ARPEL - Clean Air Initiative in Latin America
Joint Activities
Systemic Approach to Control Vehicular Emissions

Partnership for Clean Fuels and Vehicles:
Opportunities, Issues and Barriers in the Western Hemisphere
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Use of Lead in Gasoline in LAC

Unavailability of leaded gasoline

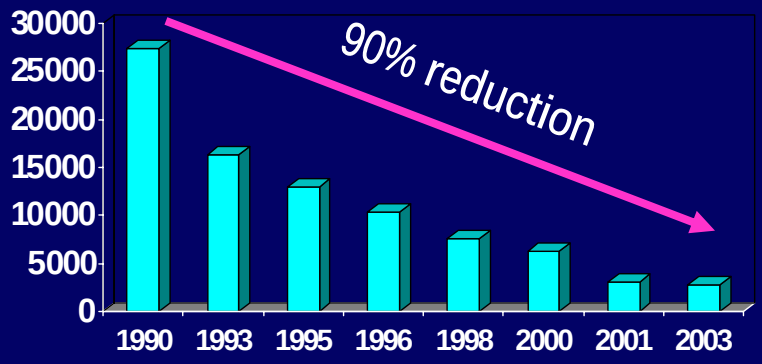
Availability of leaded gasoline

1997
15 countries
lead free

End of 2003
27 countries
lead free

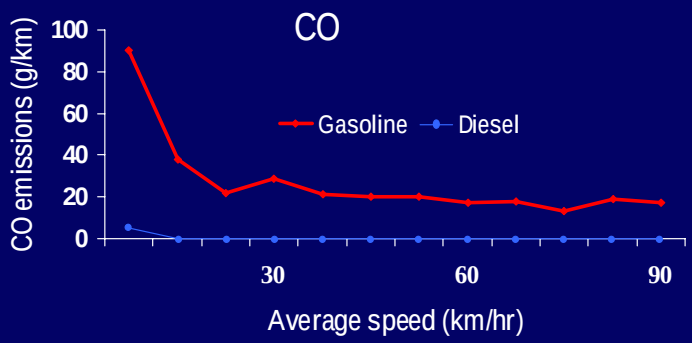
2005
29 countries
lead free

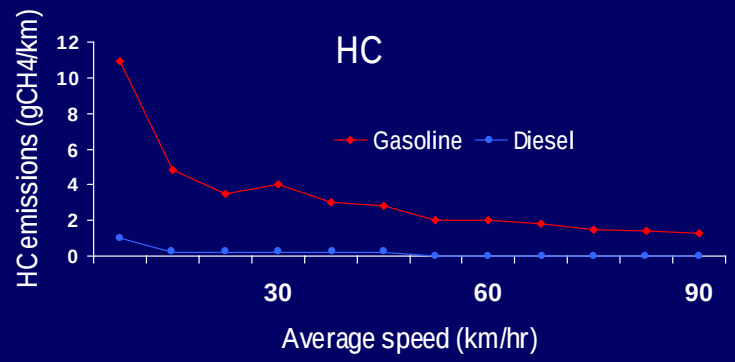
Lead addition (in tonnes of Lead per year) in LAC

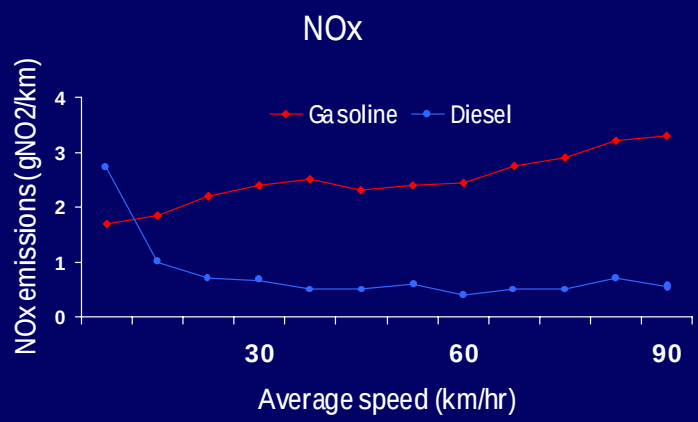


Impact of Use Conditions on Vehicle Emissions

Impact of speed on the emissions of vehicles with catalyst - INRETS driving cycles







