



# U.S. Cleaner Fuel and Vehicle Strategies And Programs

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# Overview of Presentation

- US Clean Fuel and Vehicles Programs
  - Regulatory Programs
  - Voluntary Programs
  - Diesel Retrofit Programs
- International Diesel Retrofit Programs

# The “Systems Approach”

- Treat vehicles and fuels as one system
- Regulate fuel sulfur and vehicle emissions at same time.
- Sulfur reduction necessary for the most advanced emission controls
  - Diesel Particulate Filters and Lean NOx traps
  - Advanced catalysts for spark ignition engines
- Sulfur reduction yields immediate benefit from entire fleet
- US -- Gasoline Now: 30 ppm avg; 80 ppm max
- US -- On-Road Diesel Now: 15 ppm max

# Reconciling Vehicles with the Environment:

## **EPA's Big 4 Rules ~ 90% Reductions**

### **Tier 2 Light-Duty**

final rule 1999

**fully phased in 2009**

Effects mainly gasoline vehicles;

Diesels held to same standards

Gasoline sulfur now 30 ppm



### **Heavy-Duty Highway**

final rule 2000

**Sulfur now 15 ppm**

**fully phased in 2007-2010**



### **Locomotive / Marine**

**sales 40,000/yr**

(1,000 locomotives)

