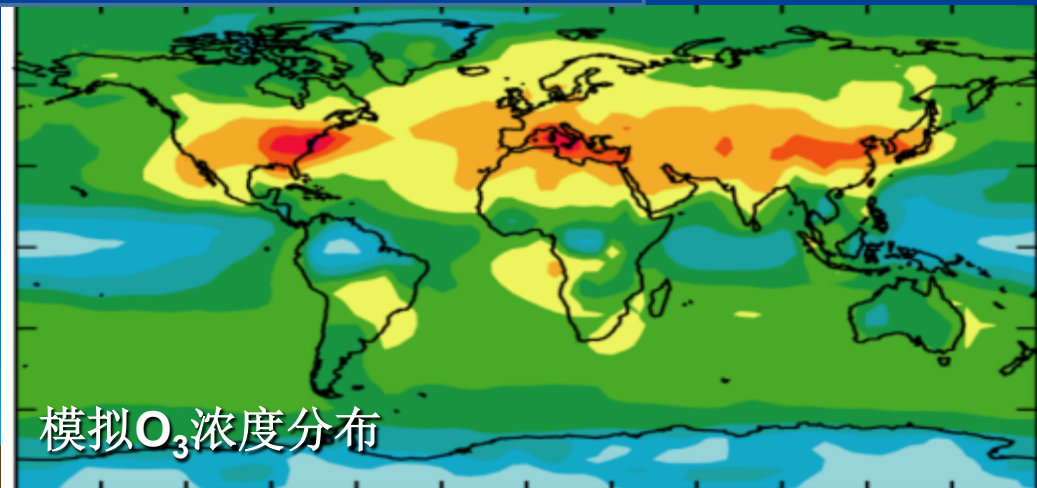
Air Pollution Is Already Reaching Crisis Levels Especially $PM_{2.5}$ And O_3



$PM_{2.5}$

Van Donkelaar et al. (2010)

O_3

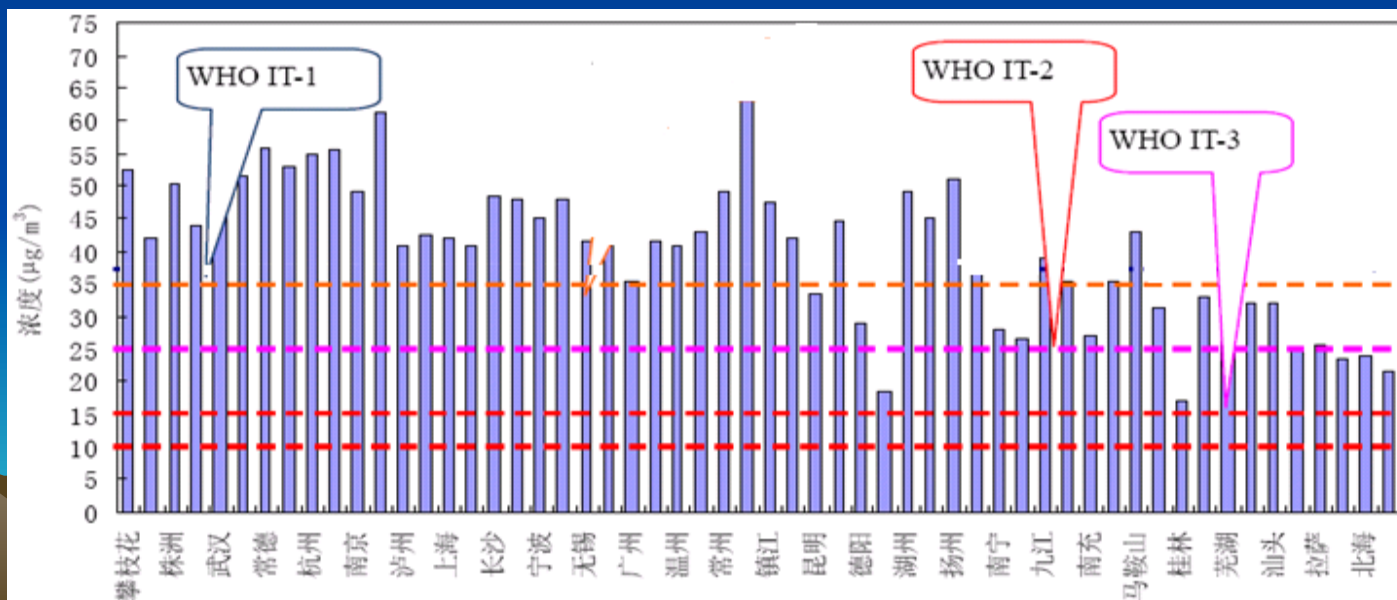
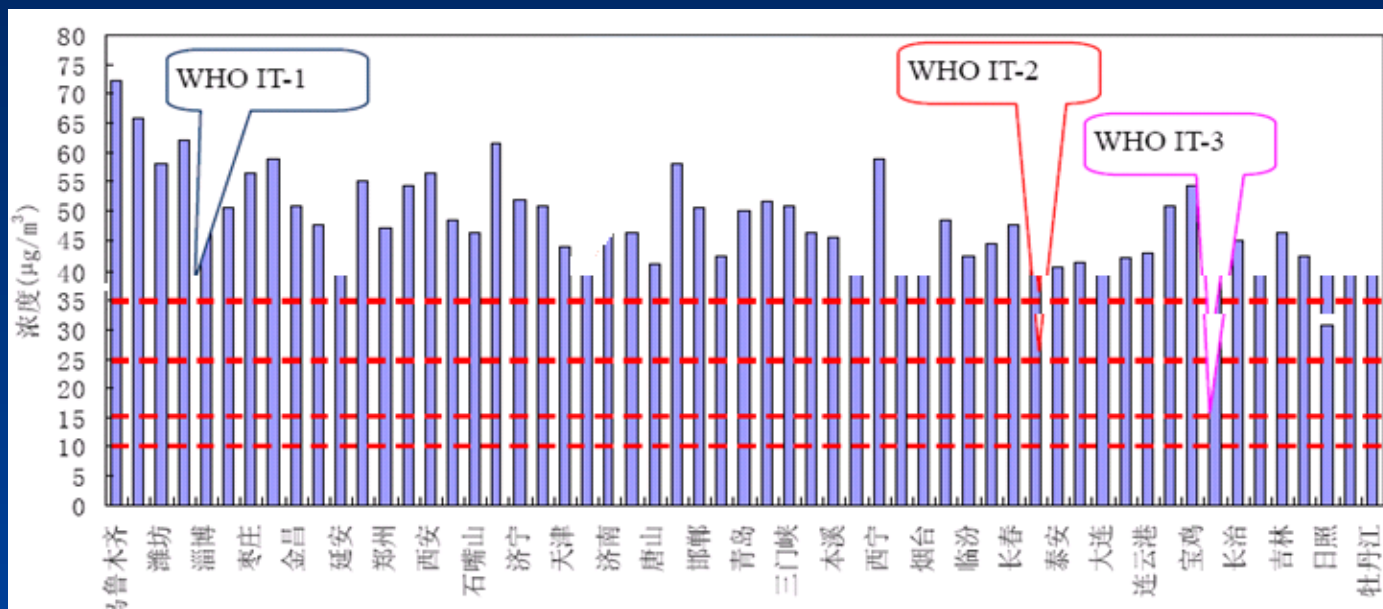


