Clean Air in the Philippines:
Summary of progress on improving air quality

Country Network Philippines
Partnership for Clean Air
November 2008

CONTENTS

About CAI-Asia

The Clean Air Initiative for Asian Cities (CAI-Asia) was established as a joint initiative by the Asian Development Bank, World Bank, and the United States – Asia Environmental Partnership (a project of USAID) in 2001.

CAI-Asia promotes innovative ways to improve air quality of Asian cities by sharing experiences and building partnerships. This multi-stakeholder initiative has three parts:

- The CAI-Asia Center, a regional, Philippines-based non-profit organization as the implementing arm of CAI-Asia
- The CAI-Asia Partnership, a United Nations Type II partnership, with over 120 member organizations
- CAI-Asia Country Networks in the People's Republic of China, India (2009), Indonesia, Nepal, Pakistan, Philippines, Sri Lanka, and Viet Nam.

FOREWORD

Air quality management (AQM) is still a major challenge in Asia. The fast growing Asian economies and continued urbanization have increased the demand for mobility and energy in the region, resulting in high levels of air pollution in cities from transport, industry and other sources. The World Health Organization estimates that ambient air pollution causes *over half a million* premature deaths per year, leaving the urban poor particularly vulnerable since they live in air pollution hotspots, have low respiratory resistance due to bad nutrition, and lack access to quality health care.

We are, therefore, pleased to present you with an update on the efforts and progress to improving air quality in the Philippines, which also focuses on related areas, most importantly health, climate change, transport and energy management. This summary report was prepared by the Clean Air Network of the Philippines, also known as the Partnership for Clean Air (PCA); its Secretariat is hosted by the Manila Observatory. This report presents

- Trends in air quality and climate change
- The Clean Air Network of the Philippines, including main achievements and challenges
- Responses to address air pollution in the Philippines including policies, programs/projects, training courses, and several case studies of concrete actions.

You are invited to discuss with us achievements and challenges of the Philippines at the Roundtable of Southeast Asian countries on Thursday, 13 November, 10:30 – 12:00, at the Better Air Quality (BAQ) workshop 2008 in Bangkok, under the theme “Air Quality and Climate Change: scaling up win-win solutions for Asia.”

You can visit our country webpage on www.cleanairnet.org/pca for more information, or contact us directly. We welcome your support to help improve air quality in the Philippines!

Angela Consuelo Ibay
Clean Air Network Coordinator – Philippines
Partnership for Clean Air

Glynda Bathan
Policy and Partnerships Manager
Clean Air Initiative-Asia Center

1. TRENDS IN AIR QUALITY AND CLIMATE CHANGE

This chapter explains the drivers of air pollution and climate change, trends in air pollutant levels and greenhouse gas emissions, and impacts from air pollution.

1.1 Drivers of Air Pollution and Climate Change

The Philippines is rapidly urbanizing – by 2050 84% of people will be living in cities, compared to 49% in 1990. Bigger cities put more pressure on available resources, including clean air.