**6B gallons / yr**

**proposal 2007**

**fully phased in 2017**



### **Nonroad Diesel /Tier 4**

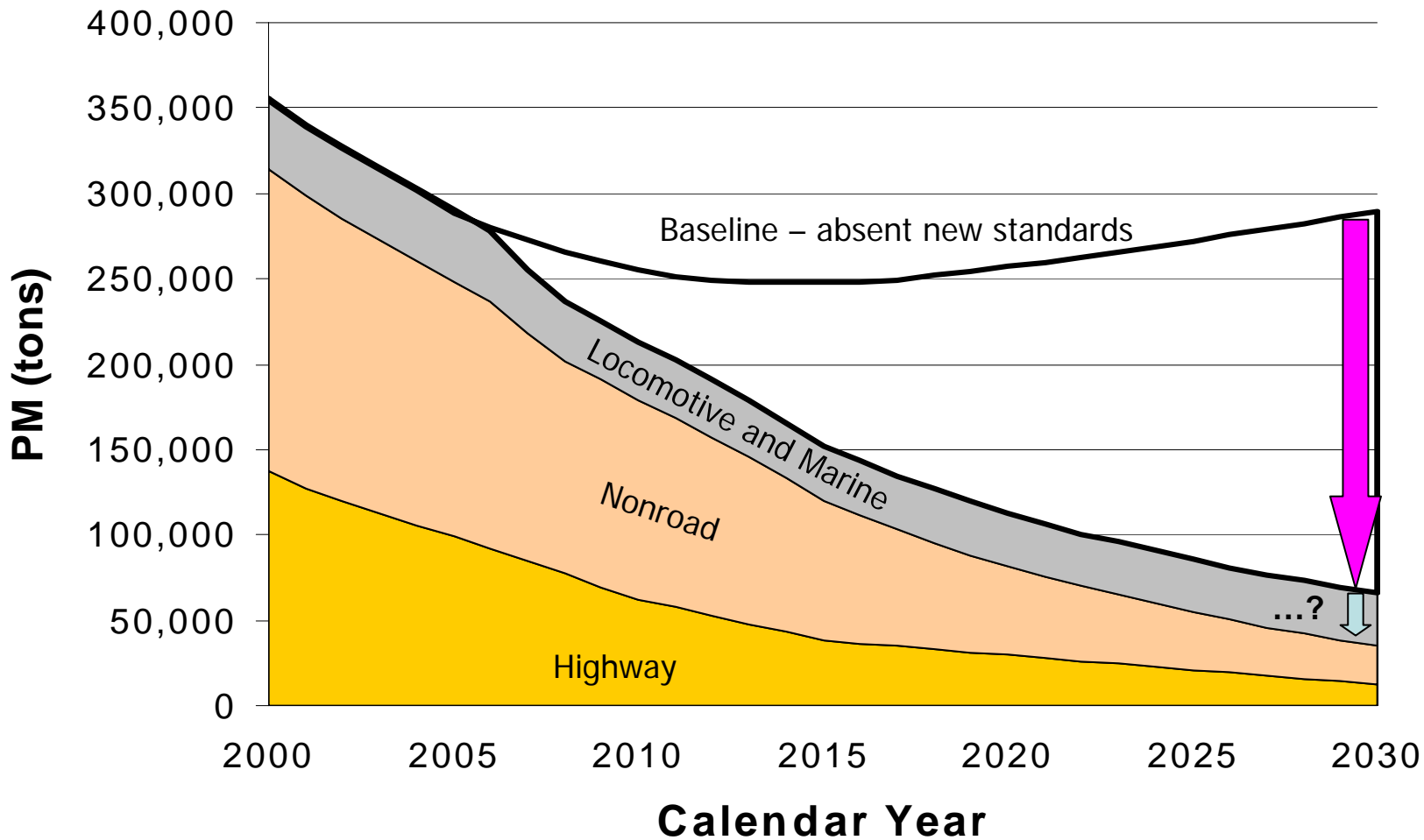
final rule 2004

**fully phased in 2015**

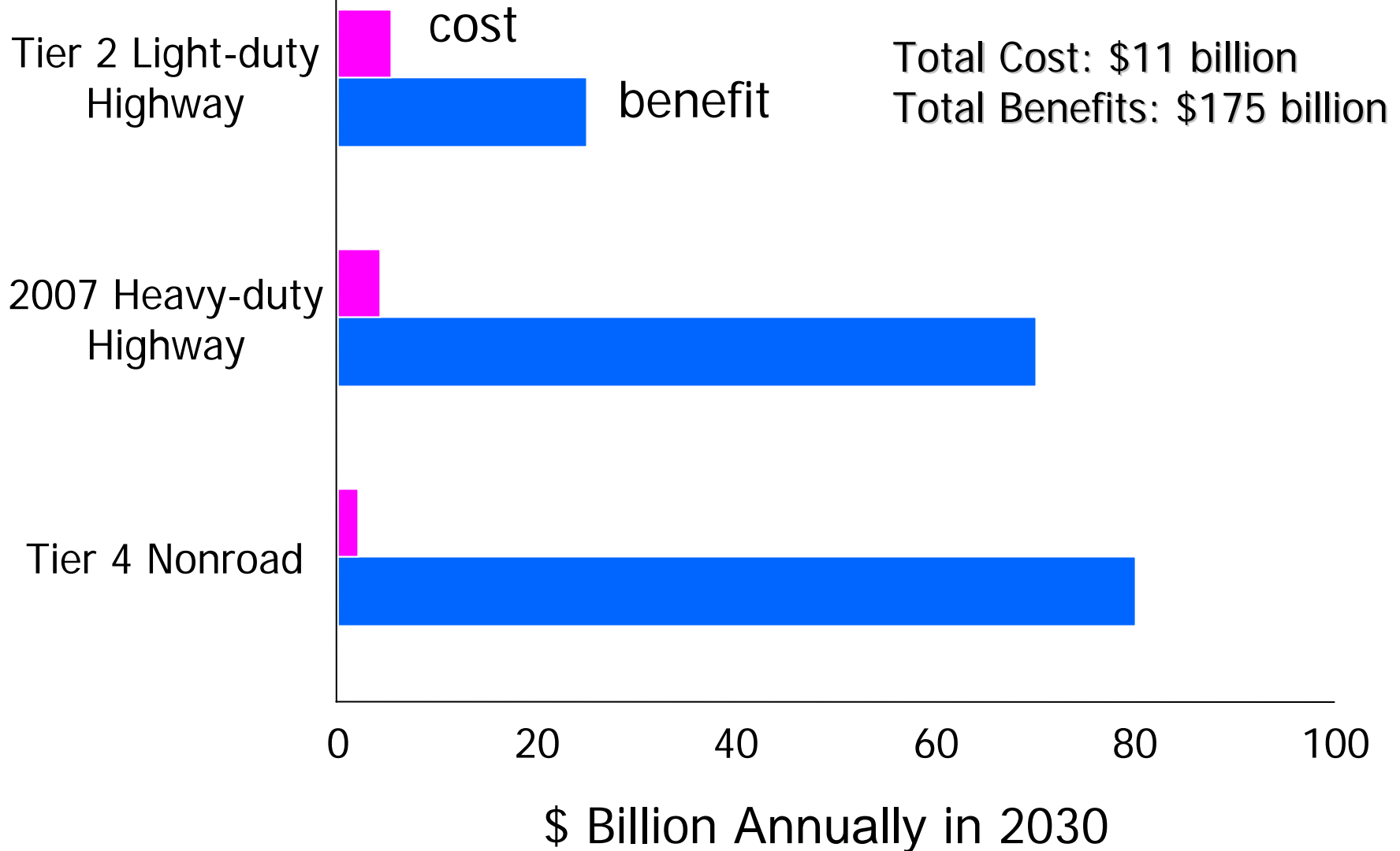
# Removing Sulfur is Key to Reducing Transportation Emissions

