Clean Fuels and Vehicles: Links to an Integrated Clean Air Strategy

Bill Vincent
The Clean Air Institute

Manizales, Colombia
March 15th, 2007

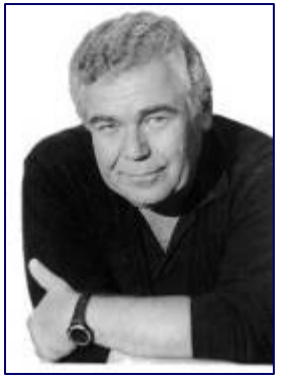
Today's Presentation

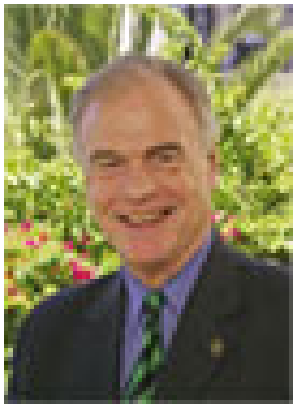
- What is CAI-LAC?
- Why should we all care about air quality?
- What is the role of ultra low sulfur fuels for reducing air pollution?
- What are cost and benefits?
- Next Steps

The Clean Air Initiative for Latin American Cities (CAI-LAC)

- Launched at World Bank in December 1998.
- Original Members:
  - 7 Largest urban centers: Bogota, Buenos Aires, Lima-Callao, Mexico, Rio de Janeiro, Santiago, Sao Paulo.
  - International development agencies: World Bank, IADB, GTZ, Environment Canada, US EPA.
  - Private sector companies: CNN, Renault, Daimler-Chrysler, Volvo, Shell.
  - Industry associations: ARPEL/IPIECA.

- CAI-LAC is now an independent non-profit
- Clean Air Institute manages the CAI partnership
  - Chair: Dr. Mario Molina
  - Executive Director: Sergio Sanchez
- Mission: to **improve air quality** in Latin American and other cities, to protect public health and welfare.





- **Colombia has set a global example of BRT that performs better than most Metros.**
  - **Covers much of the city**
  - **Approved CDM methodology**
  - **Reasonable cost**
- **Cities in Colombia and other countries are following the example**

- **Colombia still has many opportunities to protect public health and welfare**
  - **upgrade fuels and technologies in new and existing fleets**

Colombian Fuel Quality

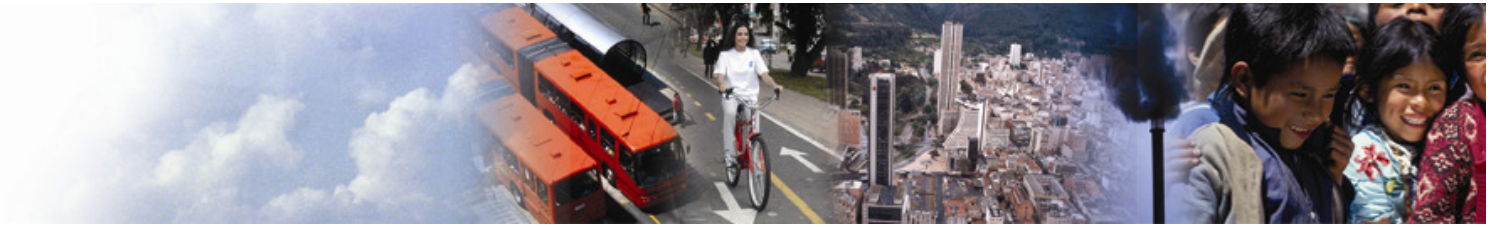
- **Improving fuel quality needs to be a top priority**

- **Recent announcement to invest in 50 ppm is very positive and important**

Sulfur content in Colombian diesel fuel and comparison to other standards from other countries

Bogotá: 1,200 ppm.
Rest of the country: 5,000 ppm.

European Union: less than 50 ppm.
Mexican and US standard: less than 15 ppm.



Why should we care about cleaner fuels and air quality?

- ***Clean air is a basic requirement for human health and welfare.***

  World Health Organization

- ***Exposure commonly found in Latin American cities has been related to increases in mortality and morbidity risks.***

  Panamerican Health Organization

Diesel exhaust considered carcinogenic

- EPA: 30 studies demonstrate increased lung cancer risk in diesel exhaust exposed humans.
  - Risks increased 33 to 47%.
- State of California - Listed as a Toxic Air Contaminant based on carcinogenicity and other non-cancer health effects.
  - Average of a 40% increase in lung cancer risk.
- International Agency for Research on Cancer - Diesel Engine Exhaust is Probably carcinogenic to humans
  - Risk increased with greater exposure.

Mortality Risks

- 2,000,000 premature deaths due to outdoor and indoor air pollution (WHO 2005)
  - Most in developing countries
  - Could be underestimated due to lack of air quality monitoring and health effect studies in developing countries, including Latin America.
- Problems include:
  - Chronic respiratory disease
  - Lung cancer
  - Heart disease
  - Damage to the brain, nerves, liver, and kidneys.

Situation Is Better in US and Other Developed Countries But Needs Improvement

National Annual Diesel Fine Particle Health Impacts[7]	
Annual Cases in the U.S., 2010	
Premature Deaths	21,000
Lung Cancer Deaths	3,000
Hospital Admissions	15,000
Emergency Room Visits for Asthma	15,000
Non-fatal Heart Attacks	27,000
Asthma Attacks	410,000
Chronic Bronchitis	12,000
Work Loss Days	2,400,000
Restricted Activity Days	14,000,000

Source: Clean Air Task Force (2005)

Short Term Health Impacts

- Irritation to the eyes, nose and throat.
- Upper respiratory infections such as bronchitis and pneumonia.
- Headaches, nausea, and allergic reactions.
- Exacerbated asthma and emphysema.

Source: David Wells, Alicia Patterson Foundation

Vulnerable populations (children and elderly) are most affected

- Continual exposure affects lungs of growing children and may aggravate or complicate medical conditions in the elderly.

