

# Ground-Level Ozone

A Negotiated Rule-Making Process on Varara's Air Pollution Crisis

## General Information

The Mayor of Varara knew what the call was about before he picked up the receiver. It was **early June 2002**, and the city was in the midst of its worst air pollution crisis ever. At least three environmental contingencies for **ground-level ozone** had been declared in each of the past four weeks. With a quick glance at the smog outside his penthouse office window, the Mayor barely listened to the voice of the young intern from the city's environmental department: "Sir, we need to issue another one."

Another contingency would be disastrous. According to the plan pushed through the city council just last year, elevated ozone levels meant shutting down the city for at least a day – cars off the roads, factories shuttered, schools closed. Increased hospitalization for the elderly and suspicious respiratory deaths were only the most visible effects of the broader environmental disaster.

Varara, once one of the world's financial capitals and best-known tourist destinations, was suffering economically as well. The business section of the *Varara Times* often led with stories of businesses abandoning the city. Varara's famous art festival was beginning next week, and hotel occupancies that normally approached 80% were hovering around 40%. No businesses and no visitors meant no jobs. And no jobs meant the Mayor would not win next year's election.

It was hot that afternoon, but the hottest part of the summer was yet to come. Heat made the pollution worse. Right after the phone call, the Mayor dialed the Metropolitan Environmental Commissioner.

## The Metropolitan Area

**Varara** is the capital city of **Camitia**, a rapidly developing Third World country. Varara is the political and financial heart of the nation. It is also a federal district; much like Washington D.C. in the United States, it is a city/state that houses the federal government's offices. Topographically and geographically, Varara is particularly susceptible to air pollution; its low latitude and high altitude aggravate airborne pollution, which is caused primarily by a surplus of old, polluting vehicles and industries.

Varara is surrounded by mountains to the North, South, and East. To the West lies the city of **Sandoa**, in the Camitian state of **Mola**. Sandoa's 7 million residents are not as well off as their neighbors, but are tied to them economically. It is suspected that prevailing **westerly winds** transport pollutants from higher-polluting vehicles in Sandoa into Varara. Varara, an agglomeration of 10 million inhabitants, has suffered with the rest of the country in the worldwide economic recession, but the current environmental crisis threatens to destroy the already weakened economy. (See Appendix I for more about Varara and Sandoa. Also, note that Varara and Sandoa together are often called simply the "metropolitan area.")

Varara and Sandoa belong to the recently created **Metropolitan Environmental Commission (MEC)**. The position of MEC commissioner rotates every two years between the Mayor of Varara and the Governor of Mola, and the Technical Secretary post switches between the environmental ministers of the two governments. The Governor of Mola has just begun serving as the Metropolitan Environmental Commissioner; in two years, the Mayor of Varara will take over the position.

The Commissioner, who is no stranger to political pressure, asked **Fortuna Gomez, the Technical Secretary** of the MEC, to organize a working group to discuss the environmental crisis. Apart from her job as the Technical Secretary, Fortuna heads up Mola's environmental department. By federal mandate, Fortuna will relinquish her MEC office to a replacement from Varara in two years.

## **The Science of Ozone Formation and Major Concerns**

Carbon monoxide (CO), nitrogen oxides (NO<sub>x</sub>) and hydrocarbons (HC) are primary pollutants emitted directly by mobile sources. Ground-level ozone (O<sub>3</sub>), by contrast, is a secondary pollutant formed through **chemical processes** involving **HC, NO<sub>x</sub>, and solar radiation**. Therefore, ozone concentrations can be reduced by decreasing emissions of HC, NO<sub>x</sub>, or both.

Ground-level ozone can be very harmful to human health. Children, the elderly, and individuals with pre-existing respiratory problems are most at risk. Ozone can aggravate bronchitis, emphysema, and asthma. Even healthy adults can experience health problems on high-ozone days, especially while exercising or working outdoors. When high concentrations of ozone are present, people can experience chest pain, coughing, nausea, throat irritation, and congestion. Prolonged exposure to high concentrations of ground-level ozone can lead to lung damage.

