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“Energy in sustainable development, industrial development, air pollution / atmosphere, and climate change: Findings, trends and challenges for Latin America and the Caribbean”

(Preliminary version)*

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"The role of energy in sustainable development, industrial development, air pollution / atmosphere, and climate change: Findings, trends and challenges for Latin America and the Caribbean"

PRELIMINARY DOCUMENT

I. Introduction

This report assesses the status of air quality in Latin America and the Caribbean. It considers both local and global impact, and examines the way in which these factors affect the changing energy situation at the international level.

The report presents and analyzes data collected, and identifies new challenges and opportunities in overcoming barriers to the implementation of pollution reduction measures. In an attempt to enhance environmental and energy sustainability in the Latin American and Caribbean region, future challenges have also been identified in regard to maximizing the effectiveness of action and resources in the areas under discussion.

The report is divided into three sections:

– The first section, entitled "***The energy context***," analyzes the region's current and projected situation from the perspective of international energy issues, examining the impact of these global issues on local air quality and climate change.
– The second section, "***A regional assessment of local and global atmospheric issues,"*** presents a comparison of critical data analyzed in the document, in order to provide a basis for recommendations. A number of success stories—cases with the potential to be replicated within the region—are also described.
– The third and final section, "***Challenges and opportunities—recommendations for policies and instruments,"*** based on the analytical work of the previous sections, provides general recommendations, as well as some specific recommendations for different types of stakeholders in the region (public- and private-sector entities, as well as foreign institutions).

II. The energy context

II.1 Relation between energy and atmospheric impacts

Given the close relationship between the energy situation, at various levels, and atmospheric emissions with potential local and global impacts, gaining familiarity with certain elements of the international energy situation and their implications for the region is essential.

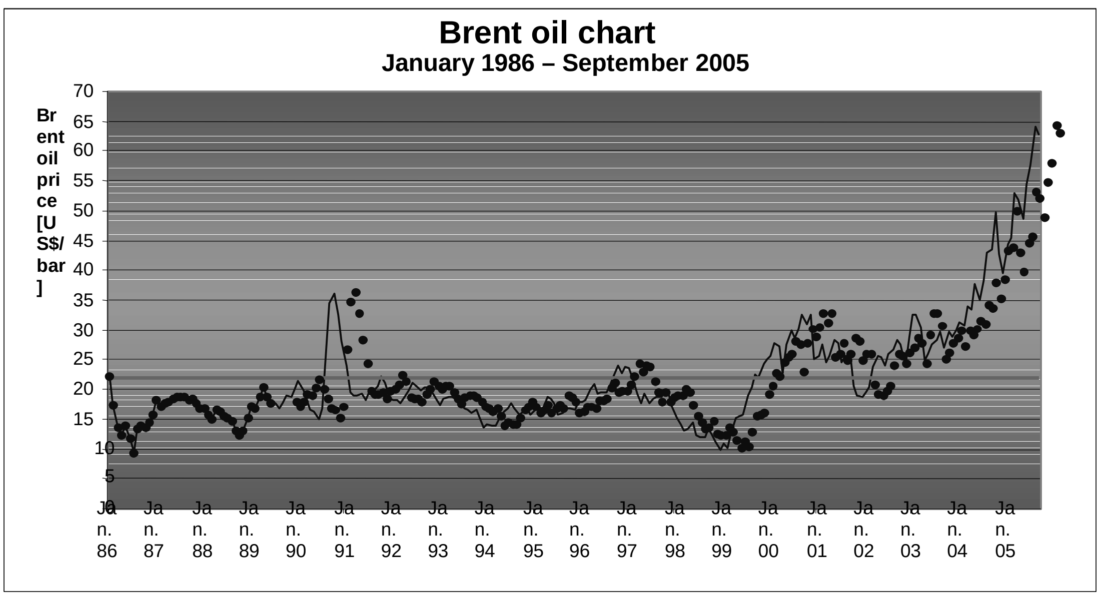
This relationship is intimately associated with economic factors, since international price projections drive decisions on both electrical power generation and the provision of fuels for industry and transportation.

One critical element in the analysis presented here, in regard to decisions on energy supply, is the internalization of the health and environmental externalities that result from such decisions.

II.2 Price projections and related factors

In the last few years, the international energy situation has been driven primarily by increases in the price of oil (see figure 1).

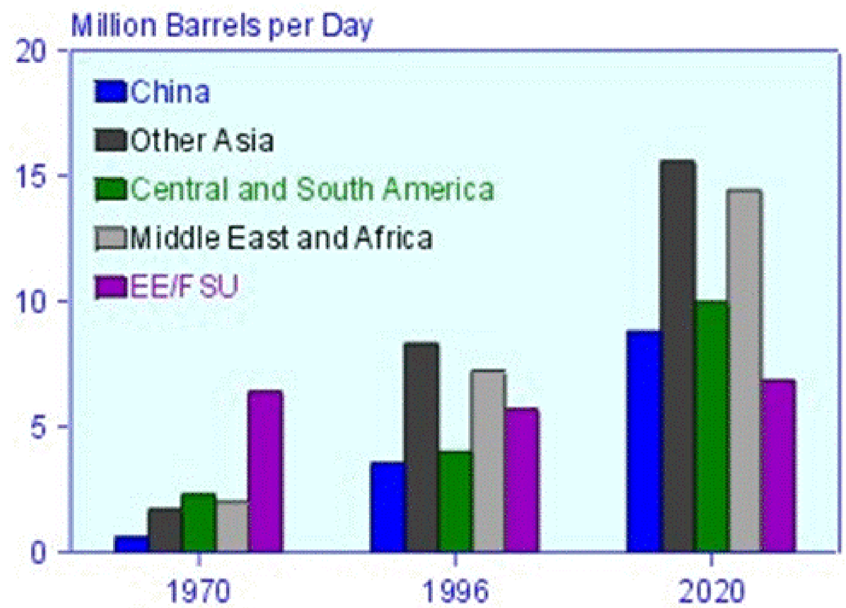
Figure 1: Changes in oil prices



Source: Platt´s, OLADE

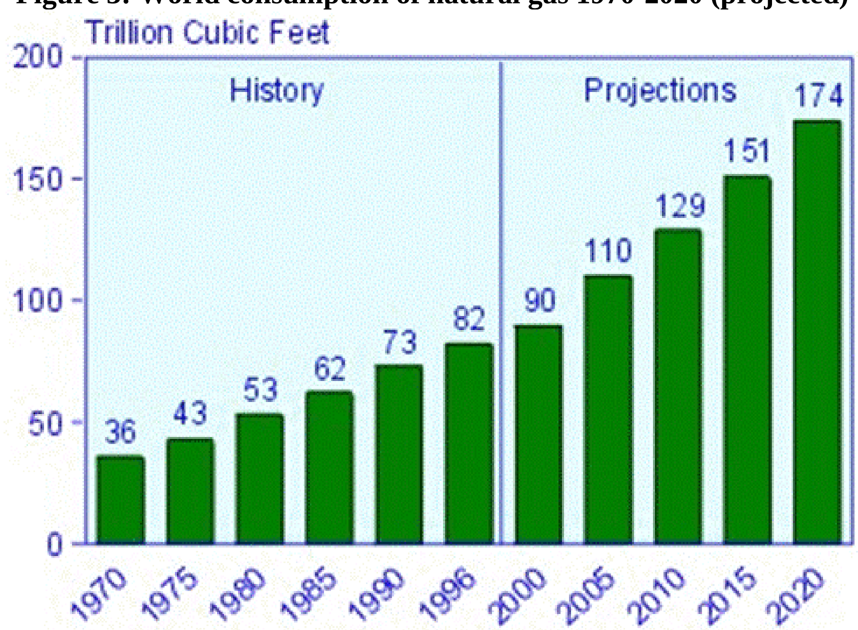
Accompanying the trend shown here has been a sustained increase in international demand for oil and fossil fuels—an increase reflected also in Latin America and the Caribbean (see figures 2 and 3).

Figure 2: Demand for oil in non-industrialized regions, 1970, 1996, and 2020 (projected)



Source: 1970 and 1996: Energy Information Administration (EIA), Office of Energy Markets and End Use, International Statistics Database and International Energy Annual 1996, DOE/EIA-0219(96) (Washington, DC, February 1998). Projections: EIA, World Energy Projection System (1999).

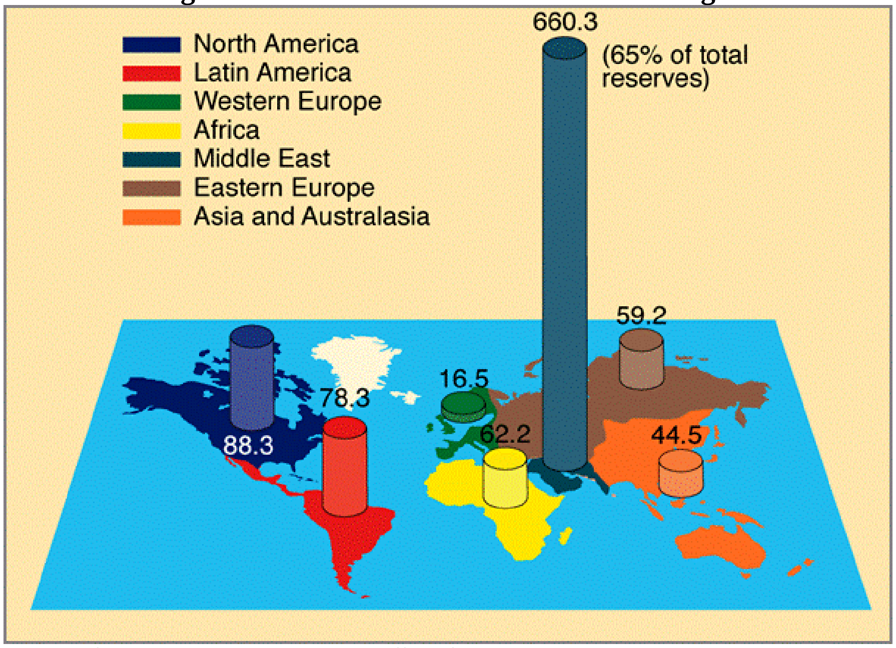
Figure 3: World consumption of natural gas 1970-2020 (projected)



Source: History: Energy Information Administration (EIA), Office of Energy Markets and End Use, International Statistics Database and International Energy Annual 1996, DOE/ EIA-0219(96) (Washington, DC, February 1998). Projections: EIA, World Energy Projection System (1999).

The phenomenon of rising oil prices is also affected by supply, which is a function not only of geopolitical factors, which have led to limitations in supply, but also of projections for international reserves (see figure 4).

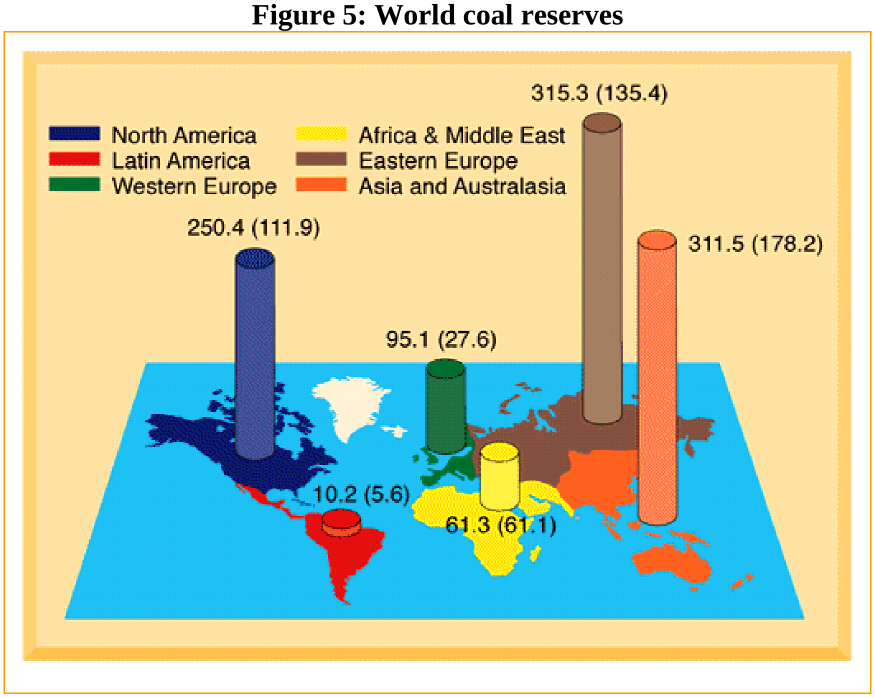
Figure 4: World reserves of oil and natural gas



Source: History: Energy Information Administration (EIA), Office of Energy Markets and End Use, International Statistics Database and International Energy Annual 1996, DOE/ EIA-0219(96) (Washington, DC, February 1998). Projections: EIA, World Energy Projection System (1999).

Involved here is a factor critical within the international context, since projected rates of oil consumption would indicate reserves for a period of 40 more years, contrasting sharply with other energy sources, such as coal (see figure 5), projected to last for more than 200 years.