Other effects of outdated technologies and fuels

- Economic
  - Higher health care costs
  - Lost worker productivity
  - lost investments and tourism opportunities
  - lost international competitiveness as markets for cleaner fuels and technologies grow
  - higher operating costs for transport concessioners
  - agricultural losses

In US, total costs from diesel particulate pollution estimated at $139 billion in 2010 (CATF 2005)

Other effects of outdated technologies and fuels

- Environmental
  - Soil acidification
  - forest damage
  - biodiversity loss
  - Impaired visibility
- Social
  - Diminished quality of life
  - Loss of credibility on transport programs and policies

Linkage Between Air Pollution and Climate Change

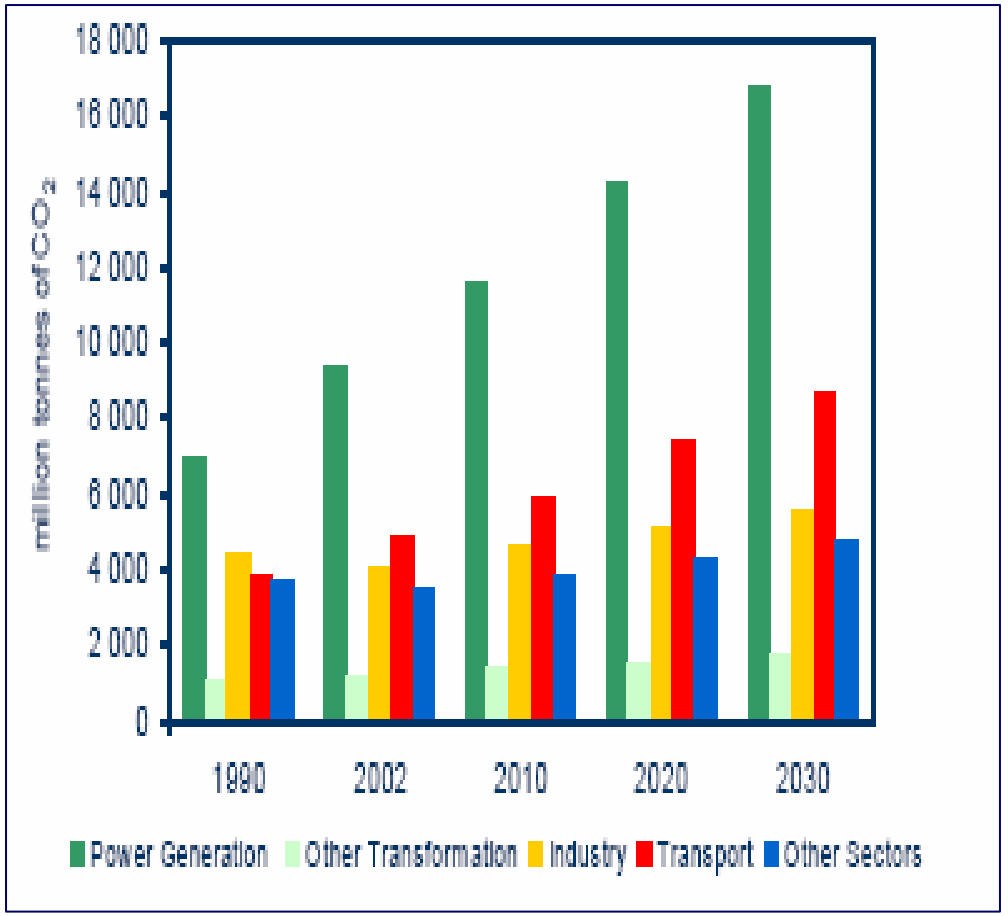
- Burning of fossil fuels is the common cause of both urban **Air Pollution** and **Climate Change**
- An integrated approach to combat to local, regional and global air pollution poses important synergies

Climate Change and Latin America

- Latin America is one of the most vulnerable regions to climate change impacts
  - Health impacts (mortality related to weather, infectious diseases, respiratory diseases related to air quality)
  - Agricultural impacts
  - Changes in forest composition and productivity
  - Impacts to water supply, quality and composition
  - Coastal land erosion and flooding

GHG Emissions Trending Upward in Developing Countries

Power generation and transport are leading causes of CO2 emissions



Forces for Change

- Additional 175 million people living in urban areas.
- 9 of 10 people living in cities.
- Vehicle fleet projected to triple.
- Energy use expected to double.
  - Most energy increase related to motorized transportation.