模拟 O_3 浓度分布

Lelieveld, J., and F. J. Dentener (2000)



Concentrations of PM_{2.5} in Chinese cities



Top 20 Mortality Risk Factors in China for 2010

Ambient PM_{2.5} is 4th leading factor

THE LANCET

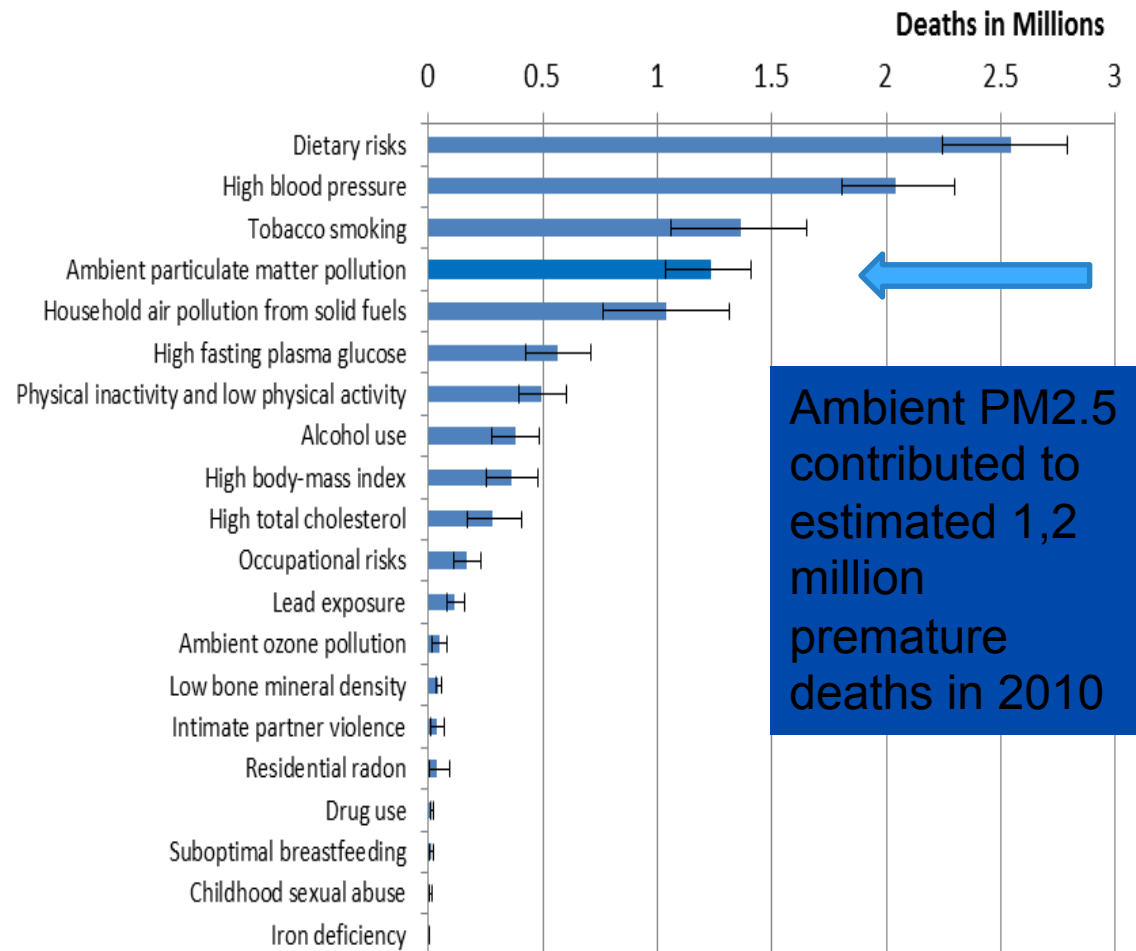
Volume 381 Number 9828 Pages 2163-2166 December 11, 2012 January 6, 2013 www.thelancet.com

The Global Burden of Disease Study 2010



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Leading Risk Factors for Deaths in China in 2010