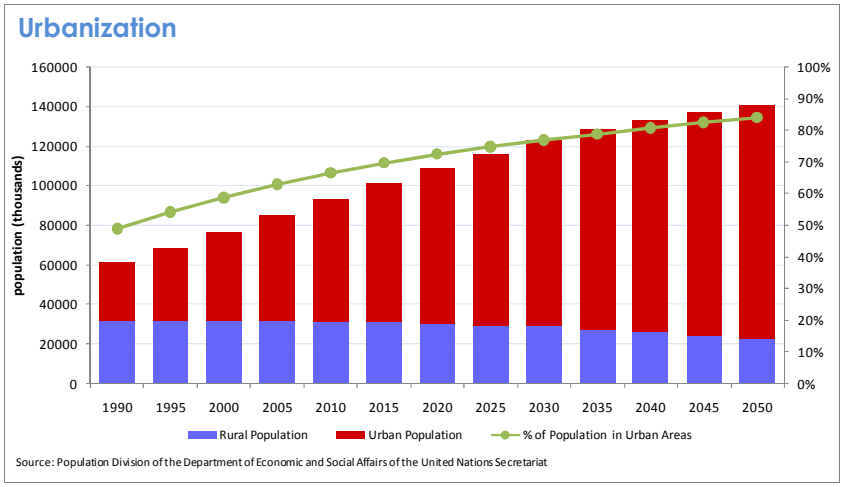


Figure 1. Urbanization increase between 1990 and 2005 and forecast for 2050

As the GDP of Philippines continues to rise, energy consumption is also increasing. Energy consumption increased from 0.731 quadrillion BTU in 1990 to 1.336 quadrillion BTU in 2005.

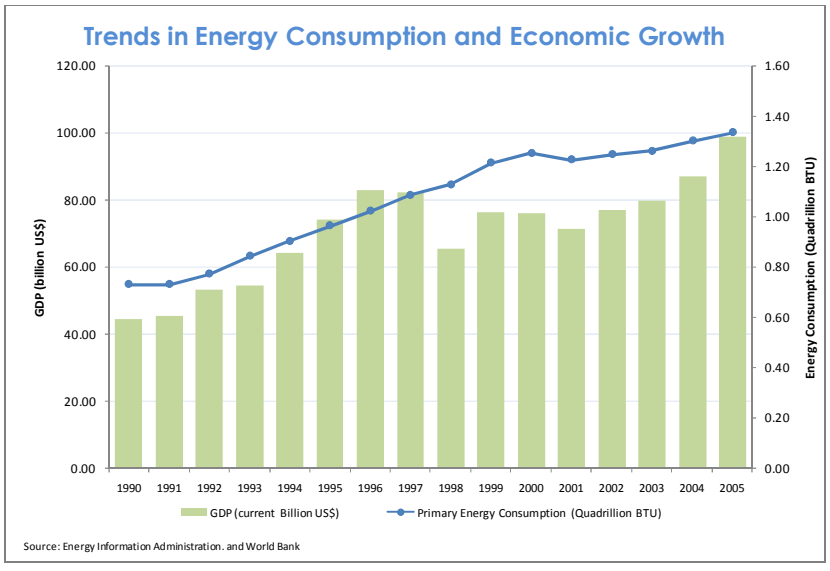


Figure 2. Energy Consumption Increase compared to GDP between 1990 and 2005

Vehicle ownership is also growing rapidly. In 1990, the total number of registered vehicles was 1.6 million; in 2007 this was 5.5 million. Since 2005, motorcycles/tricycles (MCs/TCs) have grown the fastest with an average annual increase of (10.77%), followed by SUVs (10.55%) and trucks (2.75%). It has been reported that since 2005, 75% of all new sales of motorcycles were already four-stroke motorcycles. However, in use MCs/TCs at that time were 75-80% two-stroke. Generally, motor vehicles have increased by more than 100% from 2003 to 2007. Motorcycles/tricycles are largest in number.