Source: UNHABITAT, 2001

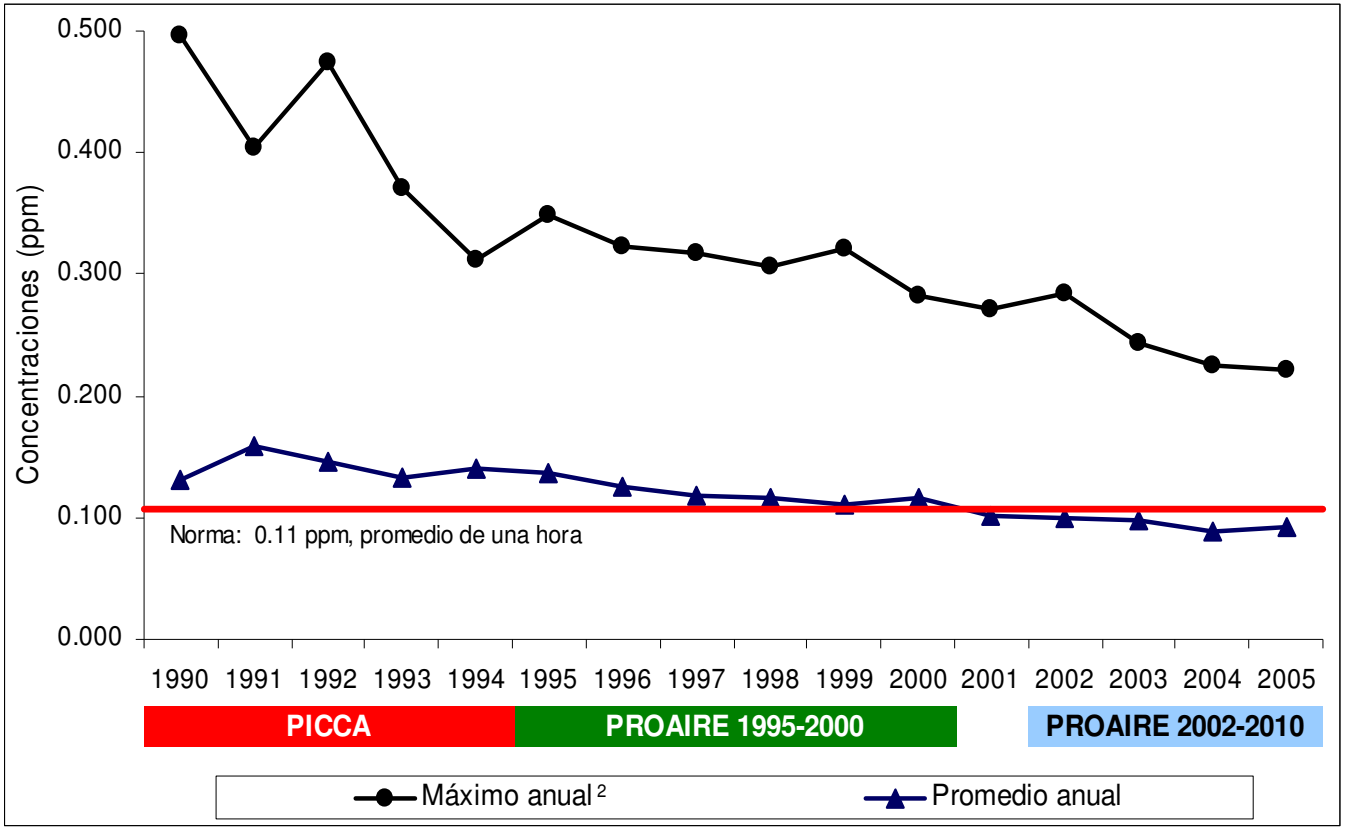
Forces for Change

- Increasing concerns about cross-border transport of pollution
- Growing opportunities for bi-lateral and multi-lateral cooperation
- New IPCC climate change report
- Major new players
  - Clinton Foundation
  - Richard Branson

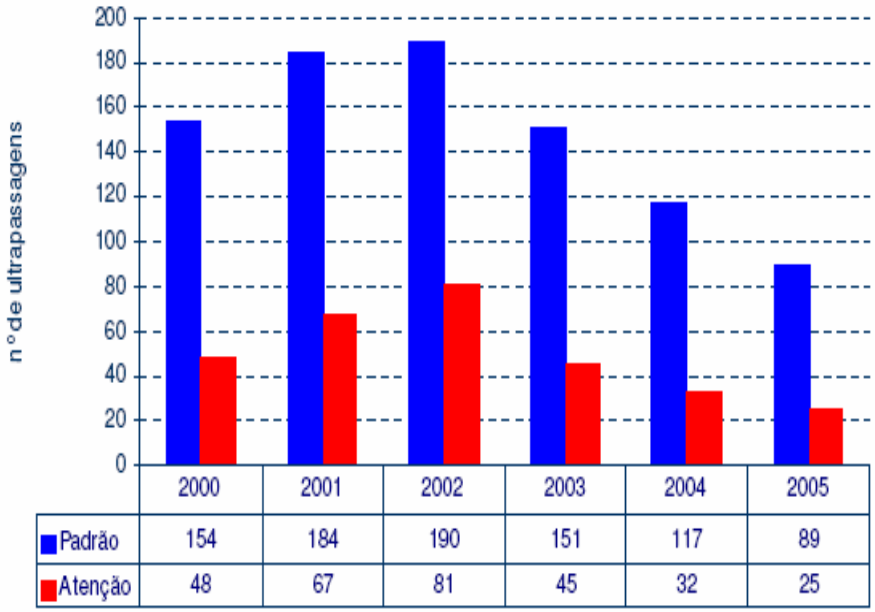
Change is Possible

- Air Pollution is decreasing in cities implementing air quality plans
  - Air pollution decreasing in Mexico City, Sao Paulo and Santiago.
- Improvements are related to the progressive introduction of cleaner fuels and vehicles.

Ozone Concentrations in Mexico City



Ozone in Sao Paulo



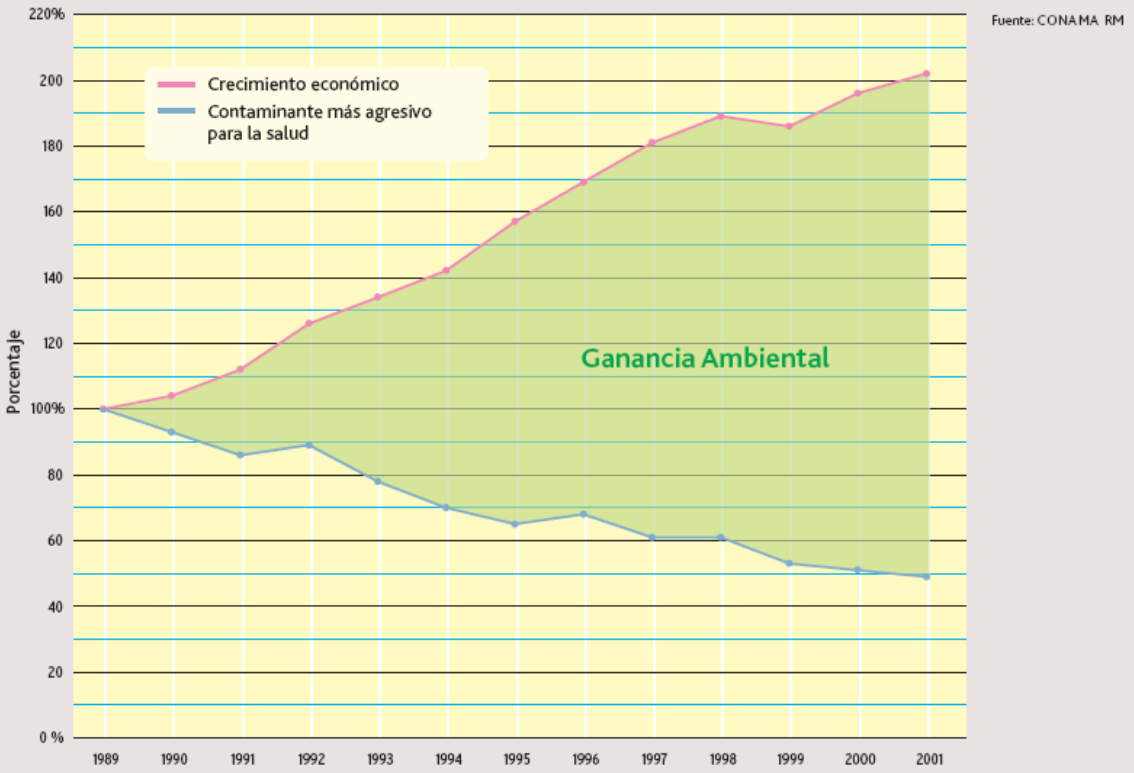
	2000	2001	2002	2003	2004	2005
Padrão	154	184	190	151	117	89
Atenção	48	67	81	45	32	25