Ambient PM_{2.5} contributed to estimated 1,2 million premature deaths in 2010

Vehicle Pollution is an Increasingly Important Challenge

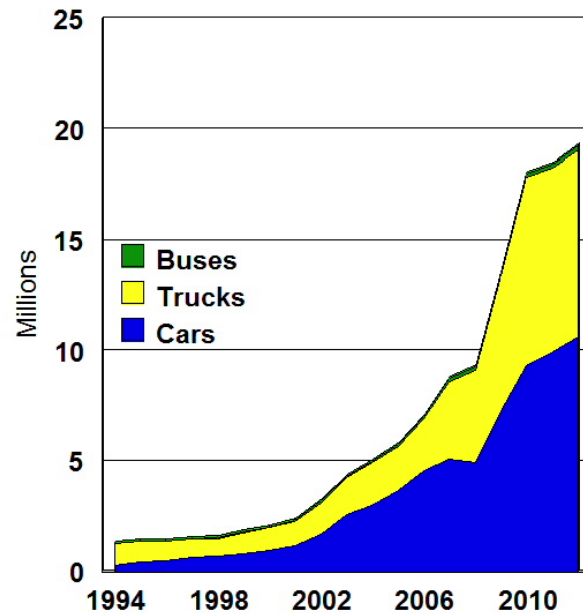


China's Vehicle Population Has Literally Exploded

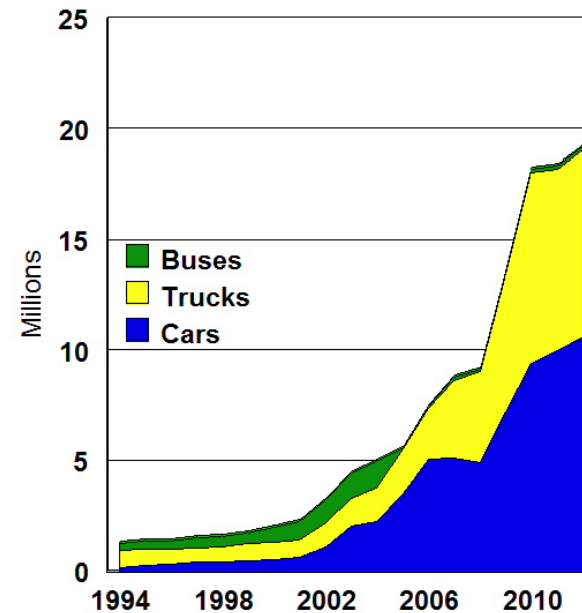
China's Vehicle Market is #1 in the World

China's Vehicle Industry is Number One in the World

China New Vehicle Sales



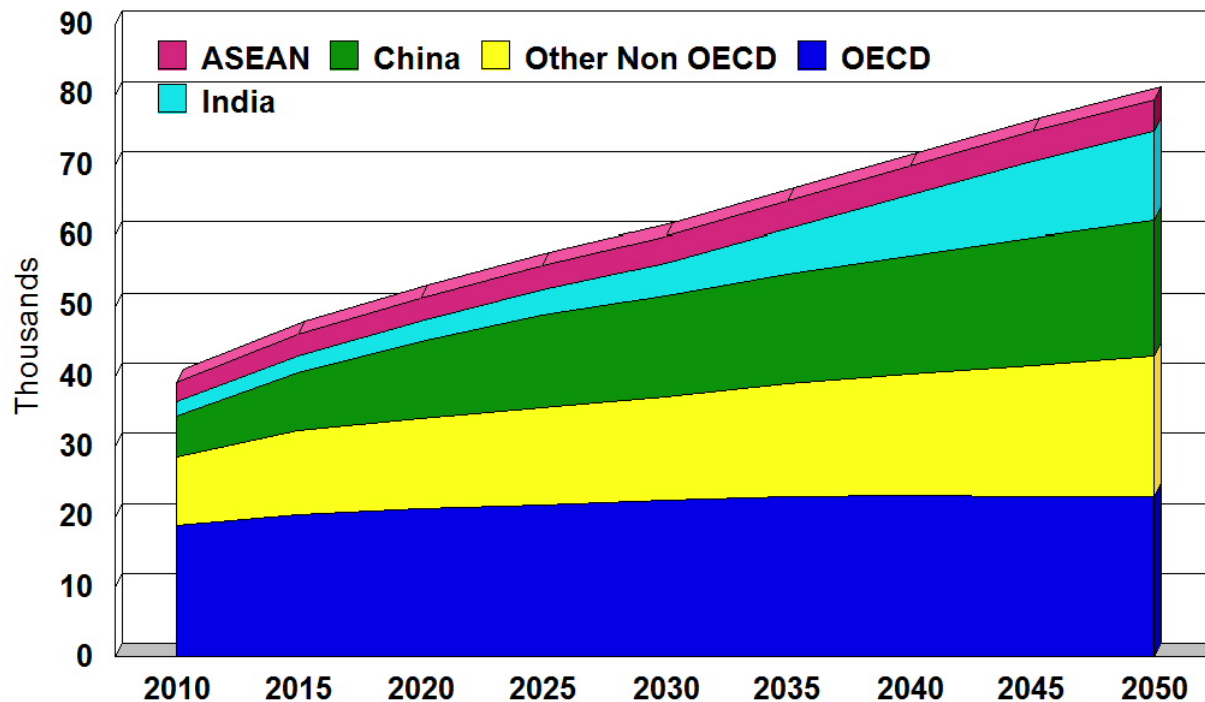
China New Vehicle Production



And All Indications Are That High Growth Will Continue

Passenger Traffic Activity by Region

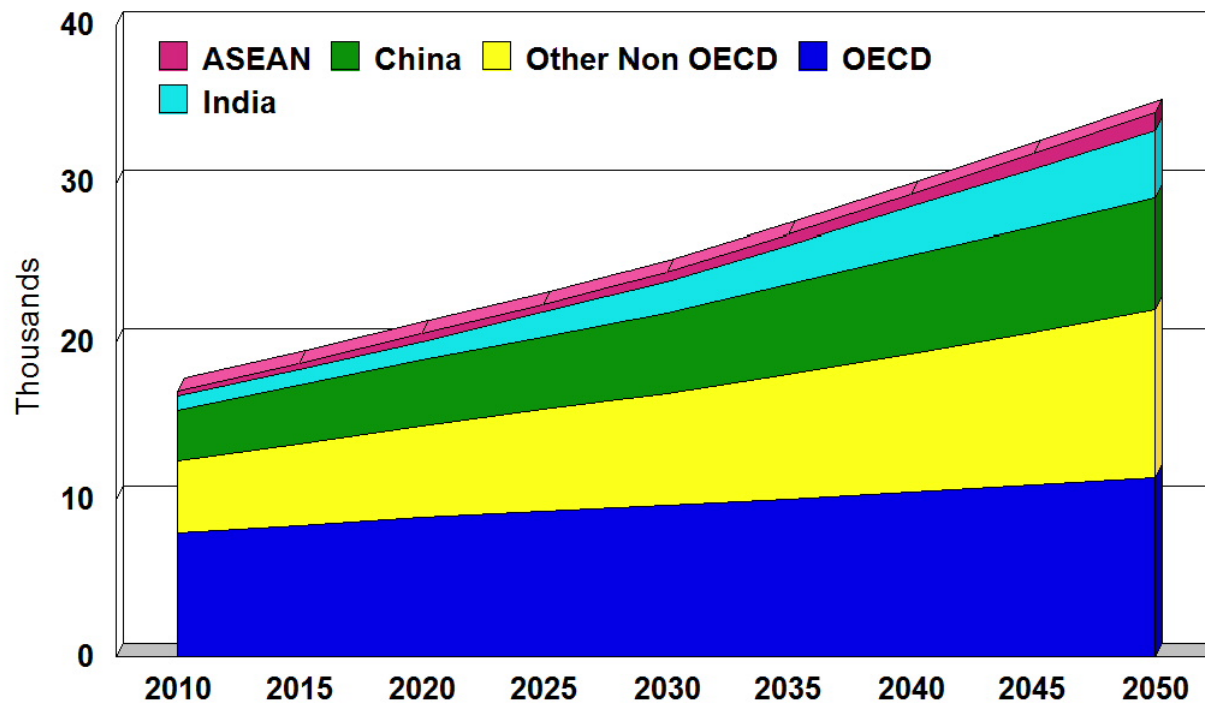
(billion passenger kilometers)