Gasoline Standards				
	WB proposal in LAC		Current LAC	
	2001	2005	Min	Max
RVP, psi		9.0/11.5*	6.5	12.0
S,ppm	1,000	400	400	2,000
Pb (g/l)		0.013	0.013	0.8
BZ%		2.5	1	4.9
ARO%		45	25	45
Diesel Fuel Standards				
Cetane Number	45	47	40	50
S,ppm	5,000	2,000	300	5,000
P.ARO%		12	12	18
T90 (ºC)		360	338	370

* RVP proposed varies among geographic regions and depends on climate conditions

Impact of Vehicle Technology on Vehicle Emissions

Exhaust emissions control for gasoline light duty vehicles

Control level

Parameter	% controlled*	Required controls
HC	66	Ignition timing
CO	63	Air/fuel ratio
NOx	11	Air injection, EGR
HC	89	Oxidation catalyst
CO	83	Injection timing
NOx	39	EGR
HC	94	3-way catalyst
CO	95	Closed loop carburetor or
NOx	71	Electronic fuel injection
HC	94	Oxidation catalyst
CO	98	Electronic fuel injection
NOx	71	Fast burning combustion chamber
HC	96	3-way catalyst
CO	97	Electronic fuel injection
NOx	88	EGR
HC	99	3-way electric catalyst
CO	99	Electronic fuel injection
NOx	94	EGR

WB standards🖫

Increasingly stricter fuels standards

* Compared to uncontrolled levels

🖫 ARPEL estimate ≈ US Tier 1 and Euro 2

Impact of Vehicle Technology on Vehicle Emissions

Exhaust emissions control for diesel light duty vehicles

Control level

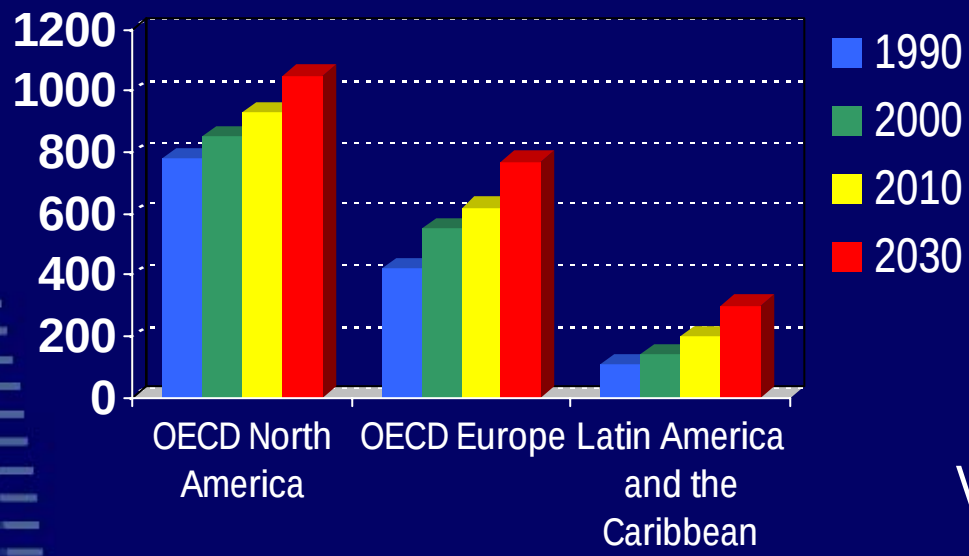
Parameter	% controlled*	Required controls	
NOx	40	Injection timing	
MP	33	Combustion optimization	
NOx	40	Variable injection timing	WB standards⛽
MP	78	Combustion optimization, EGR	
NOx	40	Electronic fuel injection, combustion optimization, EGR, catalytic converter or particles trap	
MP	92		