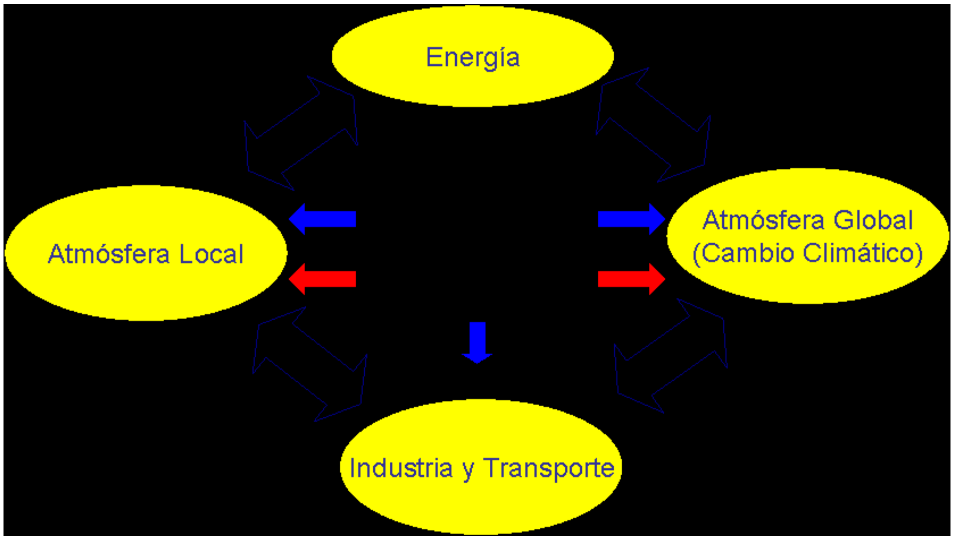
Figure 5: World coal reserves



Source: British Petroleum Company, 1995, BP Statistical Review of World Energy

This configuration implies that the problem of ensuring energy supplies for electrical generation and other purposes directly produces a series of pressures that have consequences for the environment—specifically, for local and global atmospheric conditions (see figure 6).

Figure 6: Relation between energy and atmospheric impacts



Source: Original work

[Translator's note: TEXT TO BE INSERTED IN PICTURE:
Energy
Local Atmosphere   Global Atmosphere (Climate Change)
Industry and Transportation

TEXT IN MIDDLE SECTION:
Opportunities for renewable energies and energy efficiency
Incentives for greater use of coal
Opportunities]

These pressures, associated with the challenge of ensuring energy supplies, represent opportunities for countries to diversify their energy matrices and for energy efficiency to become a strategic element in economic decisionmaking.

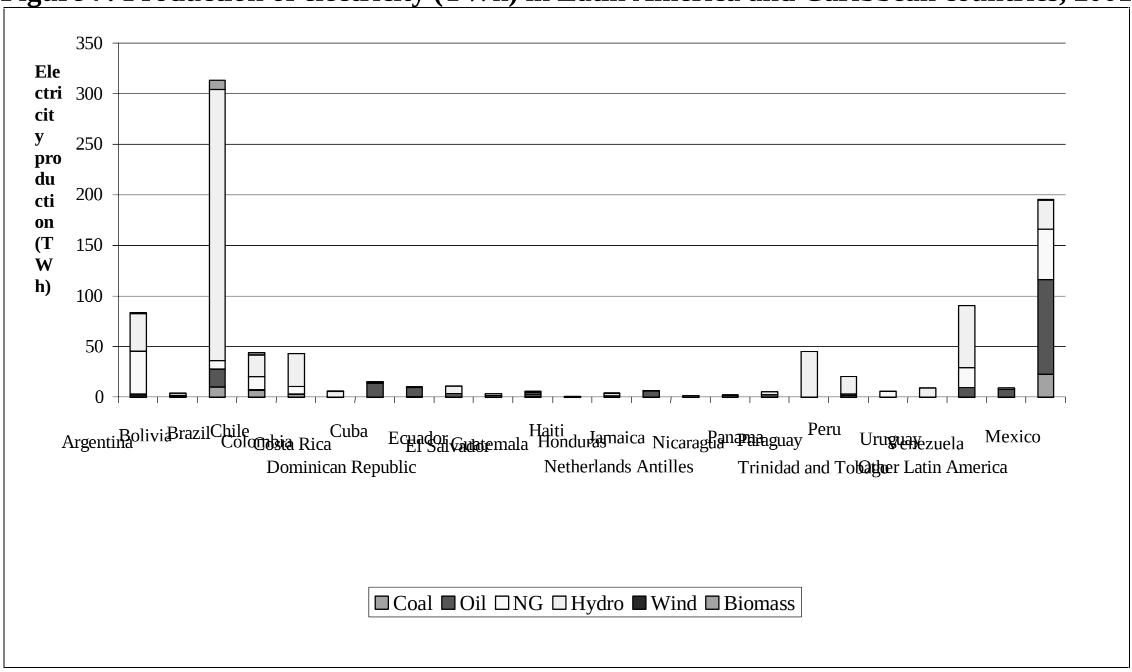
At the same time, the favorable projections regarding the availability and price of coal, needed primarily for electrical power generation, represent a threat in terms of atmospheric emissions, and may be expected to have both local impact (principally on health) and global impact (emissions of greenhouse gases, climate change).

The situation becomes even more complex when energy sources other than coal are considered. For example, despite the fact that wood is a biomass fuel, proper controls on wood burning constitute a vital challenge, given the major local impact of wood burning in Latin American cities and, increasingly, in the Caribbean.

There is ample literature on projected diversification of the energy matrix,[1] involving a greater role for renewable energy sources.

All such projections envisage a gradually increasing role for renewable energy sources, but do not predict structural changes in the composition of the energy supply in Latin American and Caribbean countries, particularly in regard to electrical generation (see figures 7 and 8).

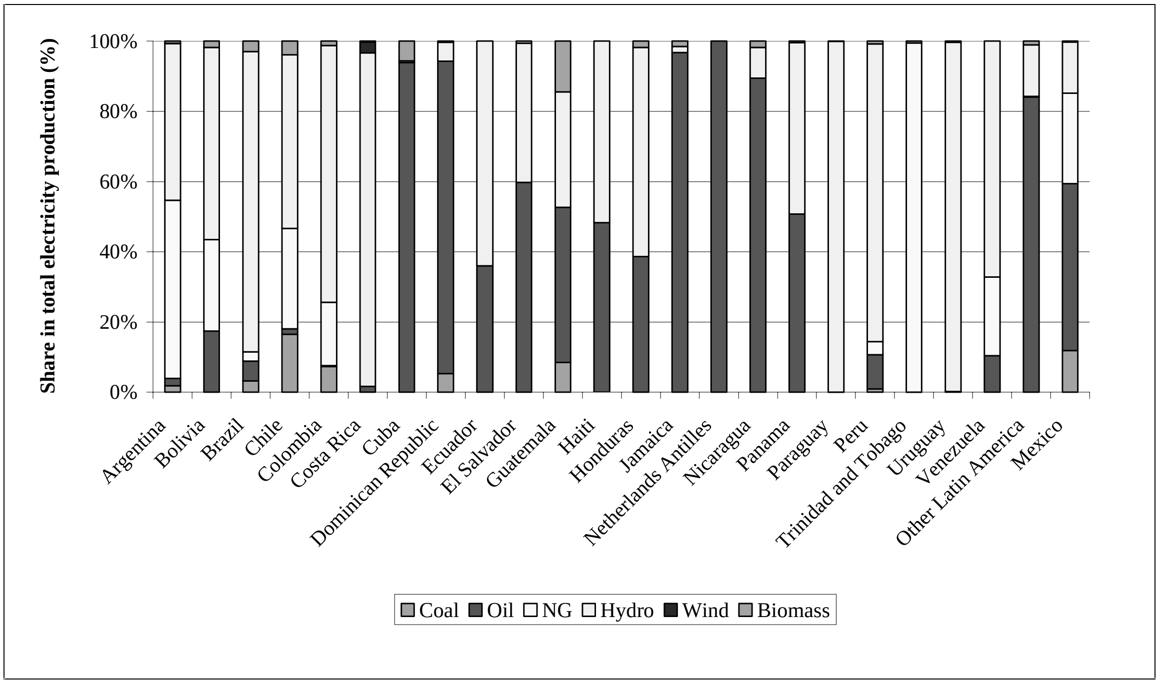
Figure 7: Production of electricity (TWh) in Latin America and Caribbean countries, 2001



Source: GHG Mitigation in Latin America And The Caribbean-Project And Sectoral Opportunities for Emission Reductions-Final Report, 2005; Ecofys; www.ecofys.nl; commissioned by the Inter-American Development Bank, Washington, D.C.

Figure 8: Installed production capacity in percentage terms, by type of country: Latin America and the Caribbean, 2001

[1] ECLAC/GTZ "Fuentes Renovables de Energía en América Latina y El Caribbean-Situación y Propuestas de Políticas," May 2004, produced by ECLAC and GTZ.



Source: GHG Mitigation in Latin America And The Caribbean-Project And Sectoral Opportunities for Emission Reductions-Final Report, 2005; Ecofys; www.ecofys.nl; commissioned by the Inter-American Development Bank, Washington, D.C.

In light of this situation, renewable energy must be considered merely one possible means of controlling atmospheric emissions. A major element in this control will inevitably involve, among other factors, the incorporation of technology.

In this respect, opportunities for technology transfer and knowledge from the United States and Europe may be helpful, as well as other cooperation activities combined with the use of incentives.

III. Regional assessment of local and global atmospheric issues

III.1 Principal focuses of action

Using the energy context outlined in the foregoing section as a point of reference, information on air quality management in the region, as it affects the atmosphere at both local and global levels, was collected.

Given the clear nexus between air quality and energy issues, this work examines the relative contributions of different sectors to atmospheric emissions.

Major responsibility in this area is increasingly associated with the transportation sector, whose activities have direct links with world oil consumption (see table 1).

Table 1: Trends in world oil consumption, 1980-2020 (Projected) and share attributable to transportation*

Year	Developing Countries		Industrialized Countries		World Total	
	Transportation	Total	Transportation	Total	Transportation	Total
Oil Consumption (Million Barrels per Day)						
1980	4.5	12.2	16.5	39.9	23.5	63.1
1990	6.8	17.0	20.9	39.0	31.0	66.0
1996	9.6	23.1	23.3	42.7	34.6	71.5
2010	17.0	37.0	29.9	50.1	49.9	93.5
2020	24.2	48.7	33.7	54.5	61.3	110.1
Annual Growth in Oil Consumption (Percent per Year)						
1980-1996	5.1	4.1	1.7	0.4	2.1	0.8
1996-2020	3.9	3.2	1.6	1.0	2.4	1.8

*Note: World totals include Eastern Europe and the former Soviet Union (EE/FSU).
Source: 1980-1996: Derived from Energy Information Administration (EIA), Office of Energy Markets and End Use, International Statistics Database and International Energy Annual 1996, DOE/EIA-0219(96) (Washington, DC, February 1998) 1996-2010: EIA, World Energy Projection System (1999).

Responsibility for atmospheric emissions in the industrial sector in Latin America and the Caribbean is concentrated in a relatively small number of industries—major industries associated primarily with thermal power generation.

By analyzing responsibility for emissions, it is possible to establish criteria for prioritizing emission-reduction measures. However, the scope of such action is determined by:

a) local factors such as:

a.1) meteorological and geographic factors affecting the dispersion of pollutants in individual regions;

a.2) the extent to which there is knowledge about the problem, in terms of air quality, allocation of responsibility for emissions, and delimitation of the impacts and consequences associated with pollution; and

b) global factors such as:

b.1) the degree of relative responsibility for greenhouse gas emissions as expressed in differential reduction targets; and

b.2) knowledge concerning the impact, consequences and control measures associated with greenhouse gas emissions.

III.2 Regional assessment of local atmospheric issues

III.2.1: Analysis of the role of factors determining dispersion of pollutants at the local level

i. Local air quality cannot be characterized by country, but rather requires disaggregation to the city level, where the principal problems are concentrated when there is a combination of high emissions and poor dispersion.

ii. There is a considerable gap between the scope of existing control measures in South American cities such as Santiago (Chile) and São Paulo (Brazil), as well as in Mexico City, versus cities in Central America and the Caribbean, where dispersion conditions are much more favorable.

Thus, it is essential, as points of reference in analyzing regional air quality management, to examine actions being taken (1) in Mexico City; (2) in Santiago, Chile;[2] and (3) in São Paulo, Brazil.

III.2.2: Analysis of the role of local knowledge regarding the problem

The following elements were selected in assessing the knowledge available within the region:

- Air quality regulations
- Air quality monitoring
- Air quality management instruments and target-setting
- Management of critical air pollution episodes
- Contribution of different sources of emissions to air pollution
- Assessment of prioritization measures and consideration of health impacts

III.2.2.1-Analysis of air quality regulations

Air quality regulation is relatively homogeneous in the region (see figures 9, 10 and 11), at least as regards particulate matter and ozone.