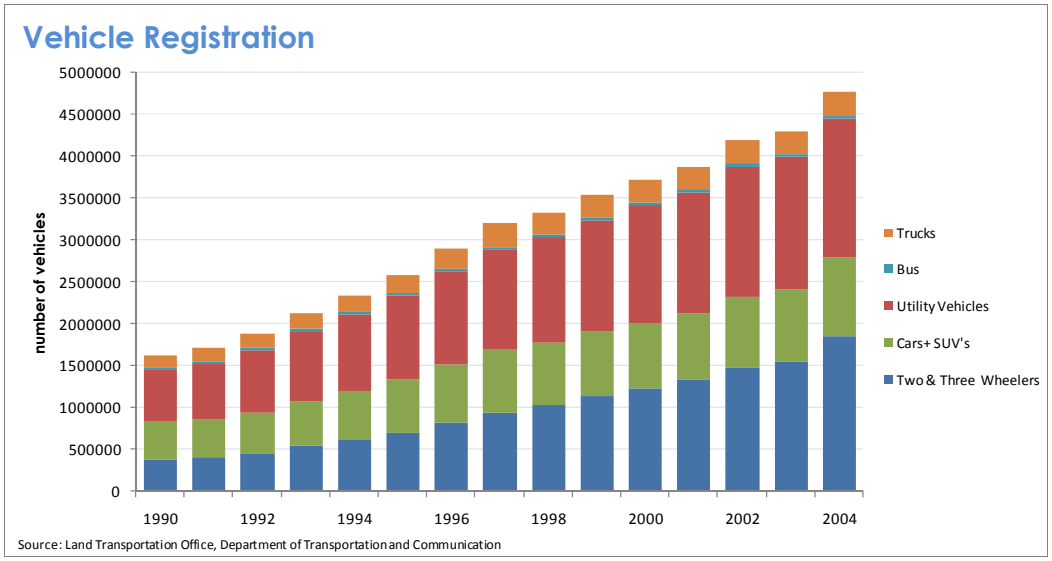


Figure 3. Vehicle Growth between 1990 and 2004

Table 1. National Annual Motor Vehicle Registration by Vehicle Type (2005-2007)

NUMBER OF MOTOR VEHICLES REGISTERED BY MV TYPE & MODE OF REGISTRATION
Comparative, ANNUAL 2005; 2006; 2007

Date of Preparation: 29 January 2008

MV TYPE	MODE OF REG.	2005	2006	2007*	%INC.'06/'05	%INC.'07/'06	AVE.% INC.
CARS	NEW	41,175	40,763	46,183	(1.00)	13.30	6.15
	RENEWAL	747,233	751,610	704,909	0.59	(6.21)	(2.81)
	Sub-Total	788,408	792,373	751,092	0.50	(5.21)	(2.35)
UV	NEW	93,959	88,950	91,518	(5.33)	2.89	(1.22)
	RENEWAL	1,539,897	1,529,151	1,511,101	(0.70)	(1.18)	(0.94)
	Sub-Total	1,633,856	1,618,101	1,602,619	(0.96)	(0.96)	(0.96)
SUV	NEW	21,554	25,491	27,503	18.27	7.89	13.08
	RENEWAL	136,384	147,303	165,488	8.01	12.35	10.18
	Sub-Total	157,938	172,794	192,991	9.41	11.69	10.55
TRUCK	NEW	15,245	16,896	18,439	10.83	9.13	9.98
	RENEWAL	251,670	269,005	262,822	6.89	(2.30)	2.29
	Sub-Total	266,915	285,901	281,261	7.11	(1.62)	2.75
BUSES	NEW	1,738	2,008	2,518	15.54	25.40	20.47
	RENEWAL	29,239	27,136	27,641	(7.19)	1.86	(2.67)
	Sub-Total	30,977	29,144	30,159	(5.92)	3.48	(1.22)
MC/TC	NEW	585,482	605,038	671,588	3.34	11.00	7.17
	RENEWAL	1,572,255	1,804,325	1,975,986	14.76	9.51	12.14
	Sub-Total	2,157,737	2,409,363	2,647,574	11.66	9.89	10.77
TRAILER	NEW	1,427	2,595	1,789	81.85	(31.06)	25.40
	RENEWAL	22,495	21,303	22,567	(5.30)	5.93	0.32
	Sub-Total	23,922	23,898	24,356	(0.10)	1.92	0.91
SUB-TOTAL	NEW	760,580	781,741	859,538	2.78	9.95	6.37
	RENEWAL	4,299,173	4,549,833	4,670,514	5.83	2.65	4.24
TOTAL		5,059,753	5,331,574	5,530,052	5.37	3.72	4.55

* Excluding the unsubmitted reports of Malabang D.O. (Reg. XII-Oct. 2007); Patin-ay D.O. (CARAGA-Dec. 2007) and E-Patrol (Reg. VII-Sept.-Dec. 2007);Reg. II(Oct. 2007-Dec. 2007) & Rev-Up-Reg. IVA (Sept.-Dec. 2007)

Source: Land Transportation Office, Department of Transportation and Communication