- Sulfur is a catalyst poison
- Removing sulfur, much like removing lead from gasoline, allows for maximum catalyst efficiency & enables retrofits
- Reductions in fuel sulfur provide immediate PM reductions
- U.S. Passenger Car Standards (Tier 2) requires Low Sulfur Gasoline
  - New Tier 2 vehicles have near zero running emissions
  - Existing vehicles see significant improvement from the new fuel
- Ultra-Low Sulfur Diesel Fuel (Highway and Nonroad)
  - Enables PM filters that can eliminate 99% of carbonaceous PM
  - Enables advanced NOx catalysts giving 90+% reductions
  - Immediate benefits from in-use fleet

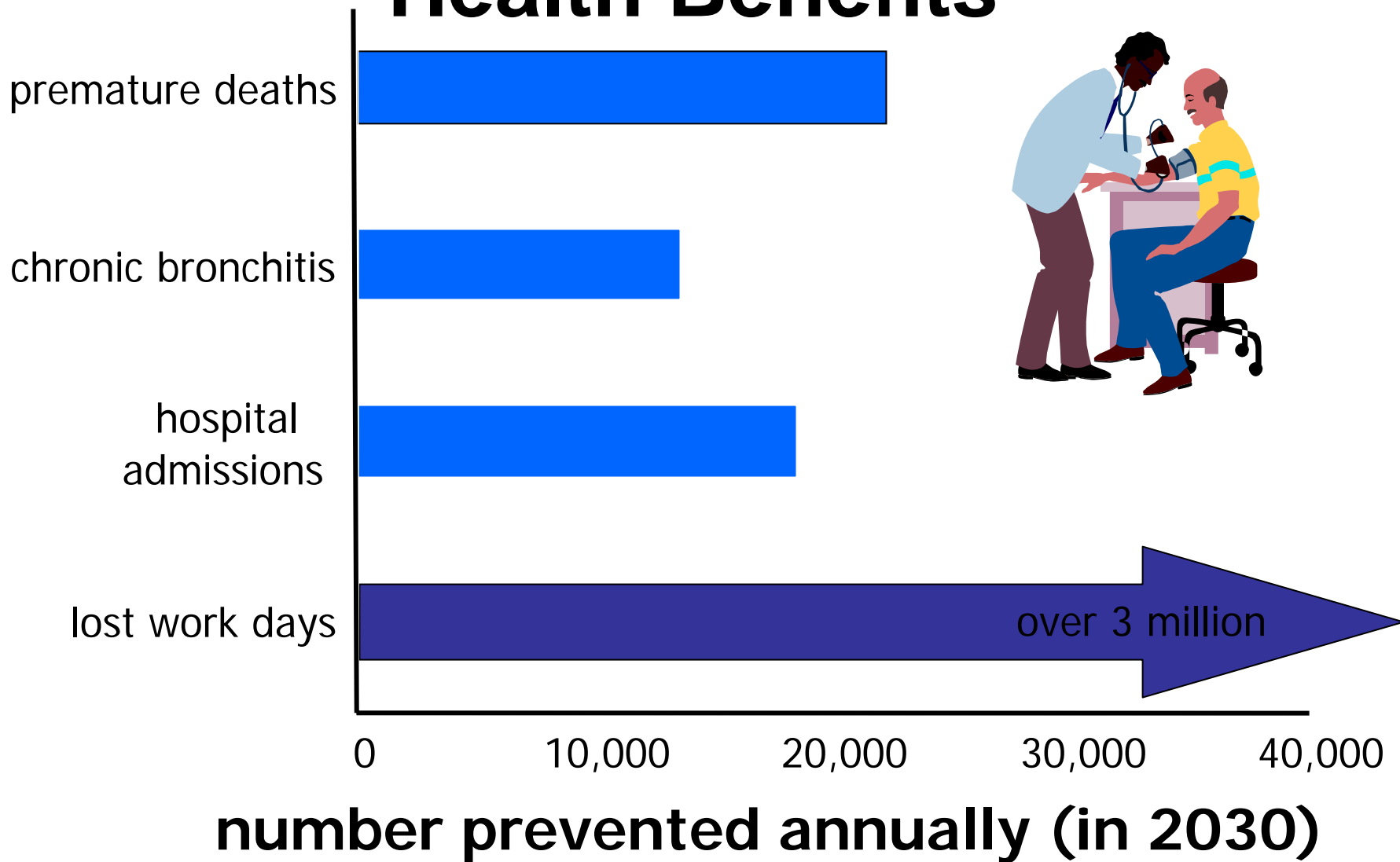
# PM Reductions from Recent U.S. Diesel Regulations