Base: Estações Moóca, Ibirapuera, São Caetano do Sul, Mauá e Diadema

Figura 40 - O_3 – Número de ultrapassagens do padrão por ano – RMSP

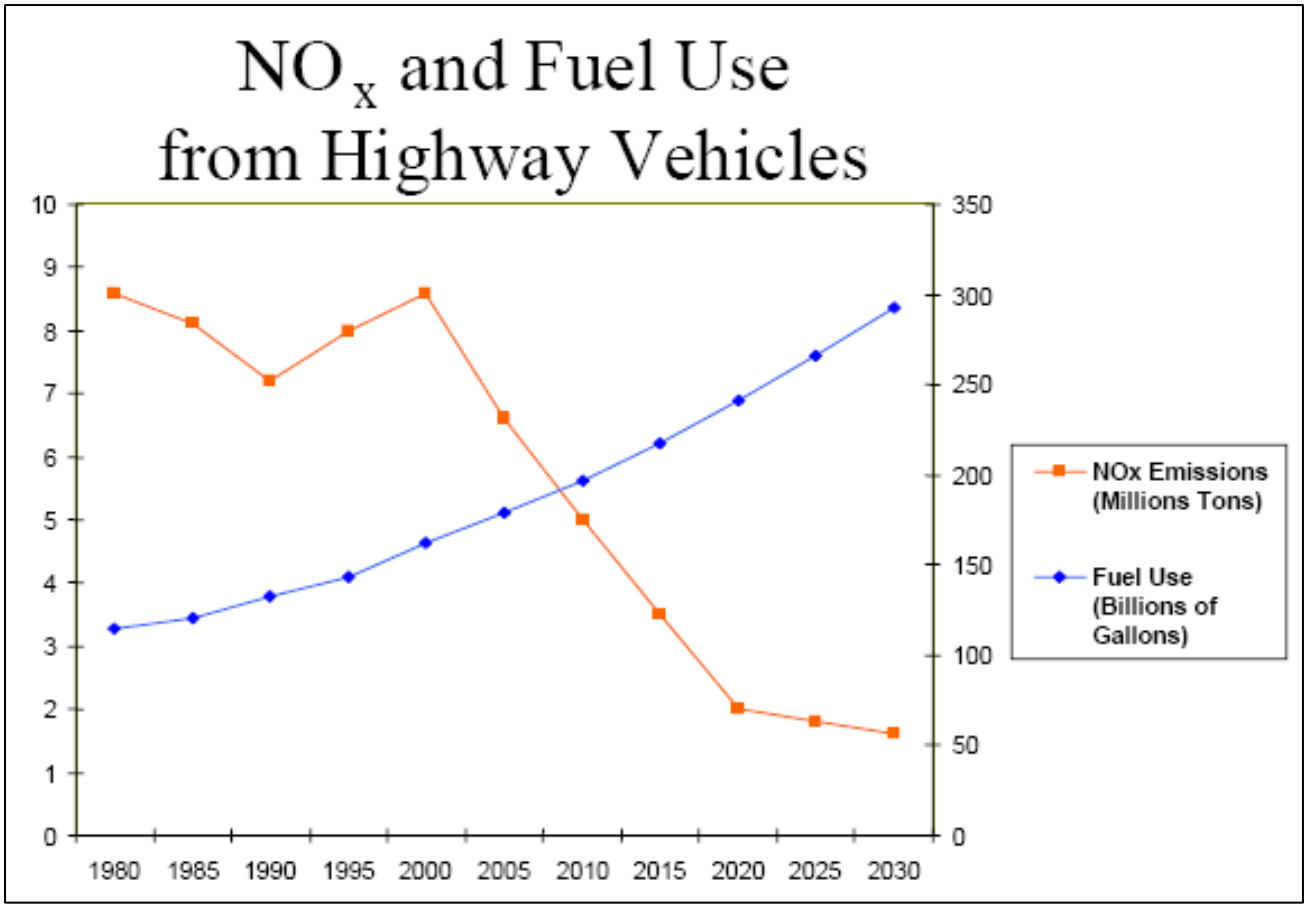
Economic Growth Can Occur with Air Quality Improvements: Santiago

Figura 4: Crecimiento económico de la Región Metropolitana y descontaminación

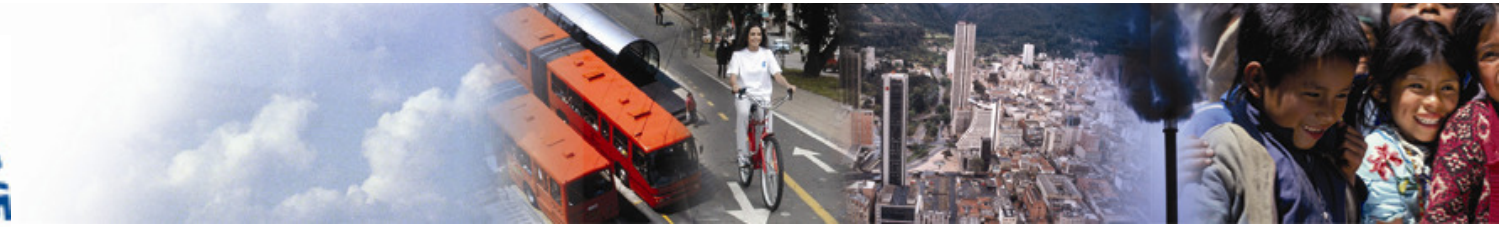


US: Cleaner Air Despite Growth

- **In US, ambient pollution levels have decreased despite a 160% growth in GDP since 1970**