And All Indications Are That High Growth Will Continue

Freight Traffic Activity by Region

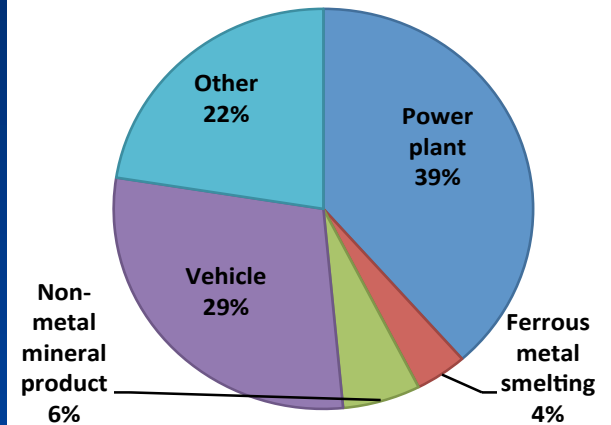
(billion ton kilometers)



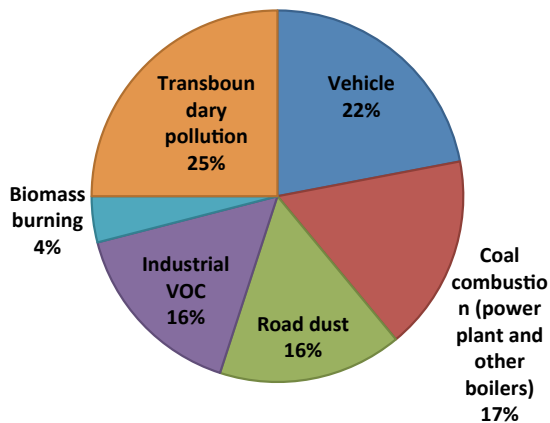
Vehicles are key to Solving the PM_{2.5} Problem

- Vehicles contribute 22-34% of PM_{2.5} in megacities and 30% of NO_x nationwide, but:
 - The percentage is growing
 - Roadside exposure much higher in dense urban areas

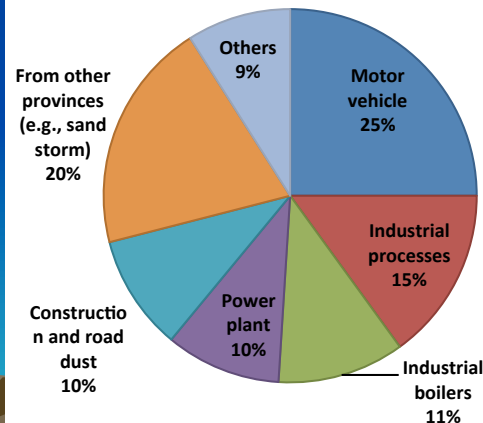
National - NO_x emission sources



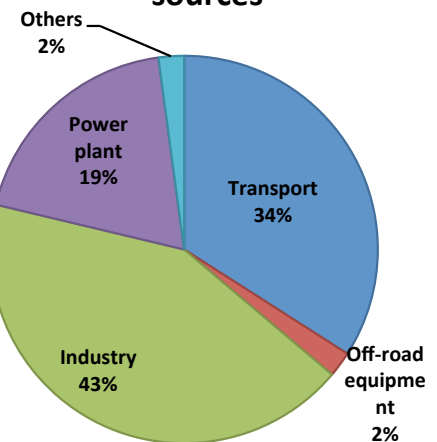
Beijing PM_{2.5} sources



Shanghai PM_{2.5} sources



Pearl River Delta PM_{2.5} sources



Widespread Exposure to Vehicle Emissions in Urban Areas



Recent Study Shows that $5 \mu\text{g}/\text{m}^3$ linked to Low Infant Birth Weight And likely Childhood Respiratory Illness

Lancet 15 Oct 2013

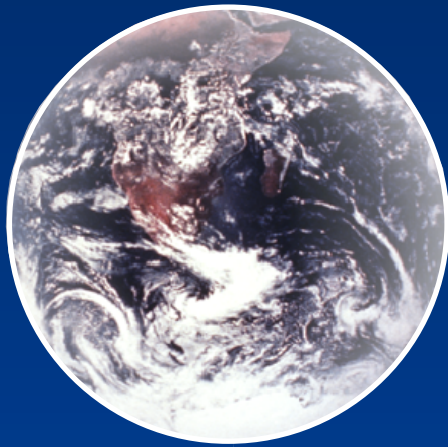
Transport Pollution is Ubiquitous

Transport Problems Not Limited To Road Vehicles



Automobiles and the Environment

Global Environment



Urban Environment

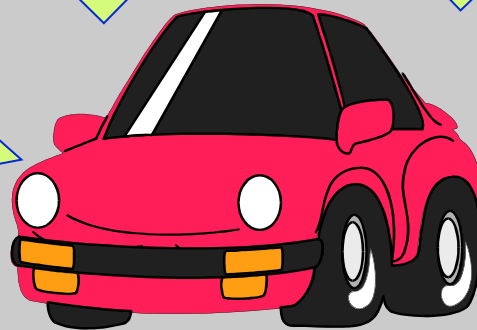


Emissions

CO₂, BC, O₃
VOC, NO_x, PM

Alternative Fuels

Energy
Security



Recycle

Economy

Safety

Convenience

Key Milestones In Mobile Source Emission Control In China

- 1983: First motor vehicle exhaust emissions standards adopted
- 1987: Enactment of the China Clean Air Law (CCA)
 - Provided legislative basis for mobile source emissions control but authority to regulate vehicular emissions is dispersed
- 1995: Revision of the CAA
 - State Council given the authority to regulate mobile source emissions
- 1999: Beijing and Shanghai implemented emission standards comparable to Euro 1/
Unleaded gasoline supply to Beijing
- 2000: Revision of the CCA
 - Clear MEP authority to set emission standards; city/regional standards must be more stringent and be approved by MEP
 - Emission limits set based on ambient air quality as well as economic and technological considerations
 - Required in-use vehicles to meet emissions standards
- 2000: Leaded gasoline phase out nationwide
LDV and HDV China1/I standards went into effect
- 2003: Motorcycles/moped Euro 1 standard went into effect
- 2004: LDV and HDV China 2/II standards went into effect
- 2005: Roadmap for LDV Euro 3 & 4 standards and HDV China III, VI, V standards announced;
Rural vehicles and in-use testing emissions limits and testing methods announced.
- 2007: China 3/III standards went into effect for all LDVs and diesel HDVs
Nonroad China I and II standards and MC China III standards announced
- 2010: China 4/IV Planned **But**