In Varara, rapid growth in the population, the motor vehicle fleet, and industrial activity, combined with the city's geographic setting, have produced extremely high levels of air pollution. Some policy initiatives enacted in the past have been effective in addressing some aspects of the problem. These initiatives included outlawing leaded gasoline and closing oil refineries in the metropolitan area. As a result, ambient

measurements of sulfur dioxide (SO<sub>2</sub>) have declined sharply in the past 10 years. However, the concentration of ground-level ozone has shown little improvement and may even be growing worse. The ozone standard has been exceeded on an average of 292 days each year since 1993, or 80% of the time.

The **transportation sector** is a major source of ozone formation in the metropolitan area, accounting for 80% of NO<sub>x</sub> emissions and 55% of HC emissions. Apart from simply the enormous number of private vehicles, the old age and poor maintenance of many vehicles is a serious problem. About a half of all gasoline vehicles are more than 10 years old, 15% of which are high-polluting, pre-1982 models. (See Appendix II for more information about emissions from the transportation sector.)

In Varara, a higher percentage of the population uses private transportation than in Sandoa, resulting in extreme traffic congestion. Varara does have some public transit, in the form of the Metro. The Metro does not extend into Sandoa, however.

Urbanization in Sandoa has been so rapid as to outstrip the ability of city authorities to manage it. Since Sandoa has not made major investments in public transit, and few residents own cars, **microbuses** have become the primary mode of public transportation. Microbuses run on gasoline and are an average of 13 years old. The operation of the informal microbus “system” resembles anarchy. Microbus operators essentially control all of public transport in Sandoa. They carry millions of Sandoa commuters to Metro stops just inside Varara, so that people may take the Metro to jobs in Varara’s downtown. It is clear that transportation-related strategies are a key mechanism for dealing with the ozone crisis. Transportation, however, is also a critical driver of economic development.

## **The Stakeholder Group**

Despite the Mayor’s call for immediate action, Fortuna Gomez believes that a long-term plan is needed to curb ozone levels, or else the situation will only worsen. Notwithstanding skepticism from other Commission officials, Fortuna has decided to introduce a new method of decision-making: a **multistakeholder process**. She is unsure about its potential for success, but is convinced about its advantages, having observed many cases where stakeholders’ resistance killed proposed initiatives. If her proposed process is successful, the resulting recommendations will have the support of many of the key stakeholders in the crisis, and could lead to the use of similar processes to resolve other critical problems in the metropolitan area.

So, Fortuna has organized the **Environment-Transport Stakeholder Group on Ground-Level Ozone**. Based on an analysis of the situation, this group of stakeholders was carefully selected and asked to come together to develop consensus recommendations. The stakeholders represent a cross-section of interests, and are assumed to be fully capable of mustering public and political support for any agreed-upon decision. A total of eight parties, including Fortuna, make up the stakeholder group.

It is now **January 2003**, and the public is still concerned about stubbornly high ozone levels. The stakeholder group's fourth meeting since last summer's crisis is scheduled for today in the Metropolitan Environmental Commission's conference room. Improved modeling information has just become available and should be of help to the group in its deliberations. This meeting will be very important to the process of building consensus. If consensus can be reached, the agreement will be written up in a final report. The report will then be submitted to the Federal Environmental Agency and legislative bodies for formal ratification, and shared with the public.

The dialogue will be chaired and **facilitated by Fortuna Gomez**, the Technical Secretary of the MEC. At any time during the discussions, participants have the right to request a caucus with one or more other members of the group. However, approval is required from all participants in order to break from the formal proceedings into smaller caucuses.

Participants are expected to reach agreement on all decision items. A **seven out of eight vote** is required for approval of any decision option and any total package of options. However, participants should strive for consensus whenever possible. Any animosity, tension, or unresolved issues will haunt the ratification process and hinder the implementation of the recommendations.

## **Parties to the Dialogue**

The following are the eight members of the Environment-Transport Stakeholder Group on Ground-Level Ozone.