Increasingly stricter fuels standards

* Compared to uncontrolled levels

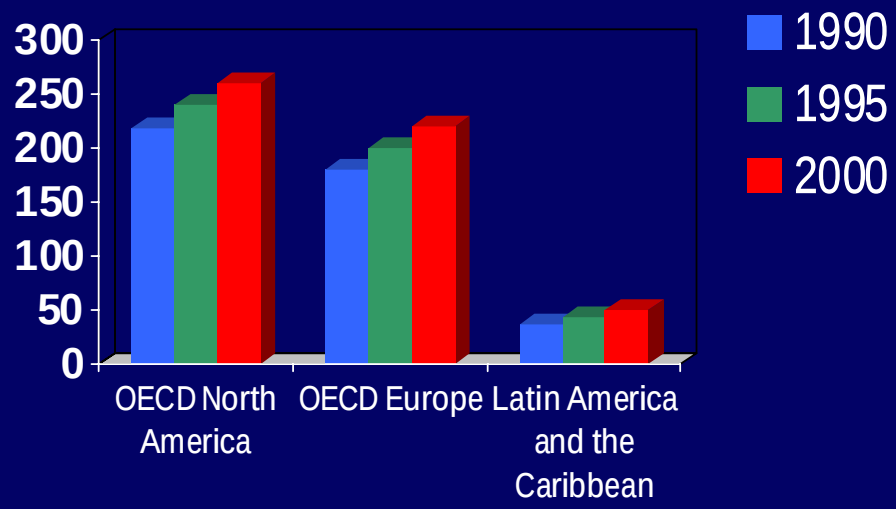
⛽ ARPEL estimate ≈ US Tier 1 and Euro 2

Vehicles per 1000 people Trends



Motorization Rate

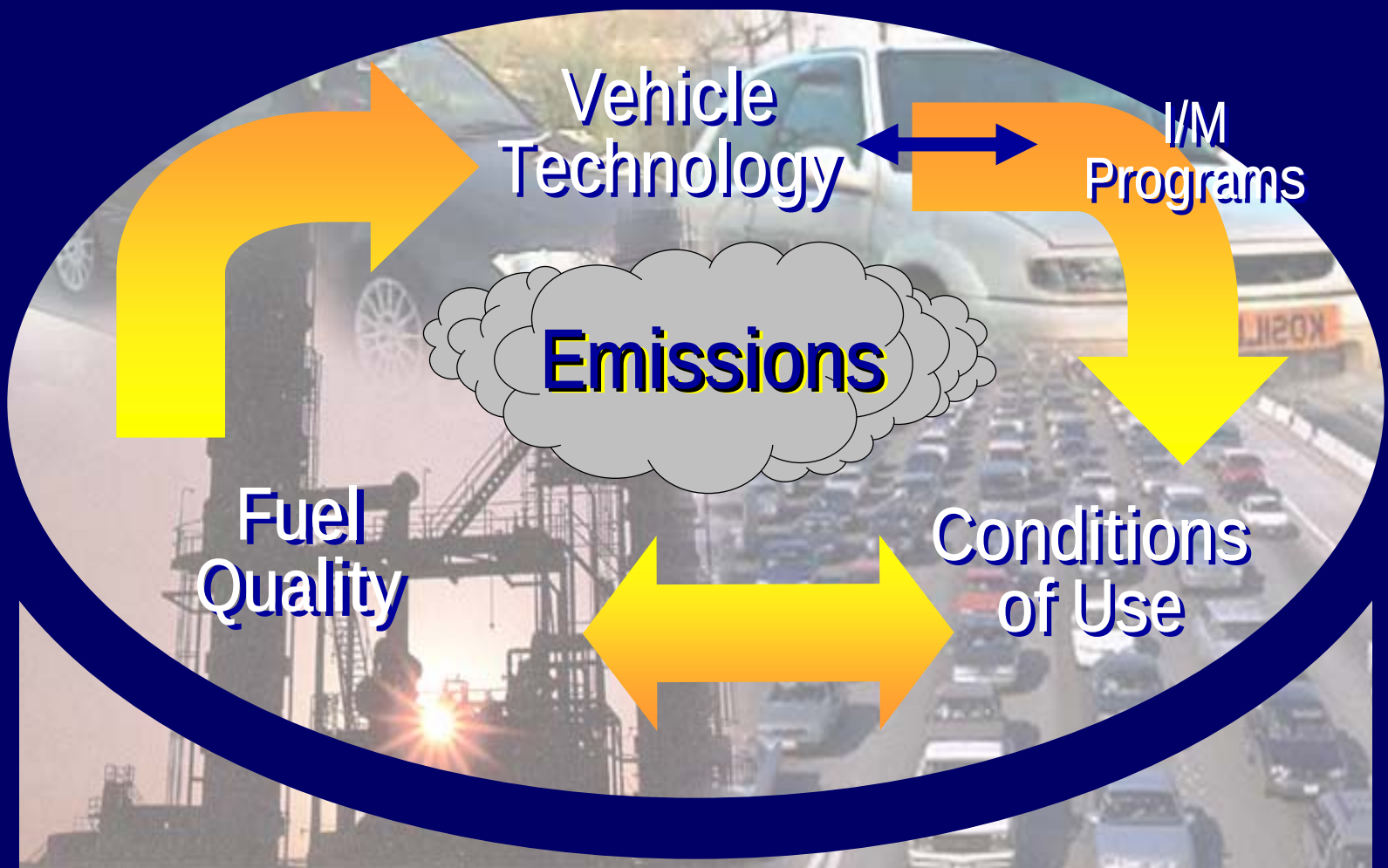
Vehicles statistics in millions



Different magnitude of the problem

Different approach

Systemic Approach to control vehicle emissions



ARPEL Atmospheric Emissions Project

- Determination of vehicle emissions factors on service conditions
- Real-time measurements with local conditions such as fuels, traffic, urban environment
- Base for the emissions modeling
- Development of cost/effective programs of urban air quality management

- Field work - Scope
  - *Direct capture of exhaust gases (CO, THC, NO_x, O_2 and CO_2) on service conditions and direct analysis (g/km) on analyzers*

- Field work - Scope
  - *International consultants of the ARPEL/CIDA Environmental Program, Phase 3 - technical support from Environment Canada*
  - *A week of field work at each city*
  - *Measurements of ca. 20 vehicles*
  - *Coordination with local CAI group to identify / select vehicles*
  - *Service conditions selected in coordination with the local CAI*

- Activities after the field work
  - *Local CAI: Submit information of the city car fleet to ARPEL for modeling*
  - *ARPEL Member Companies: Dispatch fuels to Environment Canada to compare impact on emissions - Laboratory testing with "typical" engine*

- Deliverables for the cities

  Emissions factors of gasoline-fuelled vehicles on service conditions (i.e., "street" emissions)

  \+ *Diesel emissions determination with IPIECA Toolkit*

  \+ *Modeling of the impact of the variation of fuels' specifications*

  = *Decision making elements for the management of urban vehicular emissions*

- Definition of the (4) cities and local companies
  - *Santiago de Chile - ENAP*
  - *Sao Paulo - PETROBRAS*
  - *Lima-Callao - PETROPERU*
  - *Buenos Aires ± - ExxonMobil RepsolYPF*
  - *Bogota - ECOPETROL*