China Is Responding To Current Crisis

- May, 2010: Joint Pollution Prevention and Control Plan
 - Key regions and cities must develop regional air quality management plans
- November, 2010: 12th Five-Year Plan
 - 10% NO_x emission reduction target
- February, 2012: New national focus on reducing PM_{2.5}
 - February 22, 2012: Air quality discussion at the Executive Meeting of the State Council (Prime Minister and all the Ministers)
 - February 29, 2012: MEP issued new air quality standard that includes PM_{2.5}



温家宝：PM_{2.5}监测2015年覆盖所有地级以上城市

中国网 china.com.cn 时间：2012-03-05 发表评论>>

中国网3月5日讯 今天上午9时，十一届全国人大五次会议在人民大会堂开幕，听取国务院总理温家宝作政府工作报告，审查年度计划报告和预算报告。

温家宝说，今年在京津冀、长三角、珠三角等重点区域以及直辖市和省会城市开展细颗粒物（PM_{2.5}）等项目监测，2015年覆盖所有地级以上城市。同时，促进生态保护和修复，巩固天然林保护、退态建设，大力开展植树造林，推进荒漠化、湿地、湖泊等重要生态功能区。加强适应气候设，提高防灾减灾能力。坚持共同但有区别气候变化国际谈判进程。我们要用行动昭告：康来换取经济增长，我们一定能走出一条生道路。

附件：

ZS 13.040.20
Z.20



中华人民共和国国家标准

GB 3095—2012

代替 GB 3095—1996 GB 3095—88

环境空气质量标准

Ambient air quality standards

本电子版为发布稿，请以中国环境科学出版社出版的正式标准文本为准。

2012-02-29发布

2016-01-01实施

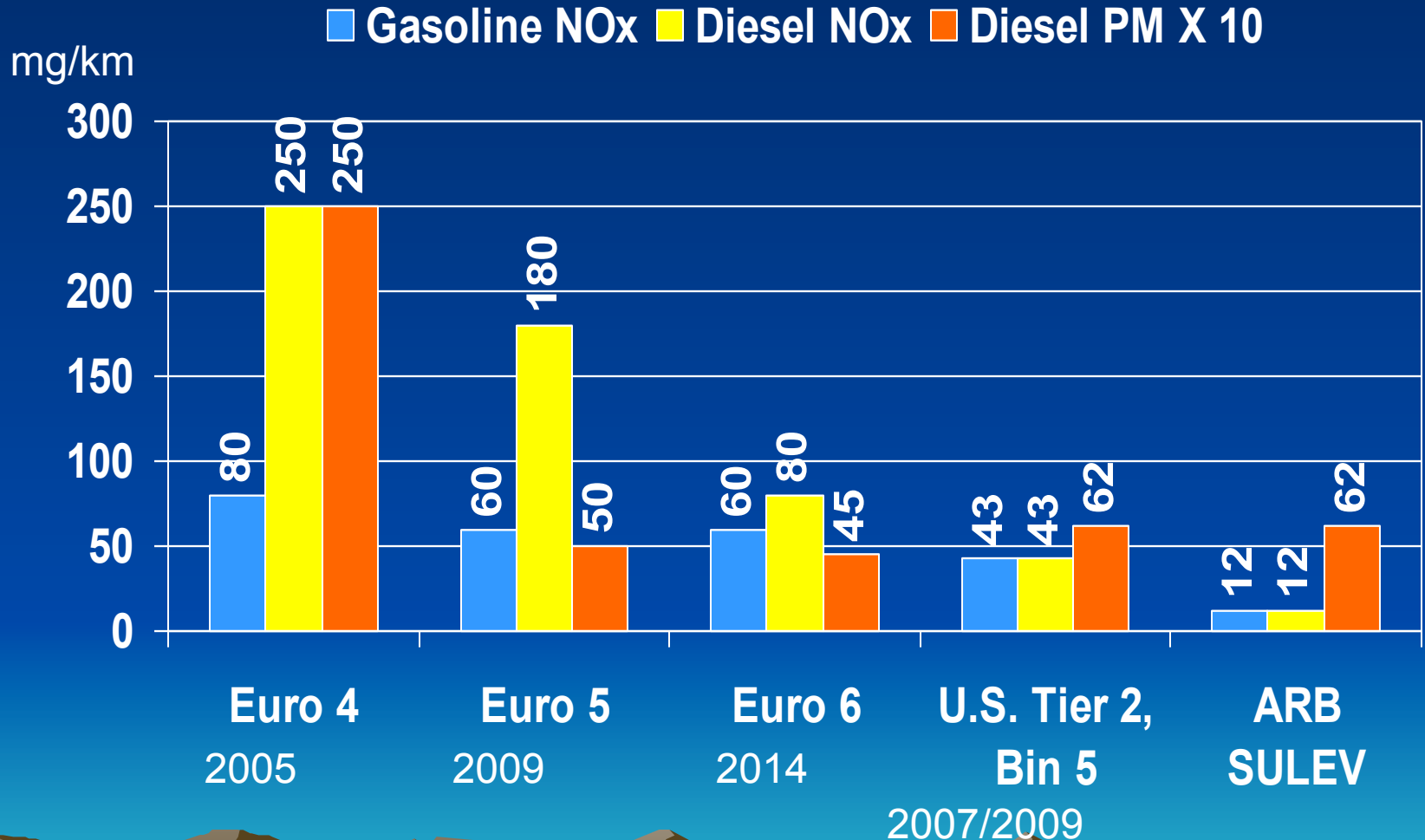
环境保护部 发布
国家质量监督检验检疫总局

China is Responding To Current Crisis (2)

- Main Regions Given Very Ambitious PM2.5 Targets by 2017
- Massive Scrappage Announced For Yellow Label Vehicles
- Clean Fuels Roadmap Now Defined
 - 50 PPM (2014), 10 PPM (end 2017), 2 years earlier in key regions
- Beijing Already At Beijing 5; announced China 6 intent by 2016
- But MEP delaying China 5 for Gasoline Cars Until 2018; Other Vehicles???