### **Alliance for a Livable City (ALC)**

The ALC is a coalition of 10 active NGOs that are based in the metropolitan area and deal with environment and equity issues. In the past, the ALC sought to block governmental projects primarily through public demonstrations. Recently, the group has learned how to mount effective media campaigns and use litigation to pursue its goals. Polls show that the ALC's credibility is relatively high with residents in the metropolitan area. The ALC criticizes the government's preferential treatment of automakers, and they argue that fundamental behavior changes are needed to curb pollution.

### **Camitia Auto Industry Association (CAIA)**

The CAIA has served as a consultant to government agencies on policy matters for nine years. Its members include six multinational firms that manufacture passenger vehicles in Camitia and two domestic firms that manufacture buses. The automobile sector is one of Camitia's most important industries in terms of its contribution to the national economy and employment.

### **Camitia Petroleum Company (CPC)**

Camitia is the world's fifth largest oil producer, and the CPC is the country's nationalized oil company. The CPC is a symbol of Camitia's sovereignty and independence, and it has exclusive rights to explore and produce oil in Camitia. The government relies heavily on the CPC for its income. The company's investment in refining capability directly affects its revenues and, therefore, the government's income from the company. Currently, due to extremely limited funding for exploration activities, Camitia's crude oil reserves are on the decline. In addition, about a quarter of gasoline consumption is imported, due to Camitia's insufficient refinery capacity. The CPC produces two grades of gasoline; "regular unleaded" accounts for 90% of total use in the transportation sector.

### **Fortuna Gomez, Technical Secretary of the Metropolitan Environmental Commission (MEC)**

Fortuna Gomez is the newly appointed Technical Secretary of the MEC. She is also the head of the Department of Environment in the state of Mola. She has been facilitating the stakeholder group and will chair this upcoming meeting.

### **MicroBus Transport Association (MBTA)**

Based in Sandoa, the MBTA is a newly organized and growing association of individual microbus operators and seven small microbus companies. Members' vehicles are old, and the passengers are mostly poor laborers. The MBTA has expressed public concern about the harmonization of inspection and maintenance programs between the two cities, as well as expansion of the Metro into Sandoa. The MBTA is severely constrained financially.

### **Ministry of Finance (MOF)**

The MOF is a federal agency that oversees national finances. It also heads the Executive Committee, which manages the Environmental Trust Fund created to support the MEC's operation. It can approve or disapprove the MEC's requests for funding. Currently, the MOF has seen the federal government's financial situation deteriorate as a result of the worldwide economic recession. Historically, it has given more direct subsidies to Varara than Sandoa, in the form of infrastructure investments such as the Metro. However, a recent political decentralization trend has necessitated a shift in public finance policy throughout the metropolitan area.

### **Metropolitan Transport Commission (MTC)**

The MTC is a metropolitan transportation management body organized in 1985. It is comprised of the three transport authorities from the federal, Varara, and Mola governments. The office of Commissioner is rotated between the two nonfederal governments; currently, the head of Varara's transportation agency holds it.

### **Varara Environmental Department (VED)**

The VED is an environmental agency that implements Varara's local environmental regulations. Due to the current ozone crisis, the VED is intent on much tougher

environmental regulations. It argues that annual emissions of NO<sub>x</sub> and HC must be reduced by at least 70% in order to comply with ozone health standards by 2018. There is a rumor that the VED may impose harsh policy options independently.

## Technical Support and Modeling

The stakeholders' decision-making requires a very solid scientific and technical foundation. A multidisciplinary research team, led by a world-renowned scientist, recently completed a new research and modeling exercise. The team's assessment integrates a broad range of disciplines beyond atmospheric science, including transportation, public health, policy analysis, and urban planning. The credibility and neutrality of the research team was key in the model's acceptance by the stakeholders.

The research team used a "scenario-based trade-off analysis" technique. To avoid the pitfalls of deterministic planning, the team explored **two alternative futures**. They named the two scenarios "Divided Cities" and "High Growth," based on different combinations of three macro factors.