Source: EPA (2004)

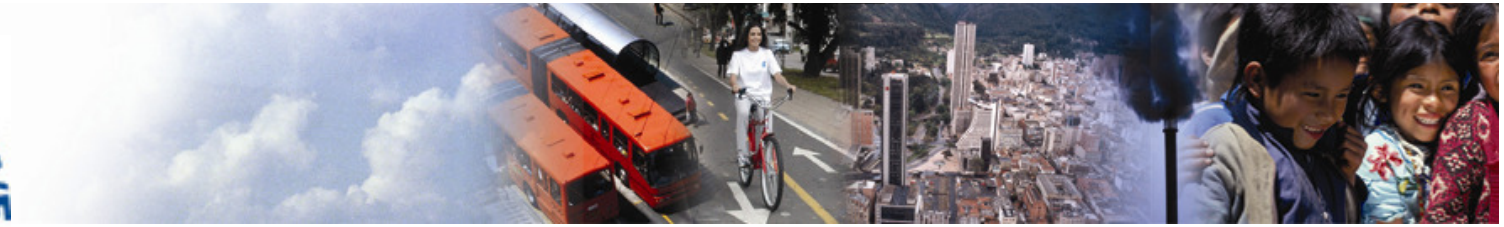


How to reduce air pollution?

Integrated approach for improving air quality and reduce GHG from urban transport

EMISSIONS FROM TRANSPORT	=	EMISSIONS PER UNIT OF FUEL	x	FUEL CONSUMPTION PER UNIT OF TRANSPORT SERVCE	x	TOTAL DEMAND OF TRANSPORT SERVICES

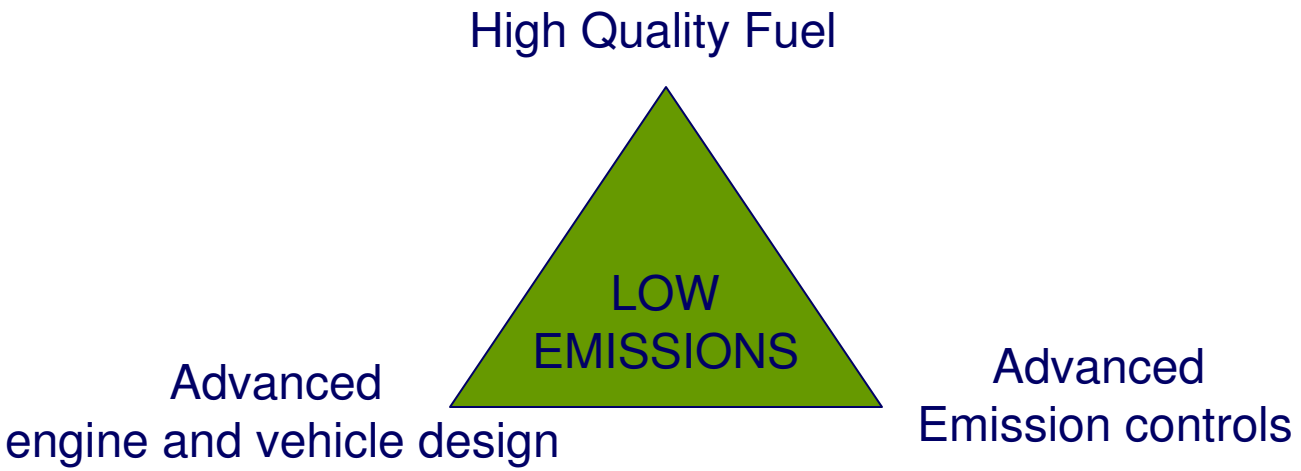
EMISSIONS PER UNIT OF FUEL	FUEL CONSUMPTION PER UNIT OF TRANSPORT SERVCE	TOTAL DEMAND OF TRANSPORT SERVICES
•Cleaner fuels and vehicles •Retrofit •Repower •Fleet replacement •I&M	• Improved transport systems •Non motorized transport •Private car restrictions •Freight management •Energy efficiency	•Land use policy •Travel demand management



What is the role of clean fuels and vehicles?

Clean fuels and vehicles

- Achieving very low emissions from motor vehicles requires a “systems approach”.



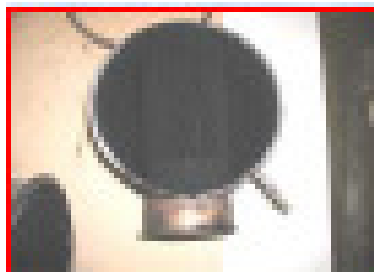
Reducing sulfur is critical

- Sulfur makes it difficult to meet tighter emission control standards.
- Near Zero Sulfur Levels (<15 ppm Sulfur)
  - Enables use of the full range of catalyst technologies, and
  - Maximizes emission control performance

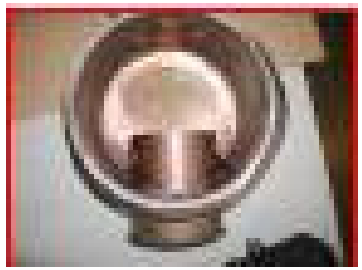
Types of emission control technologies

- For PM, CO, HC, and Toxics
  - Diesel Particulate Filters (DPFs)
  - Diesel Oxidation Catalysts (DOCs)
  - Crankcase Emission Controls
- For Oxides of Nitrogen (NOx)
  - Lean NOx Catalysts
  - NOx Adsorbers
  - Selective Catalytic Reduction with Urea Injection