Technology Now Exists To Clean Vehicles

U.S. and Europe Light-Duty Vehicle Emission Standards



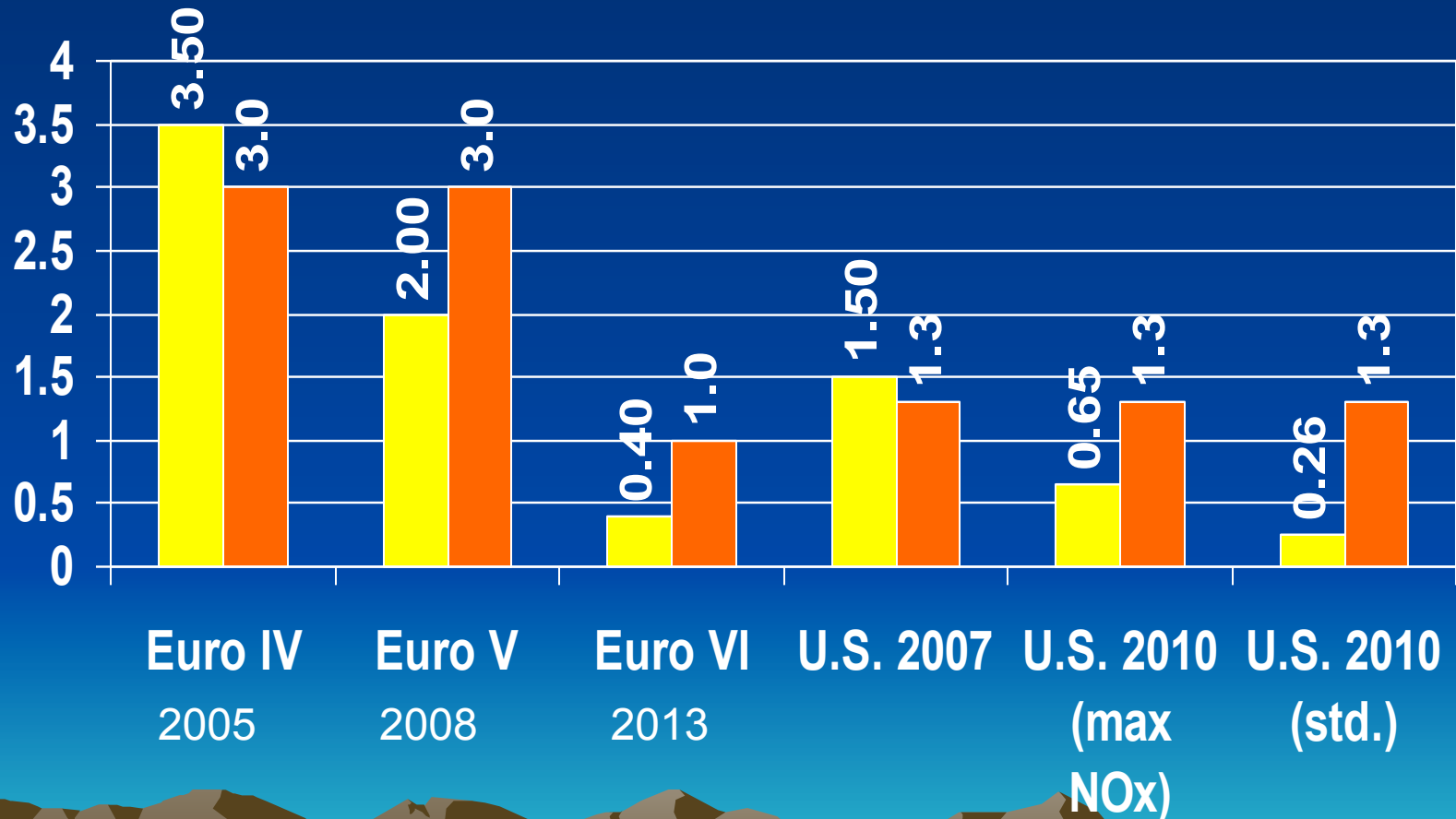
Euro 5+ (2011) and 6 include $6 \times 10^{11}/\text{km}$ particle number limit
 Euro 6 PM mass limit uses revised PMP mass protocol