### The "Divided Cities" Scenario

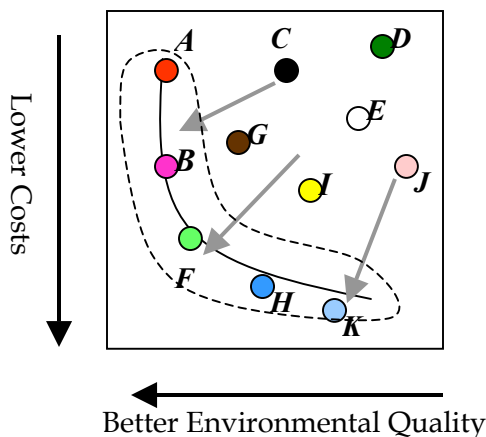
- 2.6% annual growth in Camitia's national economy
- Income inequality worsened between Varara and Mola
- 2.8% population growth in the metropolitan area

### The "High Growth" Scenario

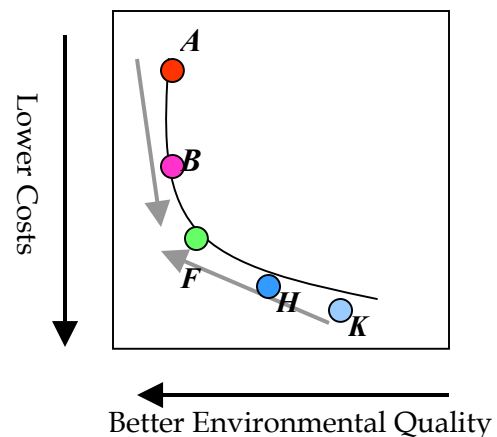
- 4.2% annual growth in Camitia's national economy
- Shrinking income inequality between Varara and Mola
- 2.1% population growth in the metropolitan area

By using trade-off analysis, the research team sought to assist in the sorting out of policy option packages, given the criteria of cost-effectiveness and emission-reduction impact.

#### Identifying a Better Bundle of Options



#### Discussing Tradeoffs



Today, stakeholders will be provided with the research team's modeling results, which estimate the environmental impact of each decision option and its implementation costs. The research team also compiled tables identifying the better bundles of options under the two scenarios.

## Decision Options

The five decisions the stakeholder group must discuss, and the respective options for each decision, are listed for below. The options were developed via a stakeholder analysis and brainstorming sessions conducted by the research team. Participants are expected to budget their time carefully so that all decision items are given due consideration before the meeting is adjourned.

In many cases, the options presented are not mutually exclusive. However, participants will be asked to agree to one option each in Decision 1 (Sulfur Content) and Decision 2 (Emission Standards). The group can choose two options each for Decision 3 (Inspection and Maintenance) and Decision 4 (Public Transportation). The result should be a package of options that will prove effective in solving the ground-level ozone problem.

Package of Options = (One option + One option) + Two options + Two options  
**in Decision 1 in Decision 2 in Decision 3 in Decision 4**

Participants must consider the financial costs of the various options in constructing the package of options. Cost estimates are provided below as a guide. Budget constraints are apparent at most levels of government, particularly in Sandoa. The Minister of Finance has only moderate budget flexibility. Private-sector actors are concerned about their profit margins and cannot afford certain innovations, but will be required to shoulder some of the costs under most of the options. All cost estimates are present-value costs, given in U.S. dollars.

The following is a description of the four decisions and the respective options for each.

### Decision 1: Sulfur Content in Regular Unleaded Gasoline

□ *How much should the sulfur content in gasoline be reduced, and when?*

The provision of low-sulfur gasoline has become more important in recent years, as the sophisticated emission-control equipment used to meet emission standards requires certain low levels of sulfur in gasoline to achieve its full emission-reduction potential. For example, cars meeting Metropolitan Emission Standard (MES) 2 (the most stringent standard in any country to date) require sulfur levels of 30 ppm or less. Currently, the average sulfur content of regular unleaded gasoline in the metropolitan area is 700 ppm.