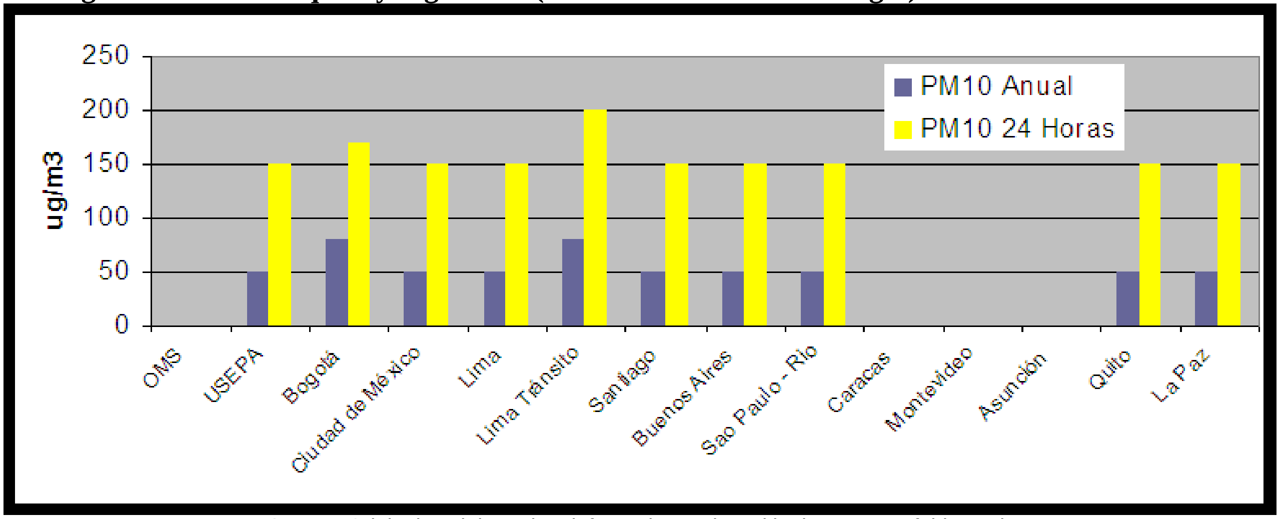
[Translated text to be inserted in figures below:
Annual PM10
24-hour PM10
WHO – USEPA – Bogotá – Mexico City – Lima – Lima tránsito – Santiago – Buenos Aires – São Paulo-Rio – Caracas – Montevideo – Asunción – Quito – La Paz

8-hour ozone
1-hour ozone

[2] Though Santiago, Chile has considerably less activity than Mexico City and São Paulo, it has comparable air pollution problems due to generally poor atmospheric dispersion conditions, which are particularly acute in the winter.

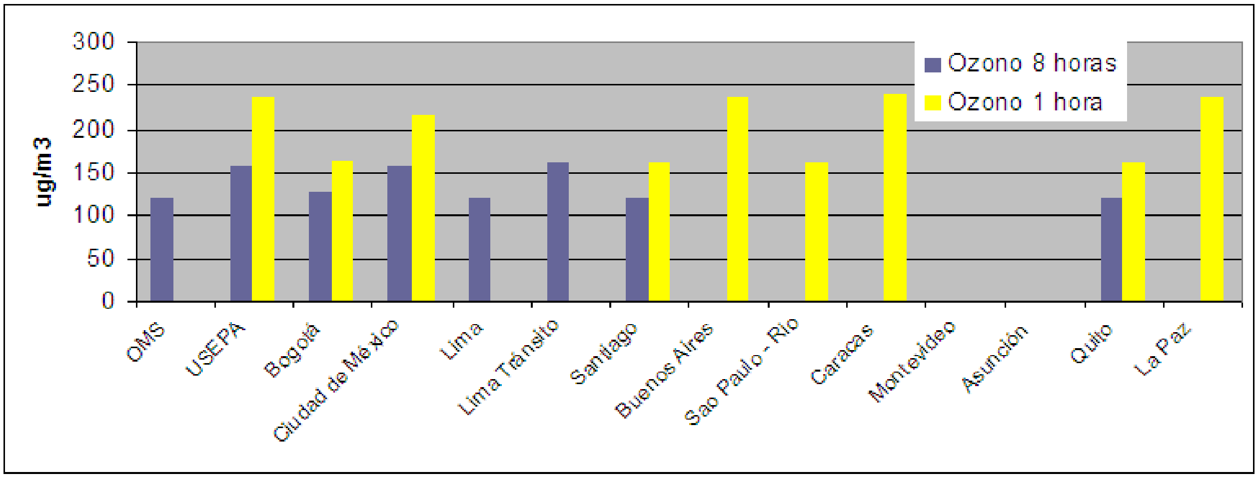
WHO – USEPA – Bogotá – Mexico City – Lima – Lima tránsito – Santiago – Buenos Aires – São Paulo-Rio – Caracas – Montevideo – Asunción – Quito – La Paz]

Figure 9: PM10 air quality regulation (annual and 24-hour averages) in Latin American cities



Source: Original work based on information gathered in the course of this study

Figure 10: Ozone air quality regulation (8-hour and 1-hour averages) in Latin American cities



Source: Original work based on information gathered in the course of this study.

[Translator's note: In Fig. 11, below, change commas to decimals where needed.]

Figure 11: Comparison of air quality standards in Latin American cities

	Period	WHO	USEPA	Bogotá	Mexico City	Lima Standard	Lima Transit Values	Santiago	Buenos Aires	São Paulo Rio de Janeiro	Caracas	Montevideo	Asunción	Quito	La P
SO_2	Annual	50	78 (30 ppb)	88 (34 ppb)	78 (30 ppb)	80	100	80 (31 ppb)	80	80	80			80 (18)	80
	24-hour	125	364 (1) (140 ppb)	367 (141ppb)	338(1) (130 ppb)	365 (1)		250(5) (96 ppb)	370	365	365			400	36
	3-hour		1300 (1) (500 ppb)	1420 (546 ppb)					1310					1500 (19)	
	1-hour							1000							
NO_2	Annual	40	100 (53 ppb)	98 (52 ppb)		100		100 (53 ppb)	100	100	100				
	24-hour			227 (121 ppb)											15
	1-hour	200		316 (168 ppb)	395(1) (210ppb)	200 (2)	250 (2)	400(5) (213 ppb)	376	320 (1)	100-300 (20)			100	40
CO	8-hour	10000	10000(1) (9 ppm)	12650 (11ppm)	12694(1) (11ppm)	10000		10000(5) (9 ppm)	10300	10000 (1)	10000			10000	100
	1-hour	30000	40000(1) (35 ppm)	44850 (39 ppm)		30000		30000(5) (26 ppm)	40100	39000 (1)	40000			40000	40000
O_3	8-hour	120	157(11) (80 ppb)	127 (65 ppb)	157(1) (80 ppb)	120 (2)	160 (2)	120(5) (61 ppb)							
	1-hour		235 (12) (120 ppb)	163 (83 ppb)	216(8) (110 ppb)			160	235	160	240			200	236
PM_{10}	Annual		50	50	50	50	80	50	50	50					50
	24-hour		150 (1)	170	150 (1) (16)	150 (3)	200 (3)	150 (6)	150	150					15
$PM_{2.5}$	Annual		15 (13)		15 (15)										
	24-hour		65 (14)		65 (15)										
TSP	Annual				75					80 (7)	75			80	75
	24-hour				260 (1) (17)					240 (1)	260			250	26
Pb	Quarterly										2				
	Annual	0,5						0,5							
	Monthly		1,5 (10)		1,5 (9)	1,5 (4)					1,5 - 2,0 (21)			1,5	1,5
	24-hour														

Source: Original work based on Comparative Information from *Cityes Socias* Clean Air Initiative, World Bank, 2003.

(1) Not to exceed more than once a year

(2) Not to exceed more than 24 times a year

(3) Not to exceed more than 3 times a year

(4) Not to exceed more than 4 times a year

(5) 99^{th} percentile of the average of 3 successive years

(6) 98^{th} percentile

(7) AGM: Annual geometric mean

(8) Not to exceed more than once every 3 years

(9) Not to exceed 3-month average

(10) Not to exceed 4-month average

(11) Average of the 4^{th} highest value for 3 successive years

(12) Not to exceed more than once a year. Applies where an 8-hour standard has not be promulgated.

(13) Average of 3 years

(14) 98^{th} percentile of 3-year average

(15) Proposed official standard

(16) Proposed official standard modifies this to 120 ug/m3

(17) Proposed official standard modifies this to 210 ug/m3

(18) Annual arithmetic mean. May never be exceeded.

(19) Only once a year

(20) The value of 100ug/m3 not to be exceeded in more than 50% of the measurements in a given year, with the maximum value of 300ug/m3 not to be exceeded in more than 5% of the measurements.

(21) The value of 1.5ug/m3 not to be exceeded in more than 50% of the measurements in a given year, with the maximum value of 2ug/m3 not to be exceeded in more than 5% of the measurements.

The homogeneity referred to above is a function of the fact that WHO recommendations were generally used as a basis for creating regulations (see table 2).

Table 2: WHO Ambient Air Quality Guidelines

Contaminant	Reference value	Time period
Ozone	120 ug/m3	8 hours
	0.06 ppm	
Nitrogen dioxide	200 ug/m3	1 hour
	0.11 ppm	
	40 to 50 ug/m3	Annual
	0.021 to 0.026 ppm	
Sulfur dioxide	500 ug/m3	0 minutes
	0.175 ppm	
	125 ug/m3	24 hours
	0.044 ppm	
	50 ug/m3	Annual
	0.017 ppm	
Particulate matter	[a]	
Carbon monoxide	100 mg/m3	15 minutes
	90 ppm [b]	
	60 mg/m3	30 minutes
	50 ppm	
	30 mg/m3	1 hour
	25 ppm	
	10 mg/m3	8 hours
	10 ppm	
Lead [c]	0.5 to 1.0 ug/m3	Annual

[a] A benchmark was not established for particulate matter, since there is no evidence of a threshold for the morbidity and mortality effects associated with it.

Source: WHO Ambient Air Quality Guidelines, most recent revision, 7 June 2004.

It should be noted that although no particulate-matter recommendation is defined, the setting of standards has also been based on a criterion of gradual change and on enforcement feasibility.

Subsequent definition of air quality regulations in the various countries, in addition to being based on WHO recommendations, has relied on previous regulation in the region.

Nevertheless, there are some differences in the region's regulations, such as:

- the persistence of air quality regulation for total suspended particulates (TSP), although some cities have eliminated such regulation; and
- proposals to set standards for fine fraction particulate matter (PM2.5), as in Mexico City.

In the case of Central America and the Caribbean, general lack of regulation is still the rule, with Costa Rica and El Salvador being exceptions.

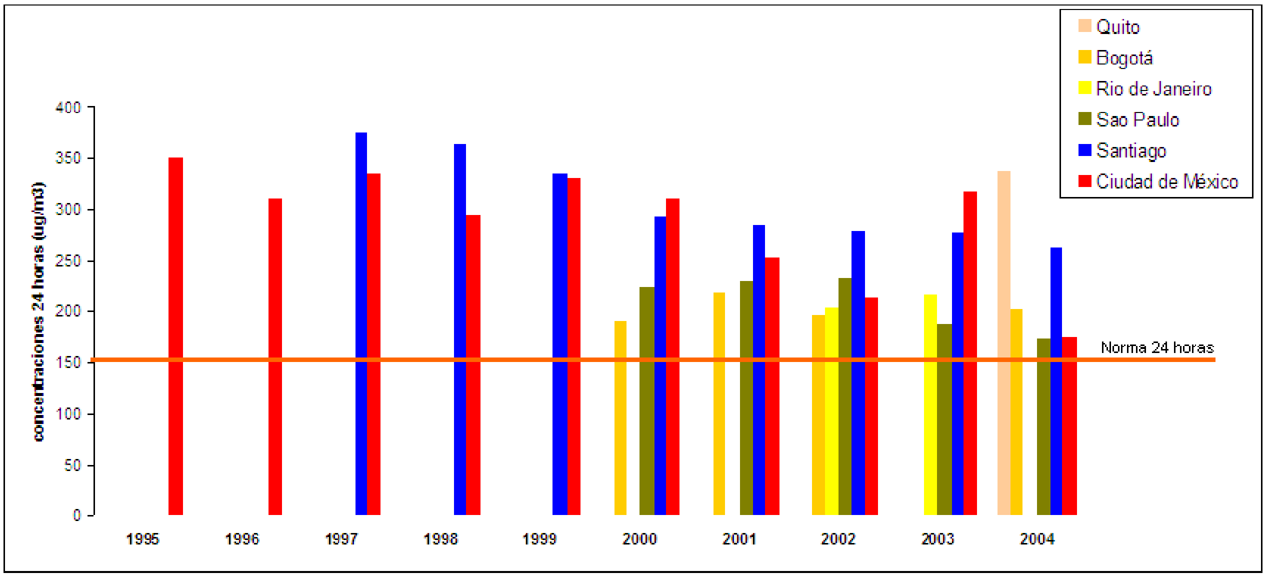
Another difference relates to whether or not percentiles are used in the regulations—a percentage value that defines the number of times that the standard may be exceeded, such that the figure may be exceeded a small number of times without constituting a violation.

III.2.2.2- Analysis of air quality monitoring

Turning now to air quality monitoring in Latin America and the Caribbean, rapid convergence may be observed in the systematic monitoring of concentrations of regulated contaminants. However, various different monitoring methods are in use, and there is a notable weakness in the reliability of the information gathered, thus making it difficult to conduct either absolute or comparative analyses for different cities.

For purposes of this report, comparative graphic information has been compiled. While the data have not been fully validated, nor have they been adjusted for meteorological factors, they are useful in providing an overview of monitoring in the region, as well as of aggregate trends in air quality standards (see figures 11, 12 and 13)

Figure 11: Changes in maximum 24-hour concentrations of PM10 in different Latin American cities



Source: Original work based on information gathered in the course of this study.