Technology Now Exists To Clean Vehicles

U.S. and Europe Heavy-Duty Engine Transient Cycle Emission Standards

g/kWh

■ Diesel NOx ■ Diesel PM X 100

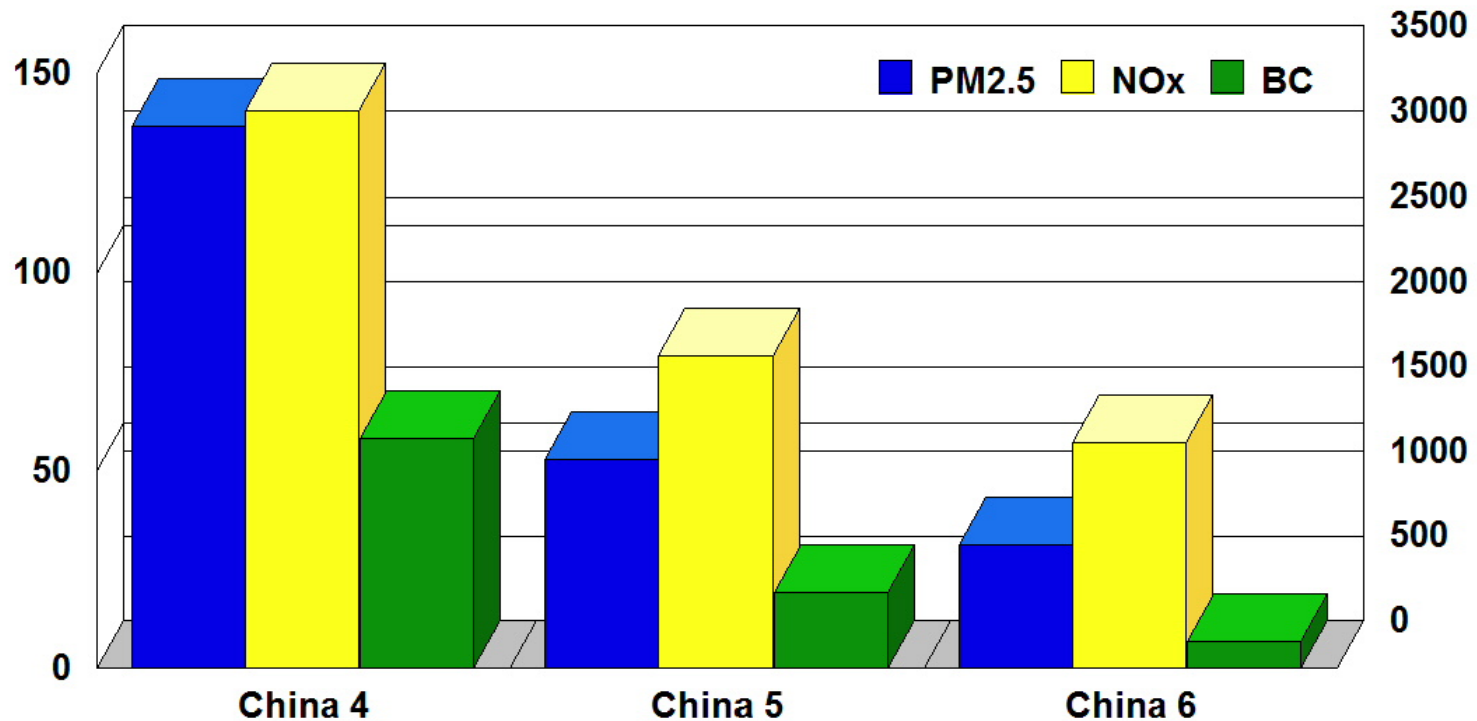


Euro VI includes particle number limit

Lifetime Emissions From One Model Year of Vehicles Under Different Emissions Standards