Filter from bus application



Inlet



Outlet

Source: Bertelsen, EETPI

Mexico City proves that retrofitting existing is feasible

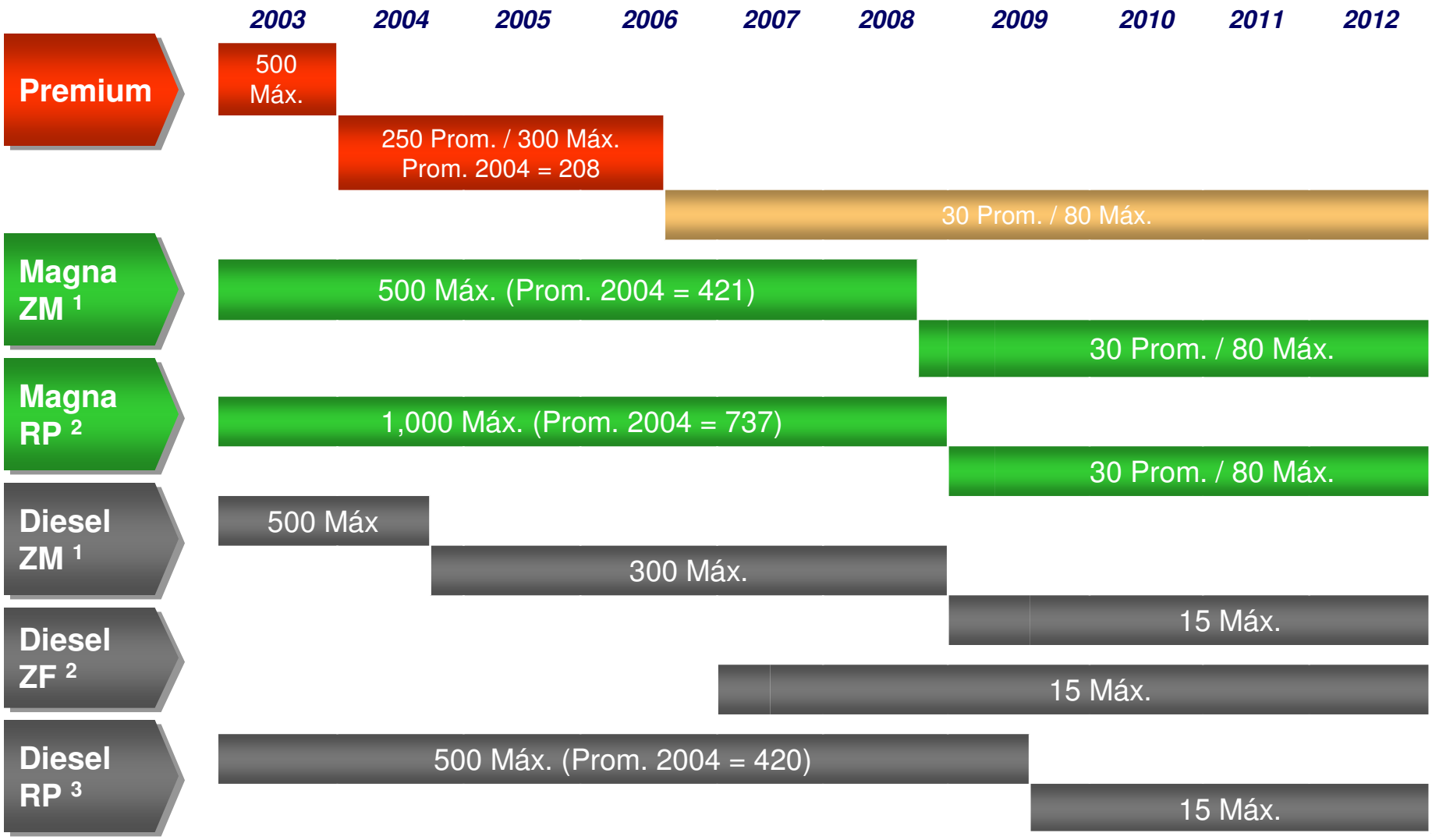
- **Diesel Particulate Filters (DPF) and Oxidation Catalyst (DOC) using ULSD were tested**
  - **90% reductions were observed on diesel buses with electronic injection and ULSF.**
  - **Estimated that a 60% reduction on fine particle atmospheric concentrations could be achieved if implemented at full scale in the Mexico City's bus fleet.**

Source: CTS et al. (2006)

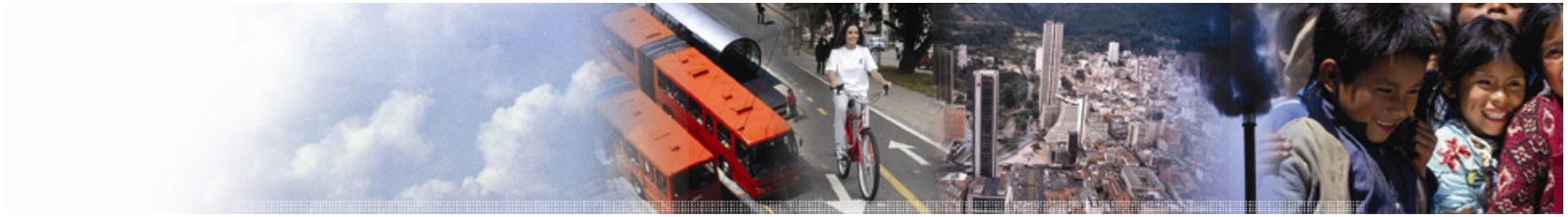
Results after a year of operation

Buses Model 1991 - Mechanical Injection- (DOC + ULSD)	Buses Model 2001 - Electronic Injection- (DPF + ULSD)
Up to 44% PM **and** 77% CO	**Up to** 92% PM **and** 100% CO
Retención of ultrafine particles (%)	99.6%