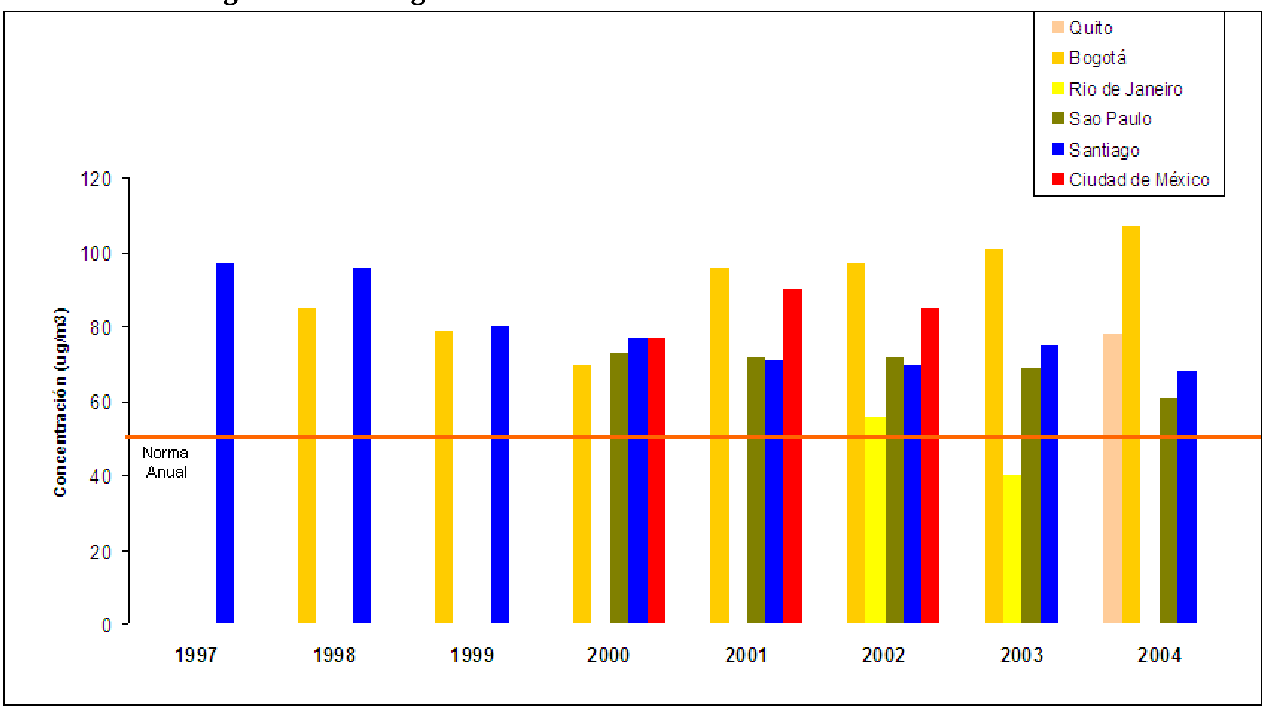
[Translated text to be substituted in figure 11:
Sao Paulo > São Paulo
Ciudad de México > Mexico City
concentraciones 24 horas > 24-hour concentrations
24-hour standard]

[Translated text to be substituted in figure 12:
Sao Paulo > São Paulo
Ciudad de México > Mexico City
concentración > concentration
norma annual > annual standard]

[Translated text to be substituted in figure 13:
Ciudad de México > Mexico City
Sao Paulo > São Paulo

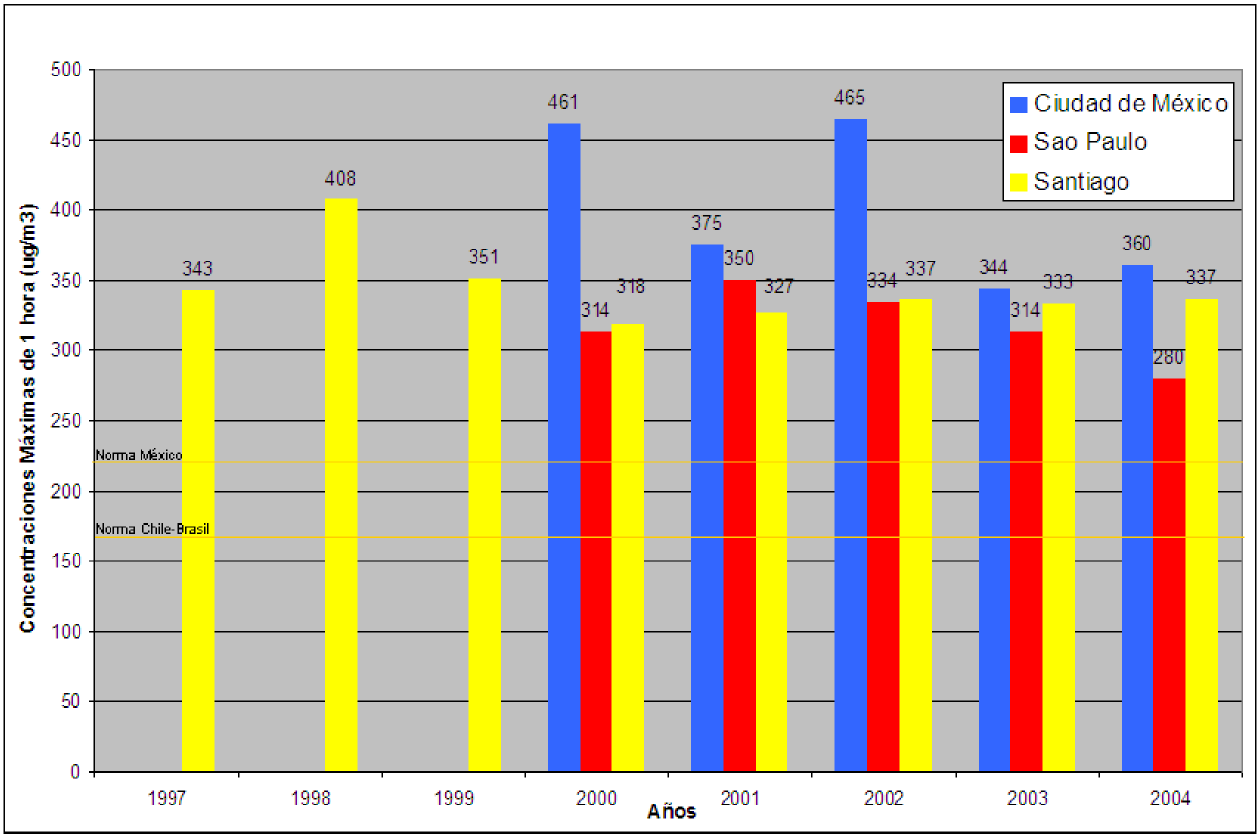
Concentraciones Maximas de 1 hora > Maximum 1-hour concentrations
Mexico standard
Chile-Brazil standard
Year]

Figure 12: Average annual concentrations of PM10 for different cities



Source: Original work based on information gathered in the course of this study.

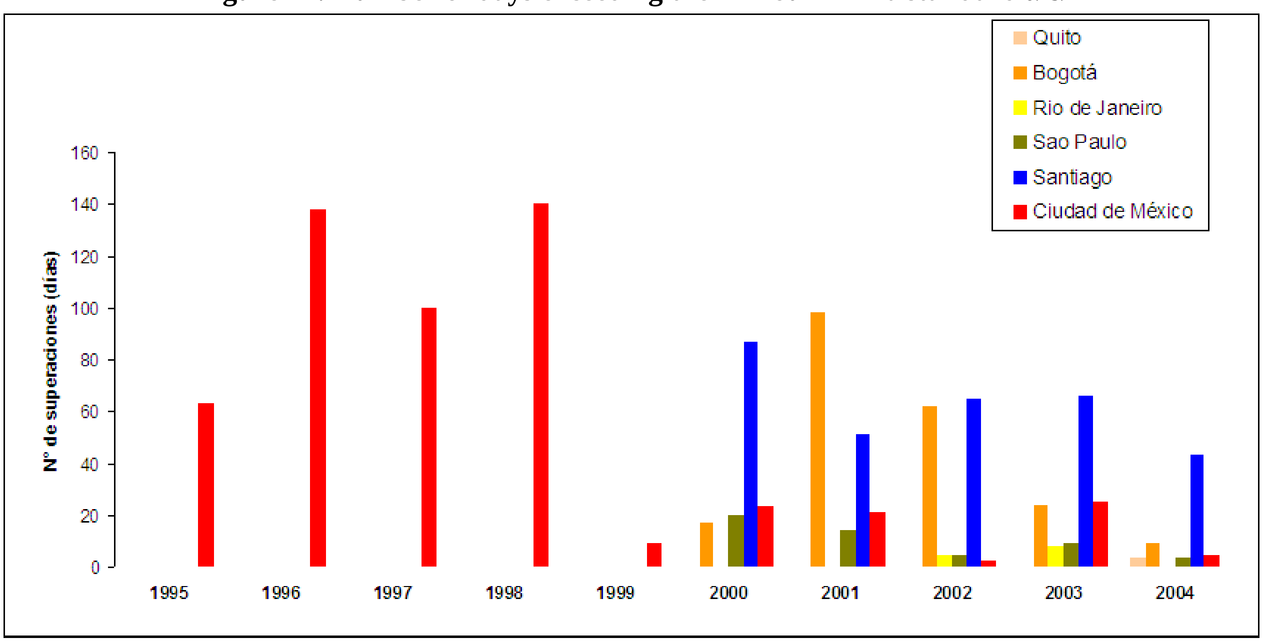
Figure 13: Maximum 1-hour concentrations of O_3 for different cities



Source: Original work based on information gathered in the course of this study.

Also of interest, in assessing enforcement of standards, is the number of times the standard is exceeded (see figures 14 and 15).

Figure 14: Number of days exceeding the 24-hour PM10 standard a/ b/



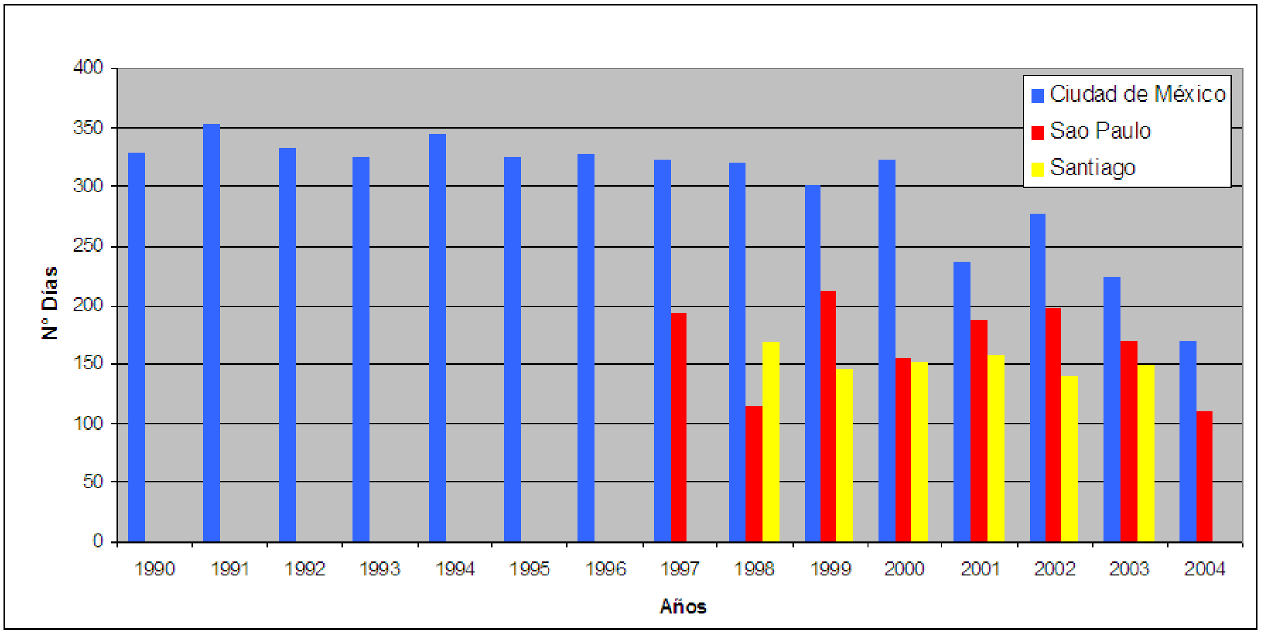
[TRANSLATED TEXT TO BE INSERTED IN FIG 14:
Sao Paulo > São Paulo

Ciudad de México > Mexico City
No de superaciones (dias) > No. of times exceeded (days)

a/ The situation in Lima is of concern, since there is evidence of average annual PM10 values of over 140 ug/m3, indicating the need to reinforce control measures.
b/ Information on some cities for which data were not directly obtained is provided in Annex II.

Source: Original work based on information gathered in the course of this study.

Figure 15: Number of days per year on which the hourly ozone limit was exceeded in different cities



Source: Original work based on information gathered in the course of this study.

[TRANSLATED TEXT TO BE INSERTED IN FIGURE 15:
Ciudad de México > Mexico City
Sao Paulo > São Paulo
No Dias > No. of Days
Años > Year]

This information indicates that:

- Systematic air quality monitoring is in place in South America's principal cities.
- The trends show a decline in concentrations of contaminants, especially as regards particulate matter and ozone.
- The exceeding of standards is widespread, suggesting a need for further air quality measures in the cities studied.
- Monitoring information for Central America and the Caribbean primarily employs passive pipes, which provide a good, low-cost spatial view of problems. The method has been used in Costa Rica, El Salvador and Nicaragua. Costa Rica, however, is soon to begin continuous monitoring, as are Panama, Tegucigalpa and San Pedro Sula (Honduras).
- Despite the difficulty of obtaining systematic information, and the absence of automatic, continuous air monitoring, one may conclude that the principal urban centers in Central America

and the Caribbean, to greater or lesser extent, have problems with PM10 particulate matter (and hence with PM2.5), with the case for Kingston, Jamaica, being particular notable.[3]

- Another problem is that monitoring has focused on specific emission sources, such as traffic, rather than on factors associated with exposure to contaminants by urban populations.
- For ozone, it is not clear that the problems are of a magnitude comparable to the particulate-matter problem, though less information is available on ozone.
- Ensuring the quality of the information gathered and the true representativeness of monitoring locations, especially as respects health impacts, remains a major challenge.