Year	2003	2004	2006	2008	2011	2015	2018
<b>Option 1</b>	700 ppm			300 ppm	150 ppm	30 ppm	
<b>Option 2</b>	700 ppm		300 ppm	150 ppm	30 ppm	15 ppm	
<b>Option 3</b>	700 ppm	300 ppm	150 ppm	30 ppm	15 ppm		

## Decision 2: Emission Standards for New Vehicles

- *What kind of emission standards should be introduced and when?*

Until now, Camitia has implemented “technology-following” standards. In other words, Camitia has introduced vehicle emission standards only after other countries have proven that the standards can be met with available technology. Now, Camitia is ready to introduce a new Metropolitan Emission Standard (MES 0), which has been in use in neighboring developed countries. MES 0 became achievable in Camitia because, with unleaded gasoline introduced in 1996 and leaded gasoline finally eliminated in 2001, automakers are now able to install catalytic converters in new cars. The CAIA agreed with the MEC that MES 0 vehicles will be introduced in 2003. The automakers may need time to make significant investments, conduct training, and find technology suppliers to comply with tougher emission standards such as MES 1 and MES 2.

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
<b>Option 1</b>	MES 0						MES 1						MES 2		
<b>Option 2</b>	MES 0				MES 1				MES 2						
<b>Option 3</b>	MES 0		MES 1				MES 2								

## Modeling Results for Decision 1 and Decision 2, Combined

Reducing the sulfur content of gasoline does not directly affect NO<sub>x</sub> and HC emissions. However, it can influence the operation of certain vehicle emission-control technologies, which are designed to comply with emission standards such as MES 1. For example, the introduction of MES 2 vehicles should follow the phase-in of 30 ppm (average) sulfur content in gasoline. Thus, Option 1 (slow phase-in) for sulfur content will not work with Options 2 or 3 (moderate and fast phase-in, respectively) in emission standards.

The analysis team modeled the expected reductions in annual emissions for each option, and the cost of those reductions, for each of the two possible future scenarios. The results are set forth in the tables below. In the “cost” columns, the first number is the cost of implementing the emission standards; the second number (in parentheses) is the cost of reducing the sulfur content of gasoline. Thus, the total cost for any

combination of the options is the sum of the two numbers. All cost figures are in U.S. \$billions.

**For "Divided Cities" Scenario Decision 1: Sulfur Content in Gasoline**

		Option 1 (Slow)			Option 2 (Moderate)			Option 3 (Fast)		
		NO <sub>x</sub>	HC	Cost	NO <sub>x</sub>	HC	Cost	NO <sub>x</sub>	HC	Cost
<b>Decision 2</b> Emission Standard	Option 1 (S)	11%	4%	17 (4)	14%	7%	17 (6)	17%	10%	17 (8)
	Option 2 (M)	X			19%	11%	23 (6)	22%	14%	23 (8)
	Option 3 (F)	X			24%	15%	30 (6)	27%	18%	30 (8)

**For "High Growth" Scenario Decision 1: Sulfur Content in Gasoline**

		Option 1 (Slow)			Option 2 (Moderate)			Option 3 (Fast)		
		NO <sub>x</sub>	HC	Cost	NO <sub>x</sub>	HC	Cost	NO <sub>x</sub>	HC	Cost
<b>Decision 2</b> Emission Standard	Option 1 (S)	14%	7%	13(5)	17%	10%	13(8)	20%	13%	13(10)
	Option 2 (M)	X			22%	14%	19(8)	25%	17%	19(10)
	Option 3 (F)	X			27%	18%	26(8)	30%	21%	26(10)

**Decision 3: Enhanced Inspection and Maintenance Program**

- *What options should be employed to enhance the inspection and maintenance program to achieve the greatest possible reduction in emissions?*

The goal of the inspection and maintenance (I&M) program is to identify and repair high-polluting vehicles. Each vehicle that circulates in the metropolitan area must be inspected every six months for CO, HC, and NO<sub>x</sub> emissions.

The environmental agencies in Varara and Mola manage the I&M program. The program is a source of revenue for the two governments. Private vehicles registered in Varara and Sandoa can be verified in any inspection center in the metropolitan area. Although the programs in Varara and Sandoa were intended to be identical, in practice the authorities in Varara have exercised greater control.