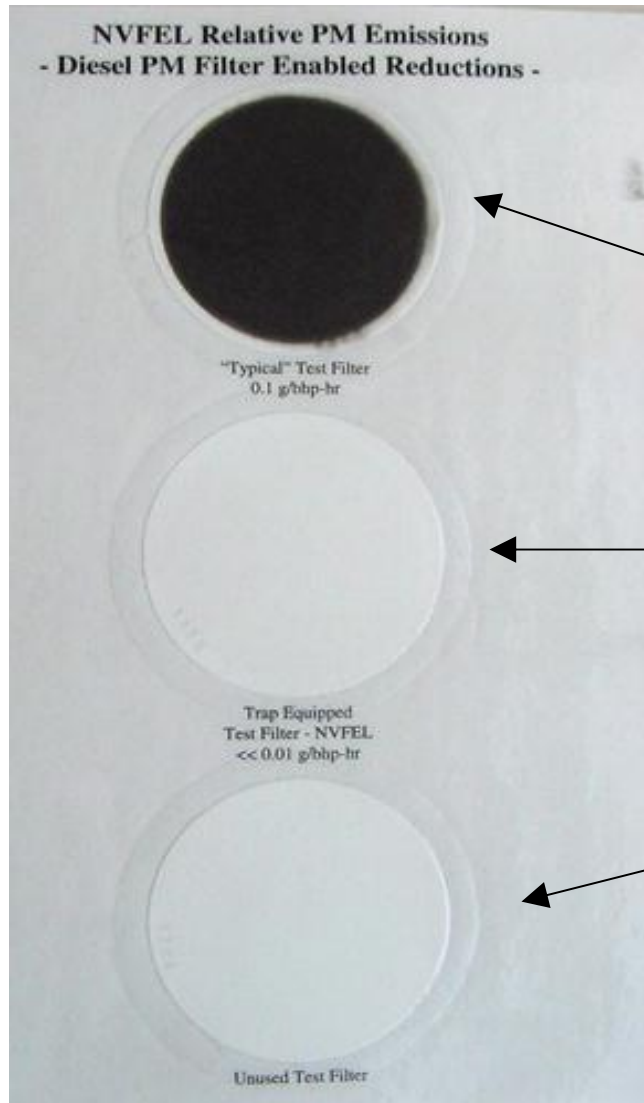
# U.S. Clean Fuel & Vehicle Programs Are Cost-Effective



# U.S. Clean Fuel & Vehicle Programs Offer Tremendous Health Benefits



# PM Emissions with Filter



- Typical test filter  
*current standards*
- Test filter  
*2007 standards*
- Unused test filter

# Benefits for the Environment

- **Lessen health impacts from diesel emissions:**
  - Exacerbates asthma, respiratory and cardiac illness
  - Possible human carcinogen
- **Improve air quality:**
  - 474 counties are out of compliance with the 8-hour ozone standard
  - 225 counties are out of compliance with the particulate matter standard
- **Lessen the impacts on our most vulnerable populations:**
  - Children, the elderly and people with existing health conditions
- **Reduce CO<sub>2</sub> emissions that contribute to climate change:**
  - Every gallon of diesel consumed creates 22.2 pounds of CO<sub>2</sub>
- **Improve energy security:**
  - Fuel prices, availability