III.2.2.3- Air quality management instruments and goal-setting

As concerns mitigating or preventive measures in the region, information has been systematized for South America and for Mexico City (see table 3), as well as for Central America (see table 4), providing a disaggregation of the types of measures associated with efforts to reduce air pollution in selected cities.

Table 3: Air pollution reduction plans, contingency plans and transportation plans in Latin American cities

City	Air quality monitoring	Air quality problems		Pollution reduction plans	Contingency plans	Transportation plans
		PM10	Ozone			
Greater Sào Paulo	23 stations Continuous/manual	Daily and annual limits still being exceeded at some stations.	1-hour and level-1 alert frequently exceeded.	Since 1979, São Paulo has been implementing emission reduction plans for transportation and industry. With the 2004 saturation decree, compensation for emissions entered into effect.	Contingency plans for PM10 and Ozone. Restrictions for industry and transportation on emergency days.	São Paulo upgraded its public transportation system in the 1990s. Currently, programs for the massive incorporation of particle filters are being evaluated.
Greater Rio de Janeiro	32 stations Continuous/manual	Both PM10 standards still widely exceeded, though there is positive change.	1-hour limit frequently exceeded, reaching levels far in excess of standards.	Information not available.	Information not available.	Information not available.
Greater Santiago	7 stations Continuous	Both PM10 standards still widely exceeded.	1-hour limit exceeded more than 40% of days. No change in last 8 years.	Santiago has had emission reduction plans since 1990. In 1998, the formal pollution reduction plan was issued, and in 2004 it was updated.	Contingency plans for PM10. No ozone events. Restrictions for industry and transportation on emergency days.	Transantiago system to be completely implemented by October 2006. Includes the incorporation of over 2000 Euro III buses and particle filters in 2000 Euro II buses. It will reduce PM10 emissions by 75% from the baseline.
Greater		Annual	1-hour and	An air quality	No contingency plan.	No information

[3] Some of these statements are based on the document, "Informe de la misión de la consultoría de apoyo a la preparación de proyecto de Asistencia Técnica Preparatoria-enero 2005," commissioned by the Central American Commission for Environment and Development (CCAD) from the Swiss Agency for Development and Cooperation (COSUDE). The authors are René Grossmann (Terra Consult) and Gianni López (Centro Mario Molina, Chile).

Quito	4 stations Continuous	limit widely exceeded.	8-hour limits exceeded infrequently.	management plan for the 2005-2010 period was recently issued.	Air quality oversight is being made a priority in the initial phase. An ozone-prediction model is being implemented.	available on transportation plans. However, Quito is developing pilot plans to incorporate particle filters in the public transportation system.
Mexico City Valley metropolitan area	17 stations Continuous/manual	Daily and annual limits widely exceeded.	1-hour limit exceeded on over 90% of days between 1990 and 2000.	Measures began in 1987. In 1990 the Integral Anti-Pollution Plan (Plan Integral Contra la Contaminación, or PICCA) was issued. Currently, an air quality improvement program for the Mexico City Valley metropolitan area (PROAIRE) for the 2002-2010 period is being implemented.	Contingency plans for PM10 and Ozone. Restrictions for industry and transportation on emergency days.	In 2005, Mexico City inaugurated the first high-capacity segregated corridor on Avenida Insurgentes, with a total of 90 articulated Euro III buses. Plans are being developed for the massive incorporation of particle filters.
Bogotá	11 stations Continuous	Daily and annual limits widely exceeded. Increasing trend.	Insufficient information available.	There is no formal pollution reduction plan. Measures are being implemented for industry, mobile sources and fuels.	No contingency plan.	Transmilenio began implementation in 2000. It is currently in the second phase. The total reorganization of the transportation system is to take place in eight stages.
Greater Lima Callao	4 stations Manual PM10 not measured, only TSP.	TSP limits widely exceeded.	Little information available; no record of limits being exceeded.	An environmental cleanup plan (Plan de Saneamiento Ambiental, or PISA L-C) was created. The measures to be taken to minimize emissions include measurement of mobile sources, stationary sources and fuels; traffic/land-use regulation; tax measures.	Regulations exists for implementing contingency plans, but to date Lima does not have an established plan. There is no online monitoring.	Lima currently has Protransporte, an entity reporting to the municipal government and responsible for redesigning the public transportation system. Implementation of an initial high-capacity segregated corridor is being evaluated.
Montevideo	**No monitoring network**	No air quality standards. Assessment campaign conducted in 2004.		There are no emission reduction plans.	No contingency plan.	No transportation plan.

Source: Information collected during the course of the study.

Table 4: Lines of Action for Air Quality Management in Central American Cities

City	Monitoring	Air quality standards	Air quality	Pollution reduction plans	Plans' lines of action
San José (Costa Rica)	Campaigns have been carried out at various times. No monitoring network.	24-hour PM10: 150 ug/m3; annual average PM10: 50 ug/m3; 1-hour ozone: 160 ug/m3	High PM10 concentrations have been detected.	Agreement between public and private entities to improve air quality by integrating urban development and transportation planning with the 2003-2006 environmental policy.	Objectives of this agreement: • Modernize the vehicles in the city. • Urban development planning, and an integrated public transportation system. • Design an air monitoring system. • Design an air pollution reduction plan. • Design an air-quality oversight system.
Guatemala City	Monitoring	24-hour PM10:	High PM10 and	This is a general	

(Guatemala)	campaigns only.	150 ug/m3.	TSP concentrations have been detected.	environmental management policy, in which the atmosphere is one of the areas of concern.	
San Salvador (El Salvador)	Monitoring of particulate matter and gases. (There is no clear information on number of stations or measurement techniques.)	24-hour PM10: 150 ug/m3 average annual PM10: 50 ug/m3 8-hour Ozone: 120 ug/m3 Annual Ozone: 60 ug/m3	High PM10 and TSP concentrations (average annual PM10 for 1997: 63 ug/m3; 1998: 52 ug/m3)	National Air Quality Policy.	Establish guidelines for: • Industrial emissions control; • Fuel quality; • Vehicle standards.
Managua (Nicaragua)	Measurements carried out since 1995; network of 7 stations (Swisscontact cooperation project)	24-hour PM10: 150 ug/m3; average annual PM10: 50 ug/m3; 8-hour ozone: 160 ug/m3; 1-hour ozone: 235 ug/m3.	PM10 limits widely exceeded.	No pollution reduction plan.	No information.
Tegucigalpa (Honduras)	Monitoring of PM and gases (at least in the 1995-2000 period)	24-hour PM10: 150 ug/m3; average annual PM10: 50 ug/m3; average annual ozone: 60 ug/m3.	High PM10 and TSP concentrations. High ozone concentrations.	Some control measures.	a) Standards "for the regulation of emissions of polluting gases and smoke from automobiles" b) Air quality and atmospheric contamination regulations for stationary sources.

Source: Information collected in the course of the study.

Thus, systematic lines of action to address air pollution are in place in the principal cities of South America and in Mexico City, as shown by:

- increasing regulation of industrial emissions and automobiles;
- design and implementation of transportation plans to improve public transportation systems in the urban areas involved;
- promising initial results from emission control measures, with levels of exposure in the cities being comparable to exposure levels outside the cities.

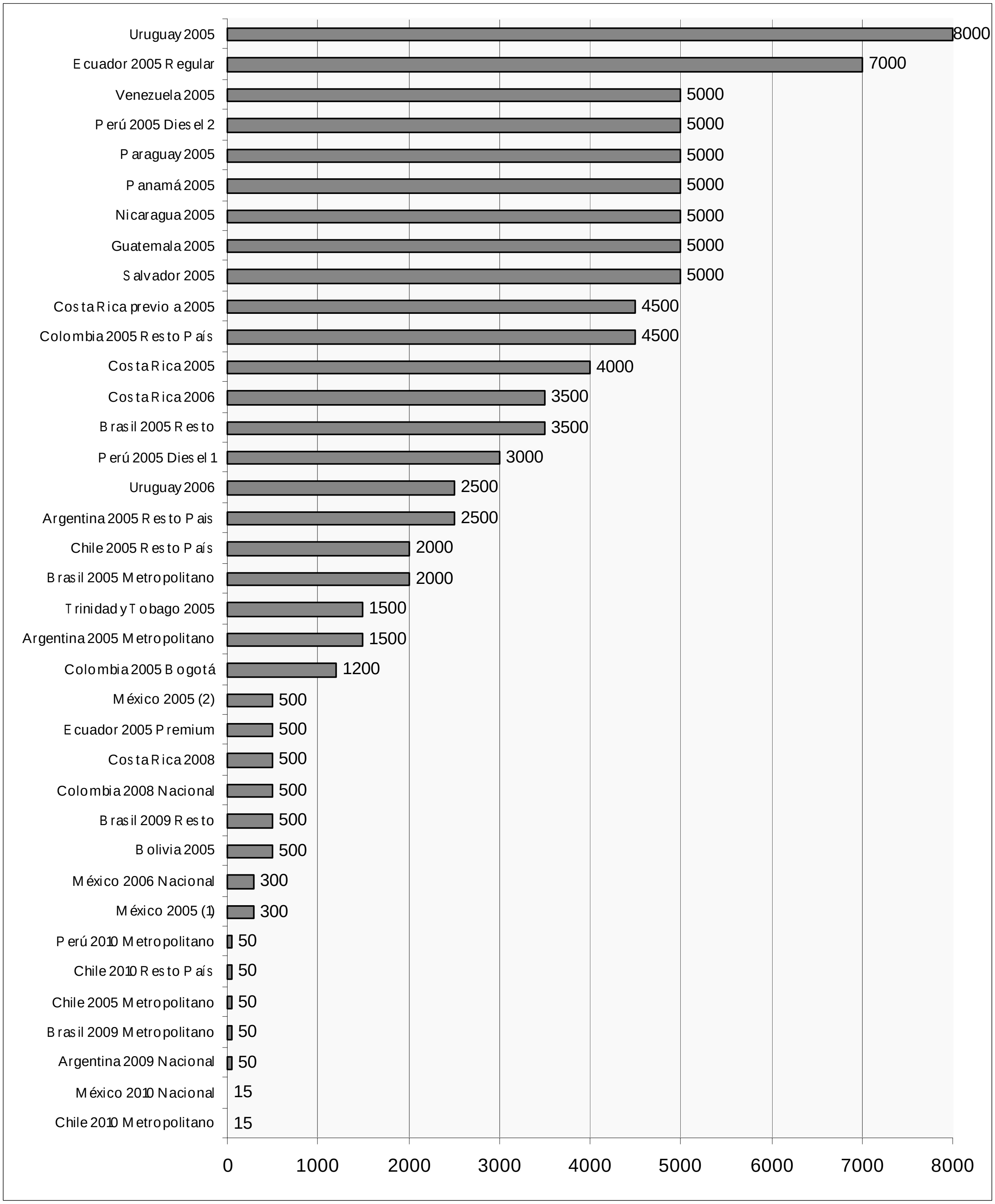
Central America presents a different situation. There, action focuses primarily on defining policies.

No lines of action are in evidence in the Caribbean, though preliminary information shows pollutant levels that suggest reason for concern, especially in terms of local exposure (in industrial areas, and via direct exposure to vehicular contamination).

One critical factor from the health perspective, complementing sector-specific emission standards, is fuel quality, which varies widely in the region.

By way of example, figure 16 shows the oil desulfurization situation for different countries in the region:

Figure 16: Sulfur content (ppm) in diesel fuel for different Latin American and Caribbean countries



Source: Original work based on information gathered in the course of this study.

[In chart, change:
Perú>Peru
...Resto Pais>Rest of Country
Brasil 2005 Metropolitano>Brazil 2005 Metropolitan area

Trinidad y Tobago>Trinidad and Tobago
Argentina 2005 Metropolitano>Argentina 2005 Metropolitan area
México Nacional >Mexico National
Perú 2010 Metropolitano>Peru 2010 Metropolitan area
Chile 2010 Resto Pais>Chile 2010 Rest of Country
Chile 2005 Metropolitano>Chile 2005 Metropolitan area
Brasil 2009 Metropolitano>Brazil 2009 Metropolitan area
México 2010 Nacional>Mexico 2010 National
Chile 2010 Metropolitano> Chile 2010 Metropolitan area]

In view of the weakness or absence of controls, it is important to identify issues that provide a basis for identifying challenges for the region:

- There is a need for controls on transportation emissions,[4] which result from:
    - very old vehicles, a consequence of permitting the importation of used vehicles from the United States;
    - high sulfur content of fuels;
    - lack of mechanical inspection requirements;
    - general lack of environmental regulation, with use of discarded buses from the United States with over 10 years' average use.
- Many cities need to deal with emissions from large agricultural burns, and from the increasing use of wood and biomass fuels.
- Attempts must be made to gradually address the industrial situation, which is notably unregulated.

Existing experience in Latin America, combined with other types of support, could contribute to action in the region. One possible form of synergy is the platform of projects and capacities being created around greenhouse gas emissions. This platform could bring important positive externalities in terms of controlling the emission of contaminants that impact the local environment.

For cities that are already implementing pollution reduction plans, an important factor is the type of control measures being employed. Most common are "command-control"-type measures, which set source-specific emission standards and rules.

The use of "economic incentives" is limited to a few cases, including attempts to install the Emissions Compensation System for Stationary Sources and New Activities—which is part of the pollution reduction plan for Santiago, Chile—in the region.

Given that experience with this type of mechanism has proven its effectiveness, it is important to strengthen it. Its advantages include simpler requirements, since the requirements are limited to defining emission limits, rather than providing a strict, differentiated description of all types of emissions.

Efforts to specify industrial processes individually tend to be costly, and usually fail to be implemented completely or within the timeframes established.