- **Option 1: Harmonization of the I&M Programs**  
Under this option, Mola's enforcement of emissions regulations and standards would be upgraded, so as to equal those in Varara.

Scenario	Reduction in Annual Emissions		Cost
	NO <sub>x</sub>	HC	
<b>Divided Cities</b>	9%	10%	0.3
<b>High Growth</b>	10%	12%	0.2

□ **Option 2: Public (i.e., external) Audits**

For inspection centers, periodic, independent, and public audits would be implemented under this option.

Scenario	Reduction in Annual Emissions		Cost
	NO <sub>x</sub>	HC	
<b>Divided Cities</b>	11%	8%	0.1
<b>High Growth</b>	10%	9%	0.1

□ **Option 3: Integration of the Inspection and Registration Databases**

Within each city, inspection data and registration data would be integrated into a central, online database that is shared among the transport department, the police, and the environmental agency.

Scenario	Reduction in Annual Emissions		Cost
	NO <sub>x</sub>	HC	
<b>Divided Cities</b>	2%	3%	0.5
<b>High Growth</b>	4%	5%	0.7

□ **Option 4: Differential Treatment in Inspections**

Vehicles would be inspected according to their age and emission technology. More frequent and complete tests (including an evaporative emission test) would be conducted for older, high-use vehicles such as minibuses, with fewer tests (or an exemption) for new vehicles.

Scenario	Reduction in Annual Emissions		Cost
	NO <sub>x</sub>	HC	
<b>Divided Cities</b>	3%	2%	0.2
<b>High Growth</b>	5%	3%	0.3

□ **Option 5: OBD (On-Board Diagnostic) Systems and Emission Warranties**

Automakers would install OBD systems in new cars sold in the metropolitan area and provide emission warranties up to 100,000 km.

Scenario	Reduction in Annual Emissions		Cost
	NO <sub>x</sub>	HC	
<b>Divided Cities</b>	8%	6%	7
<b>High Growth</b>	10%	8%	9

## Decision 4: Public Transportation

- *What options should be employed in public transportation and transport planning to reduce air pollution?*

Public transit is continuously declining in the metropolitan area, while low-capacity modes of transportation such as minibuses and private autos are increasing. This clearly has implications for pollution levels.

- **Option 1: Metro Extension to Sandoa**

Metro lines, which currently exist only within Varara, would be extended into Sandoa to enable people to commute more easily between the two cities.

Scenario	Reduction in Annual Emissions		Cost
	NO <sub>x</sub>	HC	
<b>Divided Cities</b>	9%	7%	3.3
<b>High Growth</b>	11%	9%	3

- **Option 2: Ring Road Construction**

At least two ring roads would be constructed inside Varara and between the two cities to reduce traffic congestion, thereby reducing air pollution.

Scenario	Reduction in Annual Emissions		Cost
	NO <sub>x</sub>	HC	
<b>Divided Cities</b>	7%	12%	3.5
<b>High Growth</b>	8%	13%	3.3

- **Option 3: Bicycle Lanes**

Bicycle lanes would be created inside each city so that residents do not have to use automobiles and can make short trips safely by bicycle.

Scenario	Reduction in Annual Emissions		Cost
	NO <sub>x</sub>	HC	
<b>Divided Cities</b>	2%	2%	1.2
<b>High Growth</b>	4%	3%	1

□ **Option 4: Congestion Pricing**

To reduce congestion and earn revenue for environmental planning, people would pay a “congestion fee” to drive through certain areas.

Scenario	Reduction in Annual Emissions		Cost
	NO <sub>x</sub>	HC	
<b>Divided Cities</b>	1%	4%	0.2
<b>High Growth</b>	3%	3%	0.4

□ **Option 5: Regulated Competition for Microbuses**

Microbuses would be required to comply with certain environmental criteria before being granted operating licenses.

Scenario	Reduction in Annual Emissions		Cost
	NO <sub>x</sub>	HC	
<b>Divided Cities</b>	14%	16%	0.5
<b>High Growth</b>	12%	20%	0.7

□ **Option 6: Subsidy for Microbuses**

A subsidy would be given to microbus operators, so they can upgrade their vehicles.