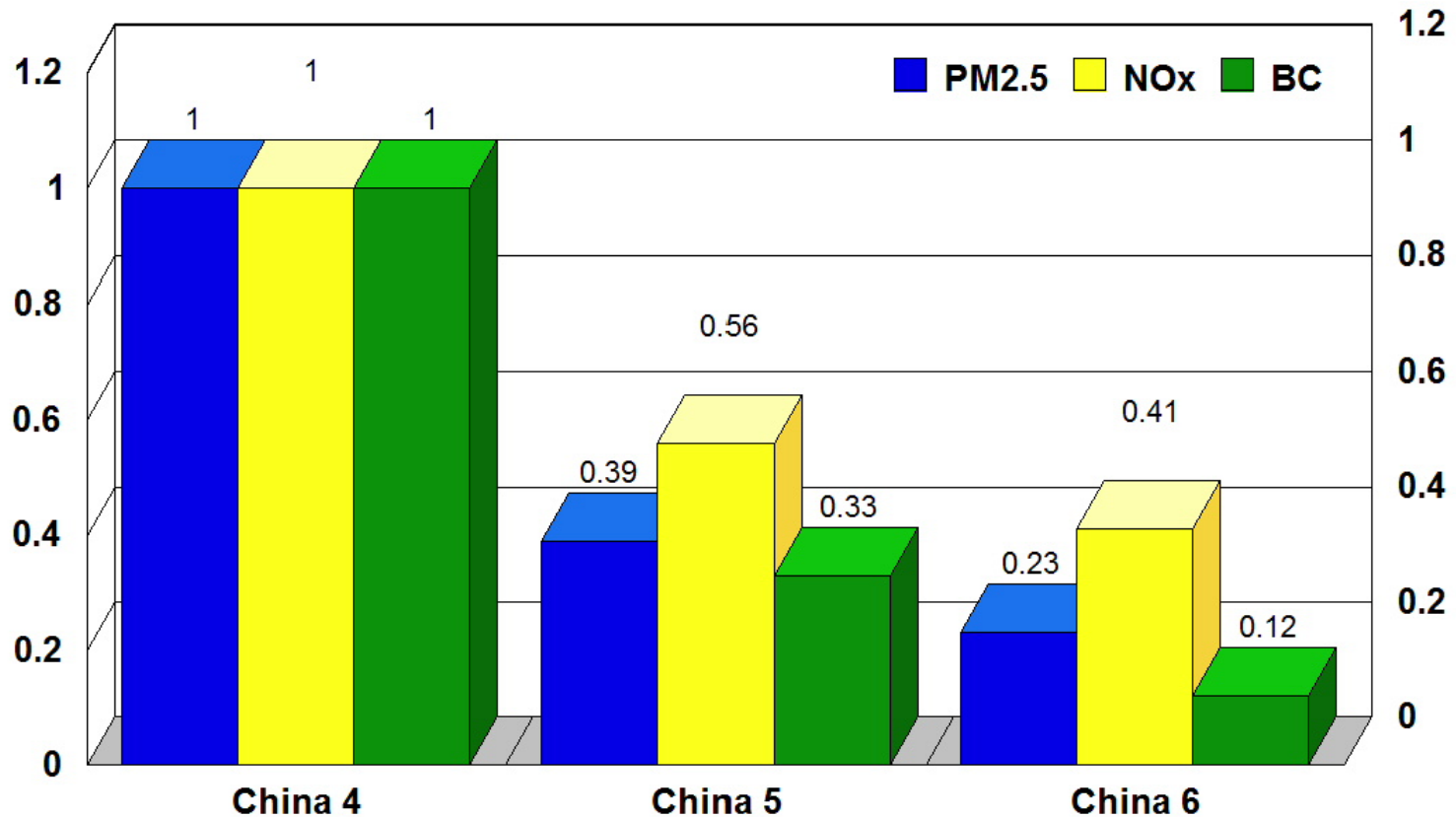
PM2.5, BC Emissions
Thousand Tonnes

NOx
Thousand Tonnes



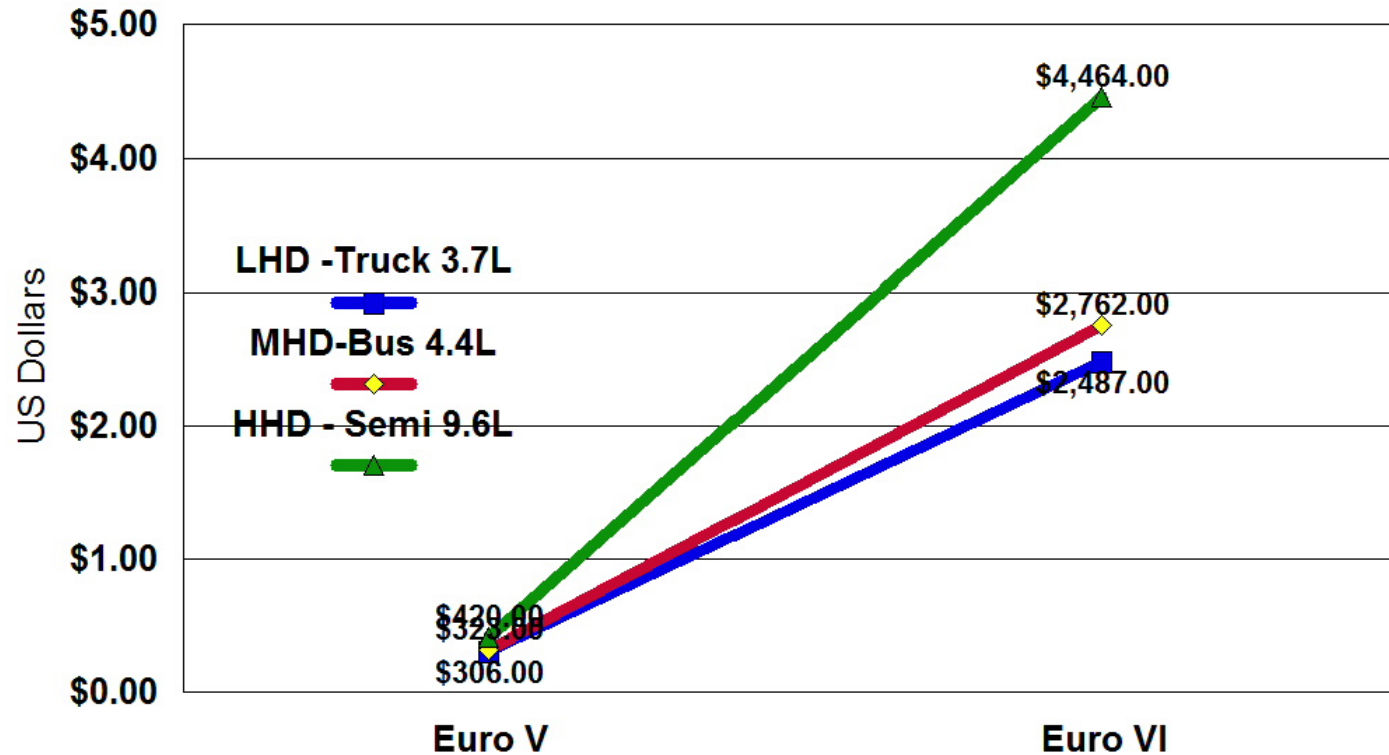
Includes Cars, Trucks and Buses

Lifetime Emissions From One Model Year of Vehicles Under Different Emissions Standards (Normalized)



Includes Cars, Trucks and Buses

Incremental Costs of Heavy Duty Truck Controls Beyond China 4

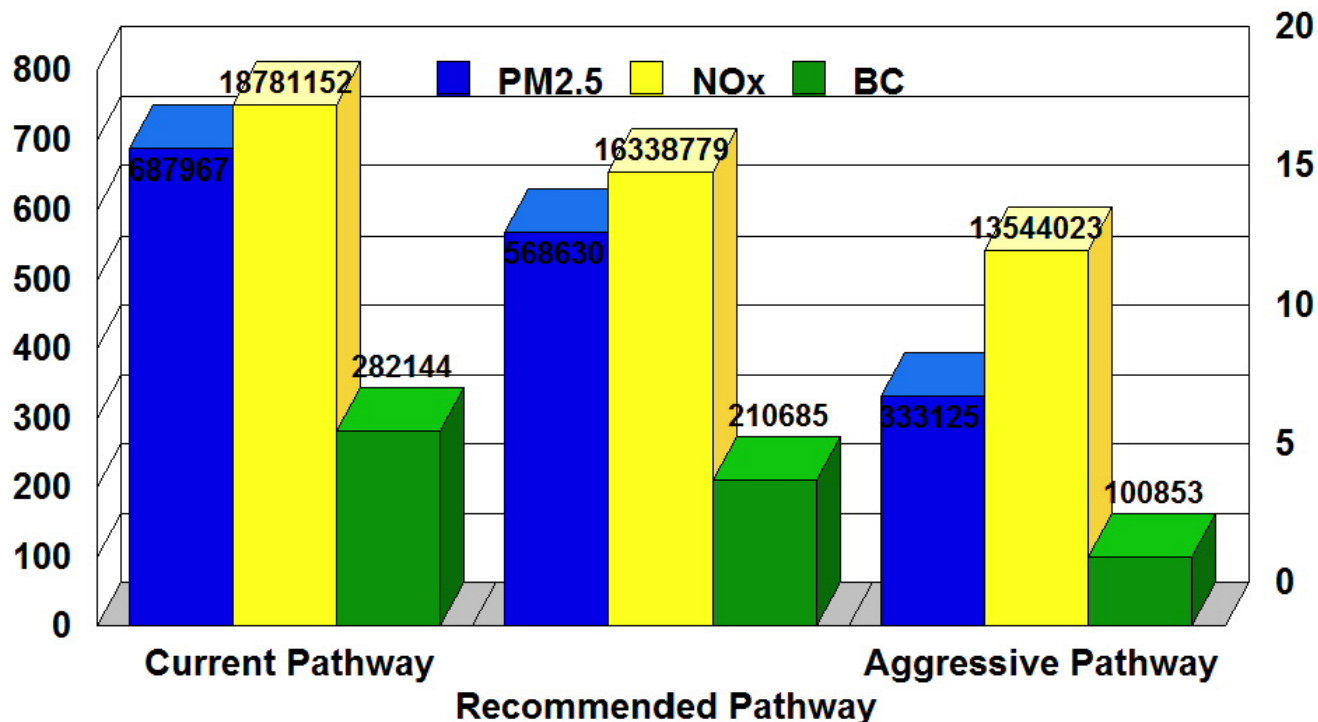


Source: ICCT

Cumulative Emissions Over Six Model Years (2015 to 2021) Under Three Scenarios

PM, BC Emissions
Thousand Tonnes

NOx Emissions
Million Tonnes



Includes Cars, Trucks and Buses

Won't Regional Focus Solve This Problem?

- It Should Help With Cars, but Cars Not Main Problem
- Most Trucks and Buses Register Nationally, Fuel Outside Cities
- Cleanest Vehicle Models Potentially Limited
- Potential Enforcement Nightmare

Thank You