[4] The case of Costa Rica should be highlighted. Here, the transportation sector is estimated to represent approximately 75% of emissions.

Progress in defining the operational framework for the Clean Development Mechanism for the control of greenhouse gas emissions should facilitate the design of equivalent pollution control instruments at the local level.

Another important consideration in assessing air quality management in the region is the need for plans of action to include precise definitions of air quality targets and the period over which they are to be attained, rather than focusing on emission reduction goals.

The correlation between reduced emissions and air quality is another area in which regional capacities need to be strengthened in order to gain a better understanding of the issues.

Finally, one common element of the plans evaluated is that the large number of measures contrasts with the lack of prioritization. Priorities are essential, since focusing on a reduced number of high-impact measures is preferable to implementing a large number of measures that entail serious monitoring difficulties.

For example, Santiago's first pollution reduction plan, in 1998, included 240 measures, while the current plan, updated in 2004, concentrates on 10 priority measures, all focused on improving control of combustion processes.

The criterion for priority in this case was "estimated net benefit for the population's health," which led to consideration of the close relationship between improved health impact among the exposed population and measures to control combustion processes.[5]

III.2.2.4- Management of critical episodes of atmospheric pollution

The management of serious incidents of air pollution is a vital issue.

Experiences in Mexico City, Santiago, Chile and São Paulo indicate that timely communication and the implementation of control measures, limited initially to these crisis situations, create increased awareness on the part of all the relevant actors (public- and private-sector and the public at large).[6]

These measures, which restrict industrial operations and circulation of vehicles, usually precede efforts at long-term pollution reduction. The experience of cities that have implemented these strategies to address crises shows that restrictions on the sources responsible for the greatest emissions[7] can create major incentives for reductions.

Table 5 shows a summary of crisis management systems in three Latin American cities.

Table 5: Comparison of contingency plans: Santiago, Chile, Mexico City and São Paulo

City (Type of plan)	Monitoring	Air quality prediction model	Emergencies declared on the basis of:	Implementation of emission reduction measures

[5] This shows that it is possible to focus reduction efforts on fine fraction particulate matter, even when there is no corresponding air quality standard.
[6] Other conditions, such as social and political factors, along with a country's level of democratization, facilitate timely communication.
[7] Of note is the criterion of industrial stoppage during critical episodes implemented in Santiago, Chile during the 1990s. A list of the most polluting industries, in order of their respective levels of polluting, was created, and the stoppage was applied to the ones at the top of the list. This led a number of industries to compete to avoid landing on the top of the list and being subject to the associated stoppage, thus reducing considerably the sector's emissions. Similarly, the stoppage for vehicles applied to those without catalytic converters.

Greater Santiago (PM10 plan)	Continuous PM10 and O_3	PM10: YES O_3: NO	PM10: Predictive O_3: None	PM10: YES O_3: NO
Greater São Paulo (PM10/ozone plan)	Continuous PM10 and O_3	PM10: NO O_3: NO	PM10: Verification + Predictions on ventilation O_3: Verification + Predictions on ventilation	PM10: YES O_3: YES
Mexico City Valley metropolitan region (PM10/ozone plan)	Continuous PM10 and O_3	PM10: NO O_3: NO	PM10: Verification O_3: Verification PM10 and Ozone Combined	PM10: YES O_3: YES

Source: Original work.

Another consequence of the management of these episodes is greater public demand for higher levels of protection—usually protection from conditions associated with the parameters used to define environmental emergencies or contingencies.

Table 6 summarizes the threshold concentrations that define emergencies in selected Latin American cities.

Table 6: Comparison of levels for contingencies: Santiago, Chile, Mexico City and São Paulo.

Contaminant	City	Standard	Level 1	Level 2	Level 3
PM10 ug/m3 (24-hour average)	Santiago	150	195	240	330
	São Paulo	150	250	420	500
	Mexico City	150	240	263	375
Ozone ug/m3 (1-hour value)	Santiago	160	400	800	1.000
	São Paulo	160	200	800	1.000
	Mexico City	216	432	518	648

Source: Original work, based on data from CETESB, CONAMA Metropolitana de Santiago and Semarnat.

Santiago, Chile is the most demanding city in terms of PM10 thresholds, while São Paulo is the most lenient. In the case of ozone, São Paulo has the lowest thresholds for declaring emergencies, and Santiago the highest, except for Level 1, where Mexico City is higher.

Mexico City defines a combined PM10/ozone type of emergency, for which the threshold values are 486 ug/m3 for ozone and 188 ug/m3 for PM10.

A final element in the management of critical episodes is that they usually bring an improvement in air quality monitoring systems and produce a need for better information regarding specific sectors' respective responsibilities for pollution.

III.2.2.5- Contribution to pollution by different emissions sources

Most cities with air pollution reduction systems have undertaken information-gathering activities that concentrate on developing inventories of emissions for different contaminants. The immediate consequence of this is the initiation of sectoral regulation and the implementation of enforcement systems.

In Latin America, this has translated into emissions standards for automobiles and industries, often focusing on the control of particulate matter and certain ozone precursors, such as nitrogen oxides.

Nevertheless, it should be noted that emissions inventories are not a sufficient basis on which to assign responsibilities for the purpose of prioritizing different mitigation or prevention measures, and that other complementary instruments to reduce pollution are of great use.

One example of this is the role of the emission of certain gases, such as sulfur oxides, in forming secondary aerosols, a factor that can ultimately be a critical component of particulate matter. Thus, when the desulfurization of diesel fuel is being considered, it is more difficult to justify the reduction of sulfur content if only air quality norms for sulfur oxides are being considered. However, a physical and chemical profile of particulate matter shows the role of sulfates in generating breathable particulate matter and, in particular, the dangerous PM2.5 fraction.

The intersection between the information provided by emissions inventories and that generated in certain campaigns to provide physical and chemical profiles can accelerate the process of desulfurizing oil, which continues to be a priority measure to advance health in the region.

Installed capacity is insufficient to improve understanding of the problems associated with atmospheric contamination. Thus, this must be viewed as an indispensable factor in future recommendations on pollution management.

Moreover, even when low-cost efforts are involved, only certain cities have programs to provide physical and chemical profiling. Santiago's pollution reduction plan is notable in this respect. This information is a structural part of the findings associated with decisions to adopt measures, and has streamlined decisionmaking on the desulfurization of oil and on improving gasoline overall.

Certain high-cost measures in the region focus on developing and updating inventories, and on increasing the intensity of monitoring. The use of some of these resources for physical/chemical profiling, along with the design of more efficient monitoring systems,[8] could significantly enhance understanding of the problem and improve the efficiency and efficacy of the actions undertaken.

III.2.2.6 – Assessment of prioritization measures and consideration of health impacts

Finally, one strategically important analytic element in proper prioritization, and in the evaluation and selection of measures, is the examination of health impacts.

Though isolated efforts and a number of studies in the region can be found, the practice is far from being a regular decisionmaking criterion in the selection and prioritization of pollution reduction measures.

The General Economic and Social Impact Analysis associated with Santiago's updated pollution reduction plan represents an exception, providing for estimates of the health benefits to be anticipated from each type of measure under consideration.

This type of instrument, by facilitating the involvement of economic authorities in environmental decisions, streamlines the implementation of measures, while helping to prioritize those with the greatest net benefit.

[8] There is a high degree of dispersion of monitoring methods that could be subject to optimization in order to reduce costs, ensure the quality of data and improve representativeness.

III.3 Regional assessment of global atmospheric issues

As indicated in section III.1, the factors that determine the scope of actions undertaken in relation to global atmospheric issues are:

- share of responsibility for greenhouse gas emissions; and
- amount of knowledge concerning the impacts, consequences and control measures associated with greenhouse gas emissions.

III. 3.1: Analysis of relative responsibility for greenhouse gas emissions

Since the greatest contribution to greenhouse gas emissions comes from the industrialized countries,[9] they have taken the lead in defining types and intensity of mitigation activities.

The principal contribution of Latin America and the Caribbean has been in presenting a number of considerations that go beyond mitigation, as such, and place emission reduction in a context of sustainability that incorporates considerations of equity and broad societal coverage.[10]

The most important development in regard to global atmospheric issues during the last biennial period is the fact that the Kyoto Protocol entered into effect in February 2005.

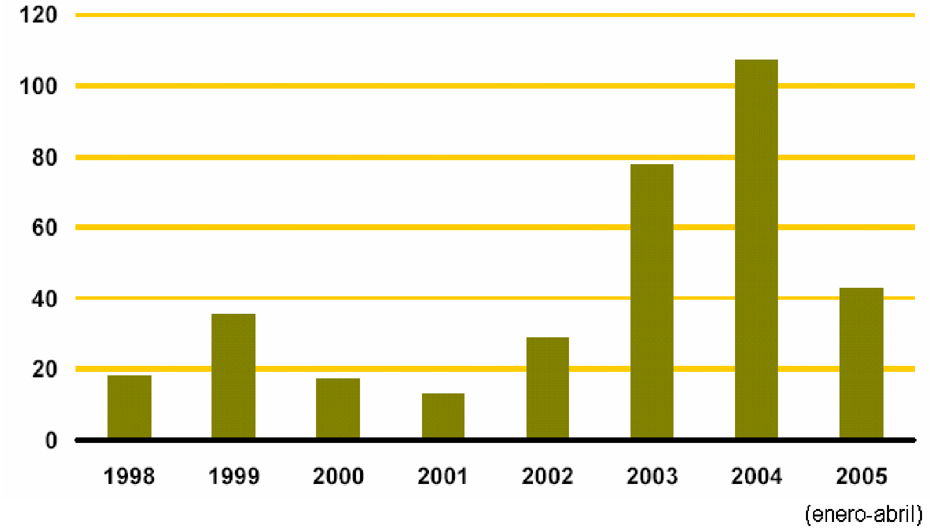
This has reduced uncertainty for operating under the Protocol's mechanisms, with the most notable advance being the strengthening of the Clean Development Mechanism.

The market in certified emission reduction (CER) has grown systematically in the last few years (see figure 17), and the region has played a leading role in this market since its inception (see figure 18).

Notably, the first CERs issued by the Clean Development Mechanism's Executive Board included two Honduran hydroelectric projects, Río Blanco and La Esperanza, which were funded by Finland and the Netherlands, respectively.

[9] Countries in Annex 1.
[10] Given the criteria used for the negotiation of the Kyoto Protocol, Brazil's relatively greater contribution to greenhouse gas emissions in the Latin American and Caribbean region has not been subject to emission reduction targets.

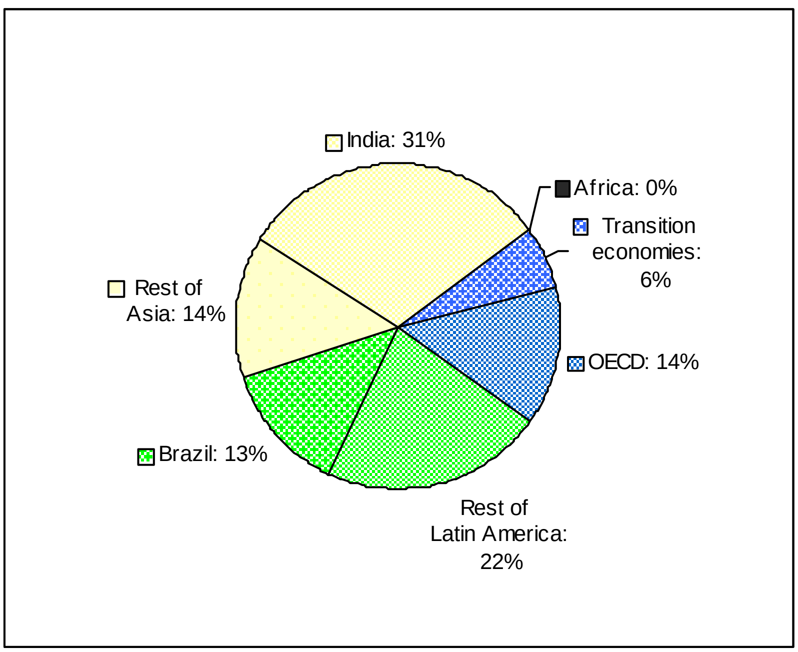
Figure 17: Annual volume of greenhouse gas emission reductions traded (millions of tons of CO_2-e)



Source: "State and Trends of the Carbon Market 2005," produced by IETA and the Carbon Fund (World Bank)

[TRANSLATED TEXT TO INSERT AT BOTTOM RIGHT OF FIGURE: (January-April)]

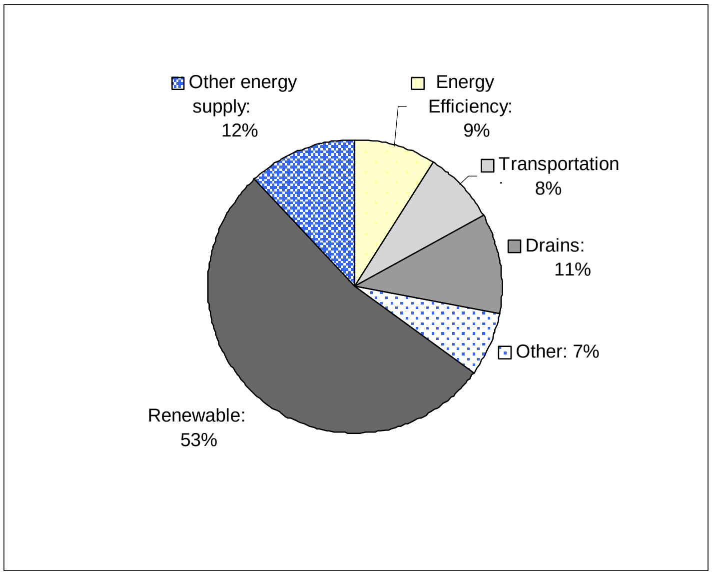
Figure 18: Location of emission reduction projects (January 2004 – April 2005)



Source: "State and Trends of the Carbon Market 2005," produced by IETA and the Carbon Fund (World Bank)

In terms of types of project, there has been a concentration on power generation using renewable energy sources (see figure 19).