Scenario	Reduction in Annual Emissions		Cost
	NO <sub>x</sub>	HC	
<b>Divided Cities</b>	11%	13%	1.5
<b>High Growth</b>	13%	12%	1.3

## Decision 5: Assigning Enforcement Responsibility and Financing

- *What should be the roles of the various government agencies, NGOs, and private-sector organizations in enforcement? Who will finance enforcement activities?*

This decision is the most important because, without adequate enforcement tools, the future of the recommended plan will not be bright. This decision will require creativity, flexibility, and the consideration of equity issues. The group’s overall success depends on participants’ consensus on these issues. Policy makers at every governmental level agree that stakeholders should be wary of recommending new regulations that are not easily enforced. Stakeholder group members should thus draft a general enforcement plan.

## **The Consequences of Failing to Reach Agreement**

**Increases in ground-level ozone and greater endangerment to public health:** Without an appropriate program, the crisis will be exacerbated.

**Harsh governmental command-and-control regulation:** The Federal Environmental Agency is preparing a very tough regulatory package (based on health criteria) for each industrial sector, jeopardizing their respective economic potential and complicating political fights.

**Citizen litigation and boycott:** Environmental NGOs are threatening to bring litigation against the government for its inaction and to boycott certain automakers.

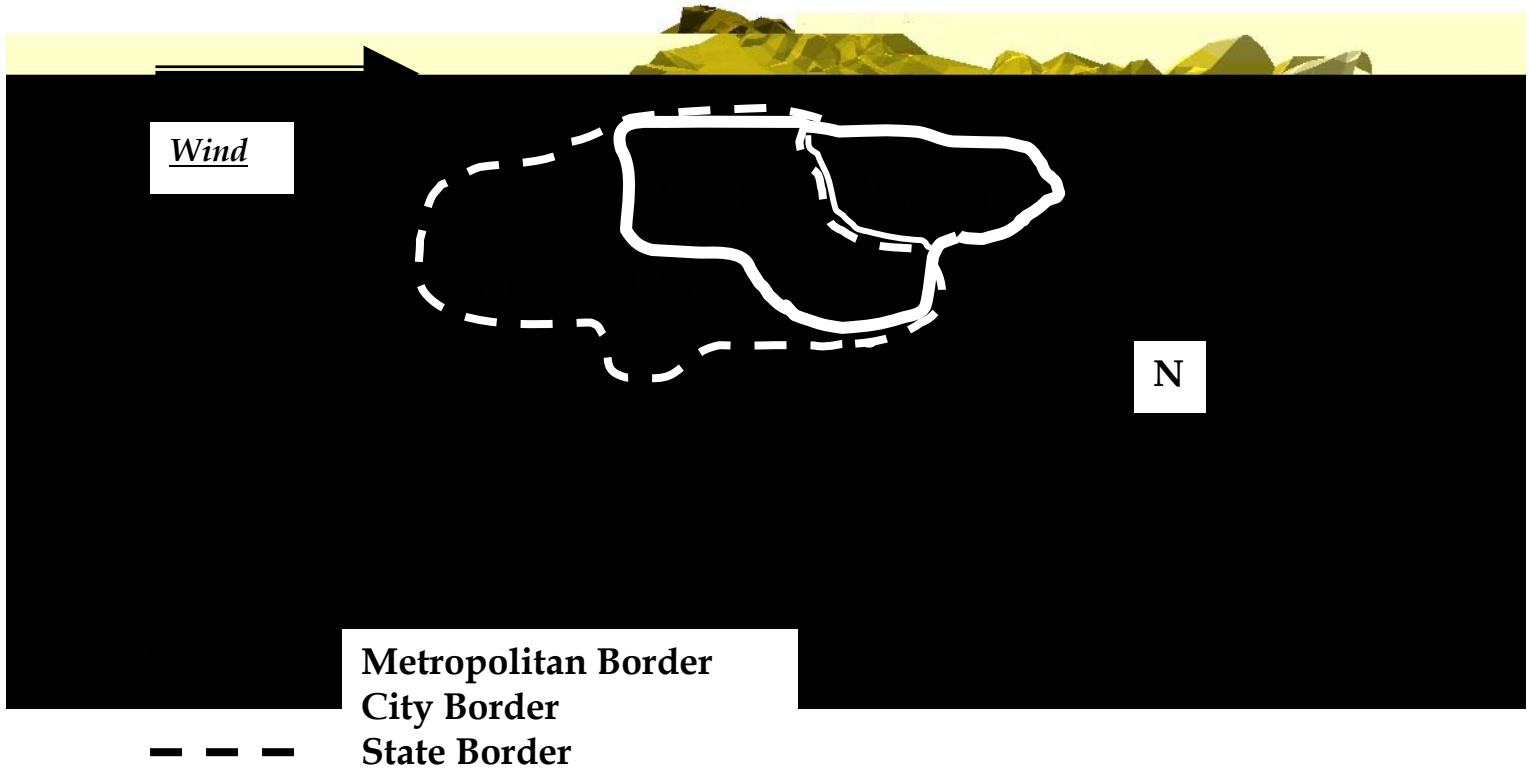
**Degradation of Camitia's image and economic situation:** Continuous pollution problems will give the country a poor image globally, which will discourage tourism and international investment and ultimately worsen the nation's financial crisis.