Mexican Program for Reducing Sulfur in Vehicle Fuels



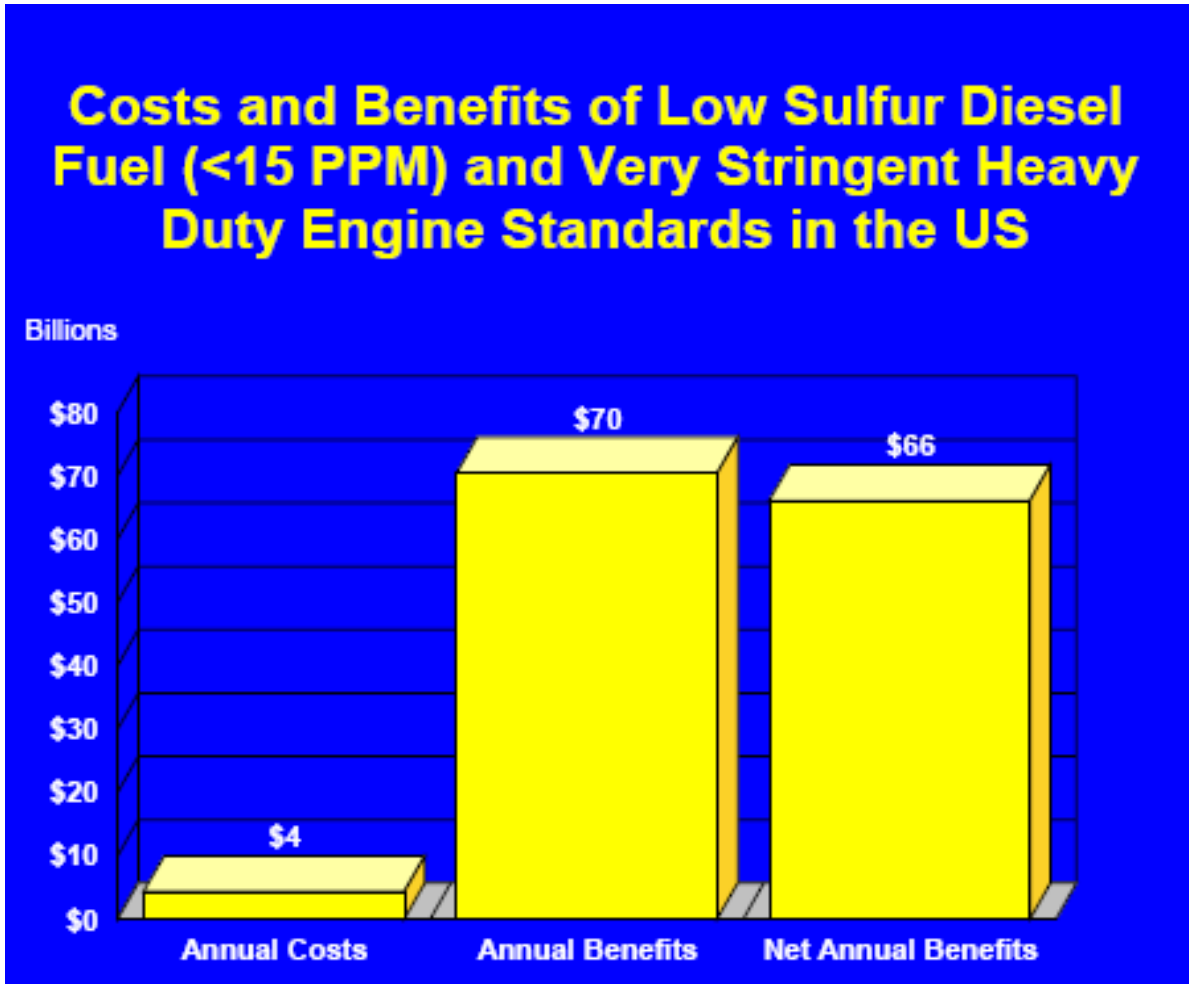
Cost/Benefit of ULSD and Emissions Controls



US Experience (EPA 2000)

EPA combined ultra low sulfur diesel (500 ppm – 50 ppm) and emissions control rule (2000)	
Benefits	**Costs**
2.6 million tons NOx	New vehicle costs raised $1,200 - $1,900
110,000 tons PM	Diesel increase $0.04 - $0.05 per gallon
8,300 premature deaths prevented	
1.5 million lost work days, 7,100 hospital admissions and 2,400 emergency room visits prevented for asthma annually	
Benefits Exceed Costs 16.5:1	

US Experience



Source: US OMB and ICCT

Mexico: Benefits Substantially Exceed Costs

Total Benefits (Nationwide):

$250-300 billion over a 25 year period (Blumberg 2004)

Implementation Costs:

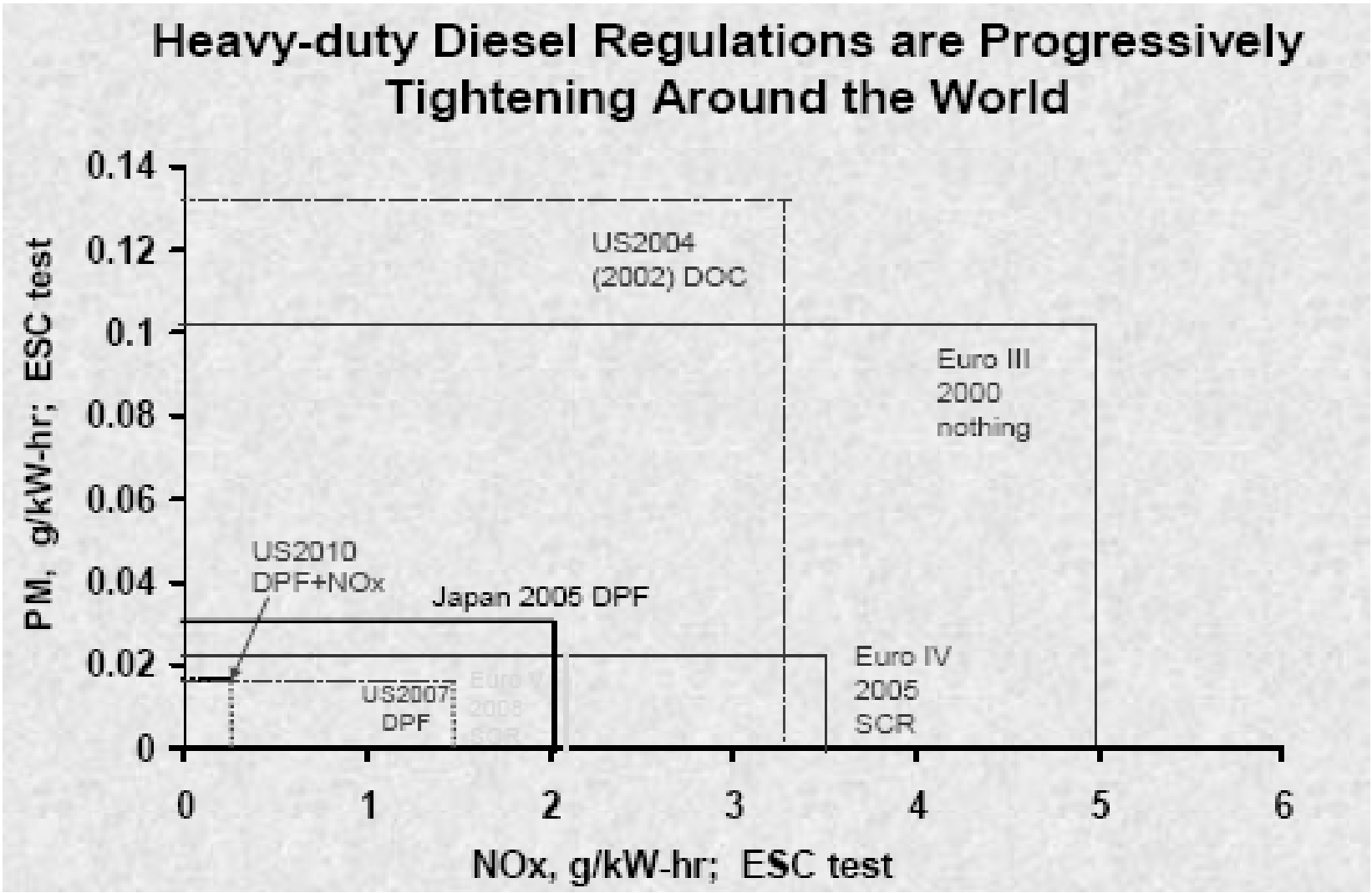
Millones de dólares

Total	2,697
Vertiente	
1. Plantas nuevas diesel [3] (4)	*1,028*
2. Modernización plantas de diesel [3] (18)	*548*
3. Plantas de postratamiento gasolina [2] (10)	*650*
4. Plantas de azufre (3)	*195*
5. Plantas de hidrógeno (4)	*276*

(1) Fuente: Pemex Refinación
(2) Varía entre Clase IV (-15% a +30%) y Clase V (-30% a +50%).
[3] Incluye catalizadores, tecnología, plantas de aguas amargas, integración y servicios auxiliares

Source: IMP

Heavy-duty Diesel Regulations are Progressively Tightening Around the World



Source: Bertelsen, EETPI

Next Steps

- CAI-LAC supports the goal of 50 ppm diesel by 2010
- To maximize benefits, there also needs to be:
  - International dialogue
  - Regional harmonization
  - Regional benchmarking
  - Regulations and incentives
  - Local action plans

CAI-LAC Role

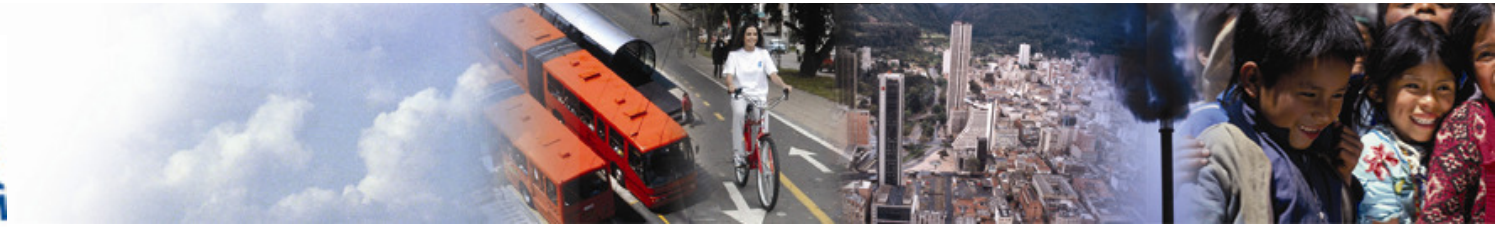
- CAI-LAC seeks to support regional, national, and local efforts by:
  - Engaging regional and international experts and stakeholders
  - Promoting targets, parameters and implementation requirements
  - Developing harmonized testing methodologies
  - Improving understanding of costs and benefits
  - Developing and diseminating best practices

CAI-LAC Program

- CAI-LAC is promoting among members the full incorporation of clean fuels and vehicle considerations into integrated action plans
- Action plans should contain:
  - Targets and goals
  - Strategies
  - Implementation mechanisms
  - Monitoring and assessment Institutional responsibilities
  - Budget

CAI-LAC Program

- LAC Bianual Benchmark Report.
  - Best practices
  - Improvement opportunities.
  - Transparency and public access to information.
  - Performance and processes indices by country and city.
    - Clean Air Index.
    - Transport, and energy and other key indices.
- LAC Clean Air Award, performance based.
- Regional Clean Air Conference 2008.



"… the present system of mobility is not sustainable, nor is it likely to become so if present trends continue.

Societies need to act to alter their direction. This is true, in particular, if mobility is to be made sustainable in the developing world."

Source:Mobility 2030, World Business Council for Sustainable Development

- **Contact information**

Sergio Sanchez

Bill Vincent

Clean Air Institute

Clean Air Initiative for

Latin American Cities

ssanchez@cleanairinstitute.org

bvincent@cleanairinstitute.org

Ph.No. 1 (202) 785 4222 x 30