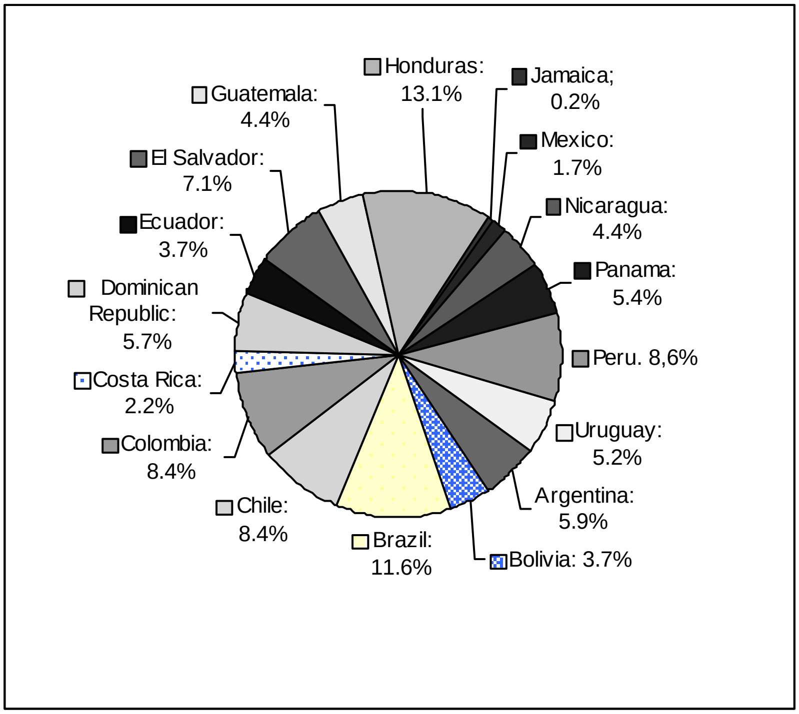
Figure 19: Types of emission reduction projects



Source: "State and Trends of the Carbon Market 2005," produced by IETA and the Carbon Fund (World Bank)

The share of the number of projects represented by different types of projects (see figure 20) is relatively homogeneous, with notable leadership on the part of countries such as Honduras, Brazil, Colombia and Chile.

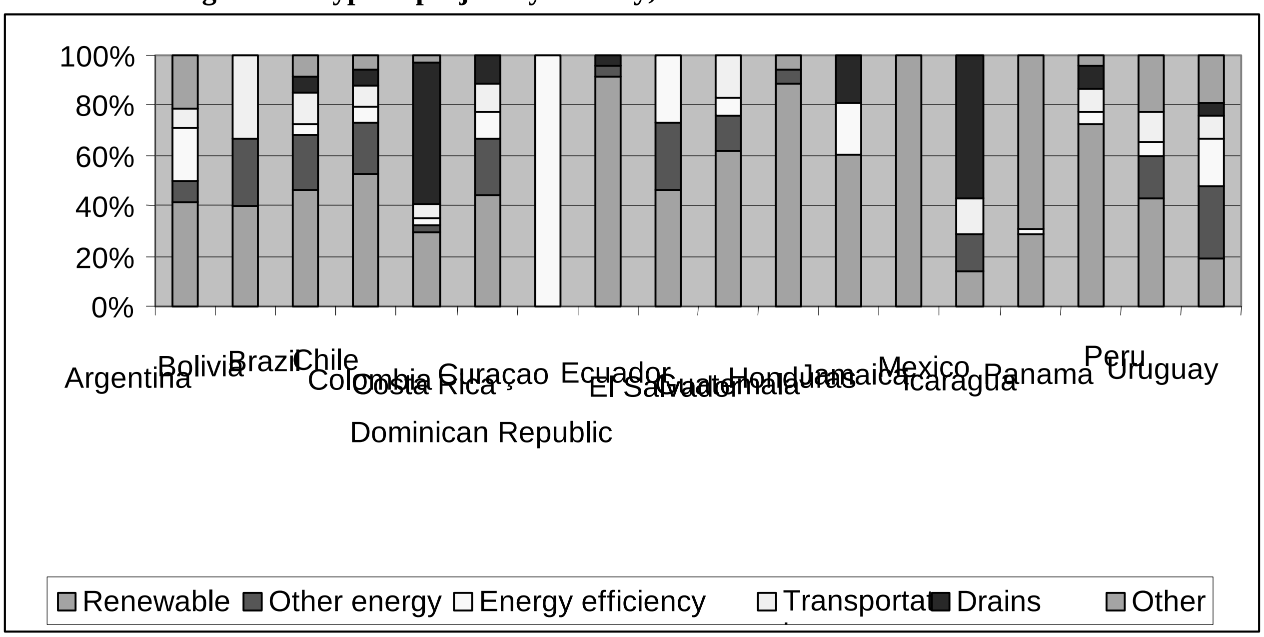
Figure 20: Countries' shares of emission reduction projects in the region



Source: Original work.

Figure 21 provides an integrated summary of type of project by country

Figure 21: Type of project by country, Latin America and the Caribbean



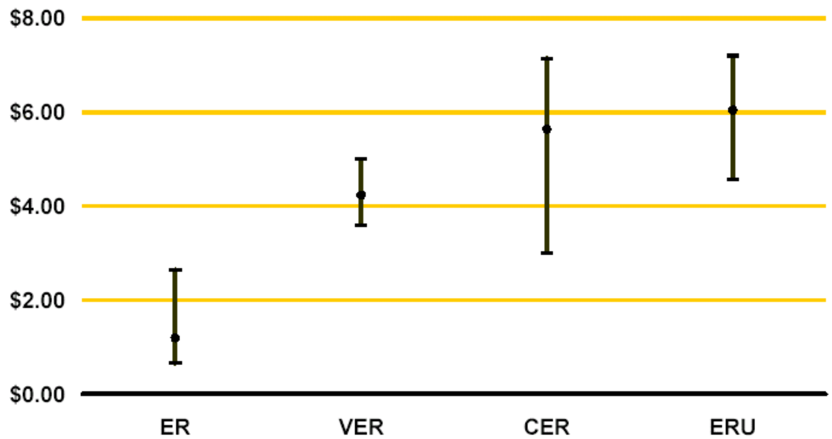
Source: Original work.

In regard to prices, the following factors may be noted:

– a sustained increase in the unit value (per ton of reduction) of transactions;

– better prices when the seller assumes the risk than when the purchaser does so (see figure 22); and
– a growing correlation between the prices of CERs and those observed in the European Union's Emissions Trading System.

Figure 22: PRICES FOR NON-RETAIL PROJECT-BASED ERs January 2004 to April 2005 (in U.S.$ per tCO_2-e)



Source: "State and Trends of the Carbon Market 2005," produced by IETA and Carbon Fund (World Bank)

Trading has shown a gradual transition toward better conditions for project owners than initially observed.

There has been a shift from:

– asymmetries of information between project owners and purchasers (especially in small and medium enterprises);
– high transaction costs;
– prohibitions on developing unilateral projects; and
– prices with little relation to the real marginal costs of reducing emissions;

to:

– more information for project owners;
– lower transaction costs (notably with special treatment for projects in the "small scale" category);
– the incorporation of unilateral projects; and
– incipient indexing of prices with respect to those seen in the European Union's Emissions Trading System.

In addition, there is greater knowledge of CER ownership schemes, while there has been an increase in the types of contractual formats used.

III.3.2: Analysis of the level of knowledge regarding the impact, consequences and control measures associated with greenhouse gas emissions

Though Latin America and the Caribbean have played a leading role in the world carbon market, certain factors are working against a greater leadership role.

While large firms tend to know about how to take advantage of opportunities associated with the carbon market, small and medium enterprises are often uninformed, making it difficult to realize the real—and as yet unexploited—potential for reduction in the region.

In contrast to the strong position of buyers in the region—acting either directly or via intermediaries—the project supply side has major weaknesses for small and medium enterprises, including an absence of clear pre-feasibility studies or pre-investment analyses relating to different phases of negotiation, along with lack of skills and know-how regarding the projects themselves.

This situation impedes negotiations, and has led to appearance, in the market, of major elements of differentiation by risk and type of project, among which the "Gold Standard Project"[11] category is of particular note. This category is strongly oriented to projects involving renewable energy and those with promising and major social impact.

The action of outside stakeholders, such as the World Bank and other representatives of purchasing funds, while bringing major benefits for sellers and buyers in this market, has focused on articulating demand. The Carbon Fund is an example of this.

From this perspective, the fact that project owners are more aware of the opportunities for better prices, or of overall selling conditions, introduces elements of distrust, when support in designing and understanding the project is exclusively on the side of the purchaser.

Consequently, there is a sharp contrast between the high demand for projects and the limited supply of well-defined projects that have received a positive assessment. An additional element is the bureaucracy associated with this mechanism, which deals with project cycles and involves a concentration of roles in the Executive Board, thus creating an unpropitious context for consolidating the market.

Finally, one important problem, in terms of assessment, is the absence of more thorough study and analysis regarding economic valuation of the potential impacts of climate change in the region, especially in the Caribbean—a new regional challenge.

Positive signs include:

-- the progress made at the Montreal Summit in 2005 on the plan of action for the second phase of the Kyoto process, with an agreement to begin negotiations for the second compliance period of 2013-2017, for which the parties were invited to contribute ideas before 15 April 2006 (a fact that will contribute to reducing the uncertainty in the market, while inevitably compelling the region to face the challenge of defining national goals for possible future compliance periods);

– the agreement of the Executive Committee of the Clean Development Mechanism regarding a retroactive registry, according to which projects that were in the validation phase as of 31 December 2005 can generate credits retroactively for the period of 1 January 2000 to 18 November 2004, provided that they register before 31 December 2006; and

– the significant fact that projects with new methodologies, submitted before 31 December 2005, can also opt for retroactive credits.

[11] http://www.reeep.org/media/downloadable_documents/g/n/Gold_Standard.pdf

This modification of the Clean Development Mechanism rules, added to elements such as the acceptance of unilateral projects, the growing use of strategies for the grouping of projects, and greater flexibility in terms of additionality, is expected to generate a significant volume of additional CERs.

The major challenges are to provide stronger support for the development of project capacities—from the supply side—through:

- focusing on the use of approved methodologies and the development of new ones;
- greater resources for sectors such as agriculture, forestry and, in particular, transportation,[12] for the creation of new methodologies;
- synergy between trade liberalization in many of the region's countries and the possibility of developing strategic partnerships for the transfer of knowledge and know-how in areas such as technology.

[12] Of great interest is the agreement reached by the World Bank for the segregated high-capacity corridor on Avenida Insurgentes in Mexico City.

IV. Challenges and opportunities: recommendations for policies and instruments

Based on an assessment of the information collected, a series of challenges and opportunities can be identified.

These are associated, in many cases, with multiple areas, and can be approached initially from a horizontal perspective, moving then to an approach that disaggregates the different areas.

IV.1 Horizontal challenges and opportunities

In the areas under consideration, at least three common approaches to action can be viewed as challenges for the region:

IV.1.1 Greater efforts to build capacities

One key issue in the region is improving the use of resources allocated to the mitigation and prevention of environmental impacts. However, environmental issues coexist with a number of other challenges of equal or greater importance, such as overcoming poverty and creating jobs. Improving the use of resources is inevitably limited by the capacities in the region, where different approaches, activities and results are found in cities and countries with common problems.

It would be beneficial for the region to establish partnerships for building capacities, following a more systematic approach such as training professionals and experts in areas associated with the environment.

Building capacity requires both public and private efforts; when done successfully, it can reduce the vulnerability of action to political change, a frequent factor in the region.

IV.1.2 Greater development and availability of instruments

Though there are different kinds of environmental institutions in the region, ranging from coordinating entities without ministerial rank to institutions with major ministerial authority in the areas of environment and energy, there is a critical need to have a broader horizontal repertoire of instruments for addressing the issues.

This challenge, which is complementary to the capacity challenge, is associated with the fact that there has been little development of economic incentives and of more-flexible mechanisms. The region also tends to have highly rigid regulatory schemes, with problems in the areas of monitoring and control.

In the different countries, the low level of involvement, on the part of economic authorities, in environmental issues is associated not only with compartmentalization and lack of policy integration, but also with the absence of management instruments to make the environment a principal focus for economic and other types of development.

Examples of such instruments include tools used for the economic valuation of health impacts associated with investment decisions, and consideration for promoting and developing renewable energy sources, as an aspect of strategic discussions on the long-term energy supply.

IV.1.3 Greater private sector involvement

Firms that produce products and services are increasingly incorporating the concept of social responsibility in their activities. This is the result of a growing awareness in the private sector that long-term business sustainability correlates directly with environmental sustainability at the local level (principally associated with siting), as well as at the global level.

Thus, one major challenge is to encourage the increasing involvement of the private sector in the issue of sustainability at various levels.

Such involvement requires, in addition to regulatory control and mitigation activities, increased transparency in communications regarding environmental action, thus helping to build greater capacity and develop policies involving public-private cooperation.

These three horizontal approaches can be enhanced by the opportunities of growing economic integration among countries and regions, typically including cooperation, technology and skills transfer, as well as opportunities for partnerships.