**Loss of political support:** Elections are approaching for the Mayor of Varara and the President of Camitia. Their popularity at the polls may be hurt if the stakeholder group fails to reach an agreement. The political careers of the MEC Commissioner and Fortuna Gomez also hinge largely on the success of her experiment with multistakeholder dialogue.

## Appendix I

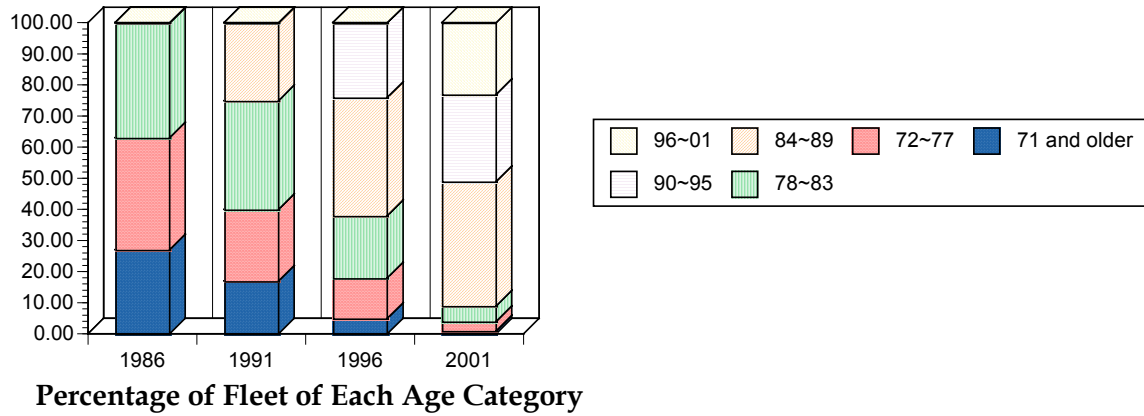
### Profile and Map of the Varara Metropolitan Area

Profile	Varara	Sandoa
Total land area	1,750 sq km	3,550 sq km
Population	10 million	7 million
Population growth	2.0%	4.0%
GDP per capita	US \$8,500	US \$6,500
GDP growth	2.5%	1.0%
Share of GDP	22%	1.5%
Population below poverty	20%	32%
Transportation mode share	Taxi - 7%	Taxi - 8%
	Bus - 8%	Bus - 7%
	Microbus - 15%	Microbus - 55%
	Metro - 25%	Metro - 0%
	Private autos - 35%	Private autos - 15%
	Nonmotorized - 10%	Nonmotorized - 15%



## Appendix II Profile of the Transportation Sector

**NO<sub>x</sub> and HC Emission Inventory**



1%

**Fleet sizes and Contribution to NO<sub>x</sub> and HC Emissions**