# EPA Voluntary Sector-Based Programs

- **SmartWay Transport Partnership**
  - Challenges freight companies to improve the environmental performance of their fleets
- **Clean School Bus USA**
  - Aims to modernize 100% of the nation's school bus fleet by 2010
- **Clean Ports USA**
  - Encourages port authorities and terminal operators to reduce emissions and provide economic incentives to operate more efficiently
- **Clean Construction USA**
  - Encourages reducing emissions from major public and private construction projects in non-attainment areas
- **Clean Air Agriculture**
  - Promotes biofuels/renewables & retrofit in farming communities in non-attainment areas through collaborative partnership

# Why Diesel Retrofit?

- New emission standards generally only affect new vehicles or new engines.
- Air quality benefits must wait for fleet turnover.
- Diesels can last 20-30+ years or more.
- Cost effective technologies are available today for existing diesels.
- Desire to demonstrate benefits of ultra low sulfur fuel with advanced technologies.

# Diesel Retrofit Technologies

- We've retrofitted over 200,000 engines
  - variety of Federal and State funding sources
- Technology verification process to assure quality and durability
- Retrofit Technologies can be:
  - Catalyst or filter
  - Other devices or systems like SCR
  - Engine upgrade or engine re-flash
  - Early engine replacement
  - Cleaner fuels
  - Idling control equipment
  - Combination of above





## Voluntary Diesel Retrofit Program

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## Verified Products

[National Clean Diesel Campaign: EPA creates new campaign to reduce pollution from diesel engines](#)

### Verified Technology List

This table summarizes all the diesel retrofit technologies that the U.S. Environmental Protection Agency (EPA) has approved for use in engine retrofit programs. Select the manufacturer link to learn more about the retrofit technology and its operating criteria. The table shows the percent reduction (of verified or tested levels) that EPA will recognize for emission reductions for each technology.

See the [retrofit manufacturers contact](#) page for more information on these manufacturers.

Key Topics:

[Technology](#)

[Verification Process](#)

[Testing Protocols](#)

[In-use Testing](#)

[Technical Summary](#)

Verified Products

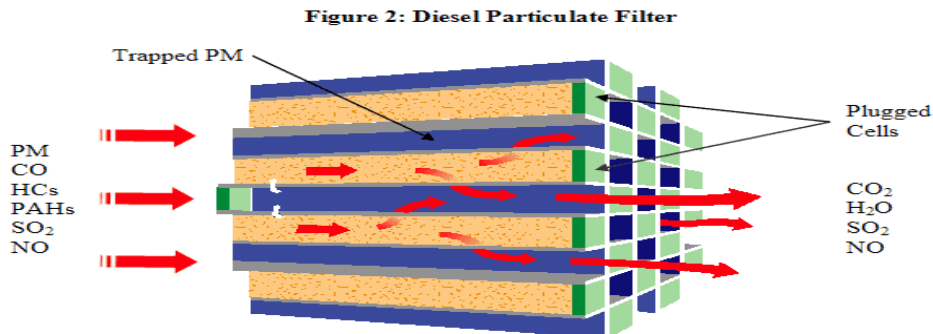
[Cost Survey](#)

### Verified Retrofit Technologies

Manuf.	Technology	Applicability	Reductions (%)			
			PM	CO	NOx	HC
<a href="#">Caterpillar, Inc.</a>	Catalyzed Converter/Muffler (CCM)	Highway, heavy-heavy and medium-heavy duty, 4-cycle, non-EGR, model year 1998 - 2003, turbocharged or naturally aspirated	20	20	na	40
		Nonroad, 4-cycle, non-EGR equipped, model				

# International Diesel Retrofit Projects

- Mexico City (completed)
- Bangkok
- Santiago Chile
- Beijing (with Beijing EPB)
- Pune India
  - Includes 2 stroke motorcycle retrofit



# Purpose of Retrofit Projects

- Demonstrate feasibility and benefits of retrofit devices
- Build capacity to do retrofits
- Build capacity to do emission testing
- Promote ultra low sulfur fuels

Figure 1: Diesel Oxidation Catalyst



# Typical Project: Details

- 20-25 Euro 1 and Euro 2 buses
- DOCs, PFFs, DPFs (Euro 2's only)
- ULSD for the buses with DPFs
- Emission testing before retrofit
- Emission testing ~4000 km after retrofit
- Emission testing after one year







# For More Information

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