Using this horizontal approach as a starting point, we can now examine challenges and opportunities in specific areas:

IV.2 Specific challenges.

IV.2.1 Challenges in the energy area

Based on the world energy situation and its implications for the region, the growing demand for energy and the need to ensure supplies can be expected to continue, along with sustained increases in oil prices.

While this scenario provides a greater role for the region's renewable energy matrix, the use of coal is also expected to regain importance for power generation, with a corresponding increase in control of associated atmospheric emissions.

Thus, the region's challenges are part of a scenario featuring greater compatibility between the challenges of economic growth and those of local and global pollution reduction.

This, in turn, provides opportunities for incorporating better technologies—changes that can be driven by the private sector and/or by governmental decisions. These may involve:

i. instruments such as the Clean Development Mechanism, for use in designing projects;
ii. partnerships for technology transfer in the context of the region's cooperation and free trade agreements.

These same opportunities can be used to increase the role of renewable energy in the region. Though representing less volume than other energy sources, the number of projects of this type could be significantly increased.[13] Thus, one challenge for the 2006-2007 biennium is for wind and biomass power generation to be developed to match the region's current use of hydroelectric power.

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[13] For the purpose, a series of documents on the elimination of barriers has been produced by ECLAC with international cooperation support, and is available at **http://www.eclac.cl/cgi-bin/getProd.asp?xml=/publicaciones/xml/9/13409/P13409.xml&xsl=/drni/tpl/p9f.xsl&base=/drni/tpl/top-bottom.xslt** **and** **http://www.eclac.cl/publicaciones/RecursosNaturales/2/LCL2132PE/Lcl2132i.pdf**

In order to progress in this direction, capacity must be developed. This can occur through joint ventures for cooperation, drawing on experiences in Europe and the United States.

At the same time, a critical issue for local health and environmental impact is the land-use issue associated with siting decisions, particularly in relation to thermal power plants.

Beyond the need for land-use planning, it is important to internalize, in relevant decisions, instruments that lead to negative (principally health-related) externalities. Thus, greater efforts are needed to strengthen instruments of economic valuation and incentives associated with siting decisions.

This can more easily be accomplished by establishing regulations for new activities than by using regulations retroactively for existing activities or sources.

Another important element, in terms of energy, is the transportation sector, where major regional challenges persist.

While there are a number of concurrent projects to optimize public transportation systems in the region, these projects entail a number of challenges:

- the need to integrate prior experience when developing and implementing transportation plans, so that cities in the region may benefit from such experience;
- supporting the development of public transportation plans in cities without such plans, especially in Central America and the Caribbean;
- moving forward in regulating the importation of used vehicles, including consideration of measures such as age limits and emission standards.

IV.2.2 Local atmospheric challenges

The region faces numerous challenges and opportunities in this area.

These may be considered in four main categories.

IV.2.2.1 Availability of information

i. Enhance efforts in the cities to make available more information regarding monitoring of health effects and the associated economic valuations.
ii. Supplement the information from air quality monitoring and emission inventories with information allowing for the allocation of sectoral responsibility for emissions, including campaigns to profile particulate matter[14]--the principal contaminant in the region's cities.
iii. Optimize the region's monitoring systems to improve their effectiveness in representing the interests of the population vis-à-vis health effects, and to introduce quality assurance mechanisms.
iv. Implement the collection of information on atmospheric contamination levels within homes.
v. Advance in the systematic collection of environmental management information at various levels, in order to facilitate action by municipalities beginning work on atmospheric emissions control.[15]

[14] This approach also facilitates an emphasis on air quality targets over emission reductions goals in pollution reduction plans and strategies.

IV.2.2.2 Air quality regulations

Though air quality regulations appear to be fairly homogeneous in the region, particularly with respect to breathable particulate matter and ozone, major challenges remain:

i. In view of the lack of threshold levels for particulate matter in the recommendations of institutions such as WHO, gradual progress must be achieved in regulating the finer fractions of this contaminant, such as PM2.5, with the greatest impact on health.
ii. There needs to be work to bring greater homogeneity to nomenclature and criteria for reports on local air quality, so as to facilitate comparative analysis between cities.
iii. Threshold levels for environmental contingencies or critical episodes must be incorporated in air quality standards.

IV.2.2.3 Management instruments and priority action

As regards instruments, the following challenges remain:

i. To broaden the spectrum of instruments regularly used for environmental management, shifting from the classic command-control measures to mixed repertoires that incorporate economic incentives.

   In addition to clean-production agreements, instruments such as tradable emissions permits should be studied more thoroughly in designing regulations, particularly in relation to the industrial sector, where specific regulations for each type of process may be costly and inefficient.

ii. Introduce elements to prioritize pollution mitigation and prevention measures as part of air pollution control and prevention plans and strategies, taking into account the health impacts.

iii. Encourage the development of transportation plans, especially those focused on optimizing public transportation systems.

iv. Promote regulation and control of vehicular emissions, with special emphasis on regulating importation of used vehicles into the region.

v. Develop instruments to improve the quality of fuels, both through oil desulfurization and by reducing the content of specific toxic substances in gasoline.

vi. Encourage the creation of air pollution contingency or emergency management plans.

IV.2.2.4 Institutional challenges

i. Strengthen monitoring and control of compliance with environmental requirements.
ii. Increase the complementarity of institutional policies in the areas of air quality and economic policy.

IV.2.3 Local atmospheric challenges

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[15] There are opportunities along this line in connection with the activities that outside entities such as the World Bank and the IDB carry out in the region. The information collection efforts of the Clean Air Initiative, led by the World Bank, is of particular note.

The challenges and opportunities in this area have been grouped as follows:

IV.2.3.1 Challenges relating to the availability of information

i. Increase efforts to more precisely identify the potential of different types of projects to reduce greenhouse gas emissions.
ii. Increase efforts to more accurately estimate the possible impacts of climate change in the region, including the economic valuation of impacts.
iii. Encourage the development of instruments or entities to build capacities that facilitate better use of the opportunities associated with Kyoto Protocol instruments, particularly opportunities for technology transfer and building of capacities linked to the Clean Development Mechanism, looking beyond the area of emission reductions.

IV.2.3.2 Challenges in developing instruments

The principal challenge here is to continue strengthening the Clean Development Mechanism and to reinforce the leadership that the Latin American and Caribbean region has shown in this area.

This requires:

i. addressing the intersection between methodologies currently approved by the Mechanism's Executive Board and project development opportunities; and
ii. encouraging the development of new methodologies for existing projects in the region.

Such opportunities are implicit in the persisting disparity between countries' marginal costs of reducing emissions—in countries where emission reduction targets exist—and corresponding costs in countries that do not have such targets.

This fact is an important element in strengthening the mechanism. It was present in COP 11, and paved the way for agreements regarding a second compliance period.

Considering opportunities for technology transfer and better operational practices at various levels, the Clean Development Mechanism may be associated with the ongoing building of capacities in energy-related areas, especially in terms of renewable energy and energy efficiency, which have been insufficiently developed in the region.

One concrete opportunity in this regard, at work in the region, is the gradual development of entities under the "ESCO"[16] approach.

IV.2.3.3 Institutional challenges

i. Strengthen the region's position vis-à-vis the international bureaucracy associated with the Kyoto Protocol and its instruments.

   There is a marked need to streamline the operation of the Clean Development Mechanism and optimize the concepts of additionality and greater flexibility.

   The role of designated national authorities must be strengthened in this connection, in order to facilitate the development of projects.

[16] Energy Service Company

ii. Encourage the development of transaction systems and the capacity to monitor Clean Development Mechanism projects.

This may provide synergy with the challenges of optimizing enforcement capacity for the control of local emissions of atmospheric contaminants.

ANNEX I: Changes in prices of U.S. energy (Nominal Dollars)

(Energy Information Administration\Short-Term Energy Outlook -- December 2005)

	2004				2005				2006				Year		
	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	2004	2005	2006
Crude Oil Prices ($/barrel)															
Imported Average [a]	31.12	33.97	38.64	39.91	41.21	45.91	56.69	53.20	55.42	56.00	56.91	57.00	35.99	49.31	56.34
WTI [b] Spot Average	35.24	38.35	43.87	48.31	49.73	53.05	63.19	60.19	62.42	63.00	63.92	64.00	41.44	56.54	63.33
Natural Gas ($/mcf)															
Average Wellhead	5.22	5.56	5.28	5.92	5.70	6.20	7.90	10.38	10.51	7.24	7.46	8.50	5.50	7.48	8.42
Henry Hub Spot	5.81	6.29	5.66	6.47	6.62	7.14	9.83	12.26	11.48	8.04	8.19	9.52	6.06	8.88	9.30
Petroleum Products ($/gallon)															
Gasoline Retail [c]															
All Grades	1.70	1.96	1.93	1.98	1.98	2.23	2.59	2.43	2.36	2.54	2.50	2.42	1.89	2.31	2.46
Regular	1.65	1.92	1.89	1.94	1.94	2.19	2.56	2.38	2.32	2.50	2.46	2.38	1.85	2.27	2.41
Distillate Fuel															
Retail Diesel	1.59	1.72	1.83	2.10	2.07	2.26	2.56	2.72	2.50	2.52	2.54	2.61	1.81	2.41	2.54
Wlsle. Htg. Oil	0.95	1.00	1.18	1.37	1.39	1.53	1.80	1.82	1.79	1.75	1.76	1.82	1.12	1.63	1.78
Retail Heating Oil	1.42	1.41	1.52	1.80	1.85	1.95	2.24	2.27	2.28	2.21	2.14	2.27	1.54	2.03	2.25
No. 6 Residual Fuel [d]	0.70	0.72	0.74	0.80	0.82	1.00	1.14	1.19	1.21	1.18	1.18	1.20	0.74	1.05	1.20
Electric Power Sector ($/mmBtu)															
Coal	1.30	1.32	1.37	1.41	1.48	1.54	1.54	1.56	1.60	1.61	1.60	1.61	1.35	1.53	1.61
Heavy Fuel Oil [e]	4.50	4.90	4.91	5.26	5.38	7.28	7.28	7.38	7.66	7.57	7.67	7.81	4.86	6.87	7.68
Natural Gas	5.69	6.04	5.73	6.36	6.42	6.87	7.88	9.62	10.64	7.58	7.76	8.95	5.94	7.75	8.55
Other Residential															
Natural Gas ($/mct)	9.82	11.33	13.49	11.30	10.96	12.52	15.69	15.26	15.28	13.35	15.44	13.69	10.74	12.77	14.52
Electricity (c/Kwh)	8.37	9.09	9.39	8.78	8.67	9.51	9.88	9.63	8.96	9.71	9.97	9.72	8.92	9.44	9.59

[a] Refiner acquisition cost (RAC) of imported crude oil.
[b] West Texas Intermediate.
[c] Average self-service cash prices.
[d] Average for all sulfur contents.
[e] Includes fuel oils No. 4, No. 5, and No. 6 and topped crude fuel oil prices.

Notes: Prices exclude taxes, except prices for gasoline, residential natural gas, and diesel. Minor discrepancies with other published EIA historical data are due to rounding. Historical data are printed in bold; estimates and forecasts are in italics. The forecasts were generated by simulation of the Short-Term Integrated Forecasting System. Mcf= thousand cubic feet. mmBtu=Million Btu.

Sources: Historical data: EIA: latest data available from EIA databases supporting the following reports: *Petroleum Marketing Monthly*, DOE/EIA-0380; *Natural Gas Monthly*, DOE/EIA-0130; *Monthly Energy Review*, DOE/EIA-0035; *Electric Power Monthly*, DOE/EIA-0226.

ANNEX II. Supplementary air quality information

In the time available for collecting information required to evaluate cities' air quality and the corresponding measures to address pollution problems, it was not possible to obtain responses from all of the entities contacted, nor to process all information received. For a significant number of capitals, such as Buenos Aires, Caracas, Asunción and La Paz, as well as some Central Americas and Caribbean capitals, it has not been possible to present a detailed report on the available information. The table below was taken from a study commissioned by the IDB and published in 2005. It contains the most recent information for various cities not covered in the present report.

Concentrations of PM10 and TSP in Latin American cities

Country	City	Period [a]	PM10 Annual Average ($\mu g/m^3$)	TSP Annual Average ($\mu g/m^3$)
Argentina	Buenos Aires	1997-1998		188.5
	Cordoba	1987-1992		154
	Mendoza	1997-1998		31.2
Brazil	Curitiba	2000-2001		51
	D. Caxias	1986-1993		115.6
	Itaguai	1989-1996		35.6
	Rio De Janeiro	1986-1996		128.1
	S.J. Meriti	1986-1996		182.4
Costa Rica	Heredia[a]	1996	76.5	228.3
	San Jose[a]	1996-1999	53	200
Ecuador	Guayaquil[a]	1994-1995		120.7
	Quito	1994-1998	59.5	200.1
El Salvador	San Salvador[a]	1996-1999	62.7	189.4
Honduras	Tegucigalpa[a]	1994-1999	79.4	452.7
Nicaragua	Managua[a]	1996-1999	60.9	313.8
Peru	Lima[a]	1999	146.4	165.8
Uruguay	Montevideo	1998-1999		253.3
Venezuela	Caracas	1986-1995		67.8

[a] The period for measurements of PM_{10} and TSP is not necessarily the same. For example PM_{10} in Lima was measured for 1999 whereas TSP was measured between 2000 and 2002. For Heredia TSP was measured between 1996 and 1999, while San Jose was measured for 1993-1999: Quito's data for TSP is for 1994-1998. Finally in Tegucigalpa TSP is for 1994-1999 and PM_{10} for 1995-1999.

Source: Urban Air Quality and Human Health in Latin America and the Caribbean, IDB study, 2005.