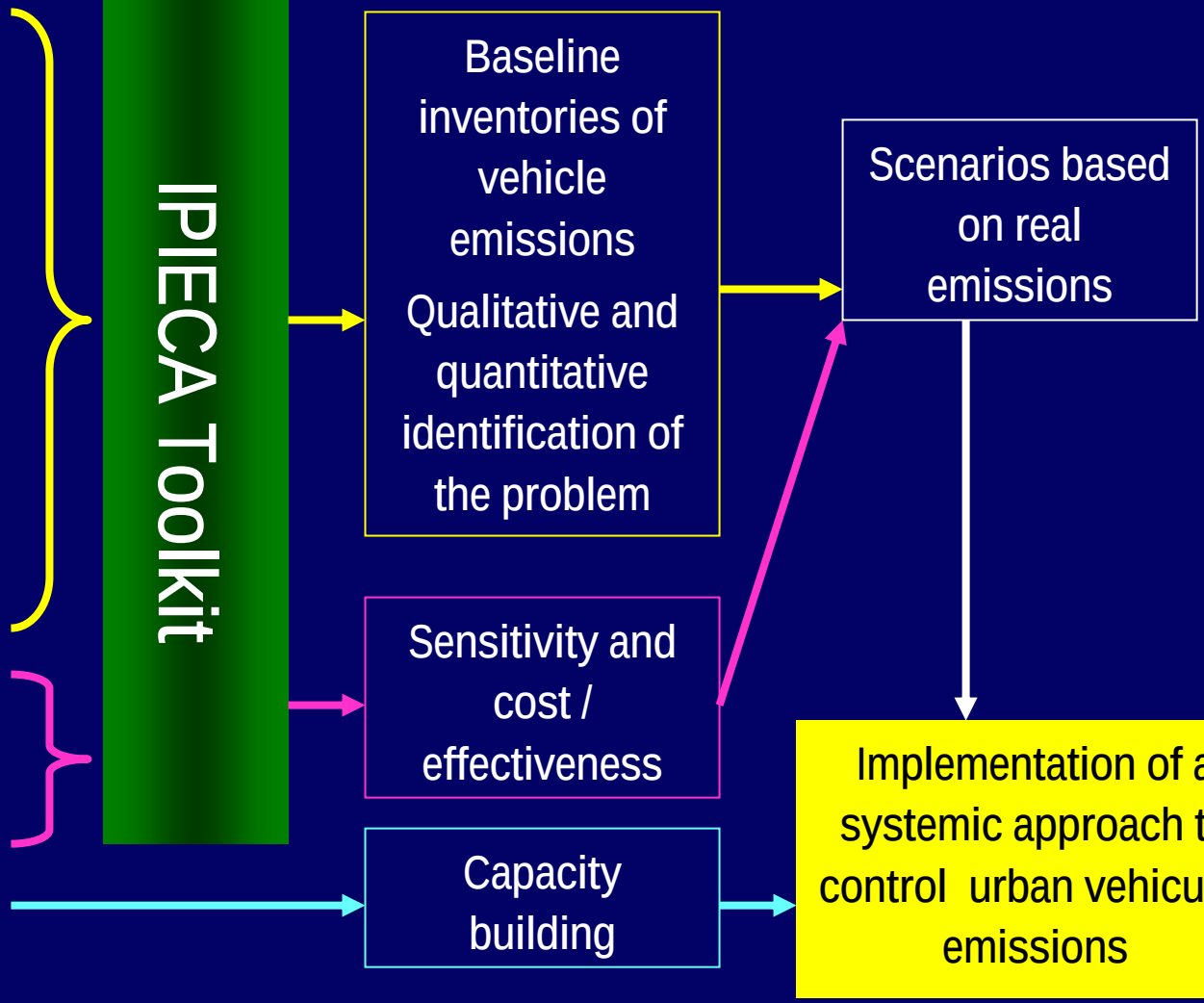
Clean Air Initiative Project

- Field Work (IVE Model) - Scope
  - *To determine driving habits (GPS)*
  - *To identify vehicle technology*
- Inspection and Maintenance programs
  - *Exchange of experiences*
  - *Establish best practices*
  - *Training*

} ARPEL input

ARPEL - CAI Project Results

- Vehicle emissions factors on real conditions
- Driving habits
- Technology features of the car fleet
- Fuels' properties
- Emission Factors Vs. Fuels' properties
- I/M vehicle programs



Scenario in LAC

- It is most likely that Latin America & the Caribbean follow a different course of action of that followed by Europe and USA
  - *Old car fleet average age is the key factor*
  - *Small motorization compared to developed economies*
  - *Gradual fuel specs improvements attending critical cities*
- Present CAI - LAC urban air quality management programs focus on:
  - *I/M programs*
  - *Inventories - Vehicle emission factors*
  - *Cost/effective approaches*

Thank you

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