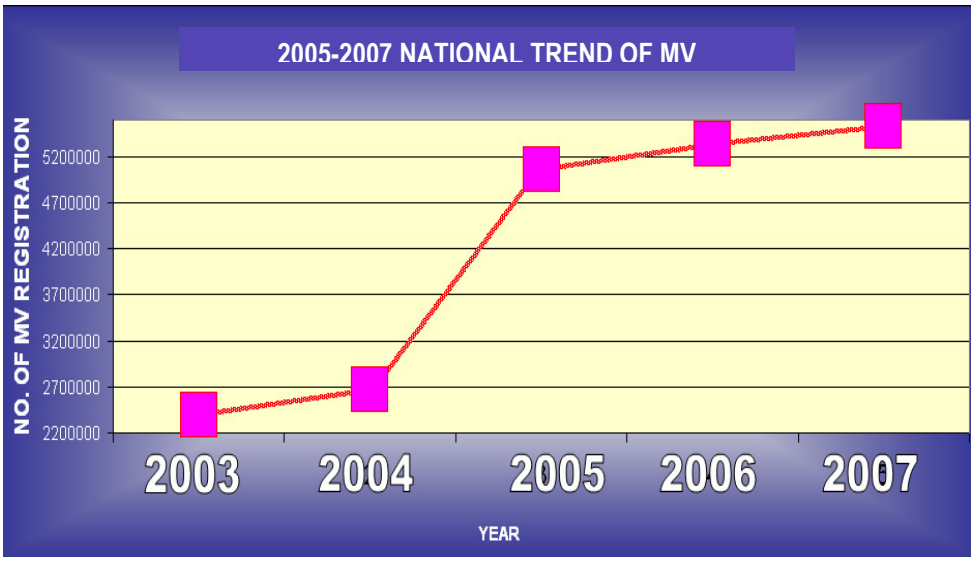


Figure 4. 2005-2007 Trend of National Motor Vehicle Registration

1.2 Air Pollutants and Greenhouse Gas Emissions

The criteria pollutants in cities are Sulfur dioxide (SO_2), Nitrogen dioxide (NO_2), particulate matter, Carbon monoxide (CO), ozone and lead. $PM_{2.5}$ and volatile organic compounds (VOCs) are also considered primary pollutants. As shown in the figures below, average national levels of Total Suspended Particulates in Philippine cities are decreasing. According to the Department of Environment and Natural Resources (DENR), nationwide TSP ambient air monitoring is conducted regularly and there are automatic installations in some urban cities of ambient network for criteria pollutants. The DENR conducts emissions inventory every three years and covers pollutants which include PM, Sulfur oxide, Nitrogen oxide, CO, VOCS, and total organic gases from mobile sources, stationary sources, area sources and aircraft.

Emission inventory is an estimation of the sources and extent of air pollutants in a given area. Although inventories are merely approximation, results serve as basis in the prioritization of air quality regulations. The conduct of emission inventory is required by the Clean Air Act (CAA) of 1999 or RA 8749 once every three years. Emissions inventories use information submitted by companies as part of their self monitoring and permitting requirements. The previous emissions inventory was conducted in 1990 and was updated in 2001, and continuously three years thereafter. Emission inventory in the Philippines utilizes emission factors as estimation tool. Emission factors are numeric values which relate the quantity of pollutants released from a source to some activity associated with those emissions. It is an excellent tool in conducting emission inventories used in quantification and identifying the extent of air pollution emitted by a certain source. Although there are available emission factors developed in other countries, it may not be generally applicable elsewhere. However, while the Philippines has not developed emission factors, inventories are calculated using USEPA AP-42 Emission Factor Compilation. (DENR, National Air Quality Status Report 2005-2007)

The 2007 inventory reveals that

- more than 50% of PM emissions come from area sources, 31% from mobile sources, and 14% from industrial sources,
- SO_2 comes mostly from stationary sources (97%),
- area and mobile sources contribute about the same level to NO_2 emissions,
- mobile sources contributes the largest to CO emissions (85%), and
- VOCs are attributable mostly to mobile sources (87%).

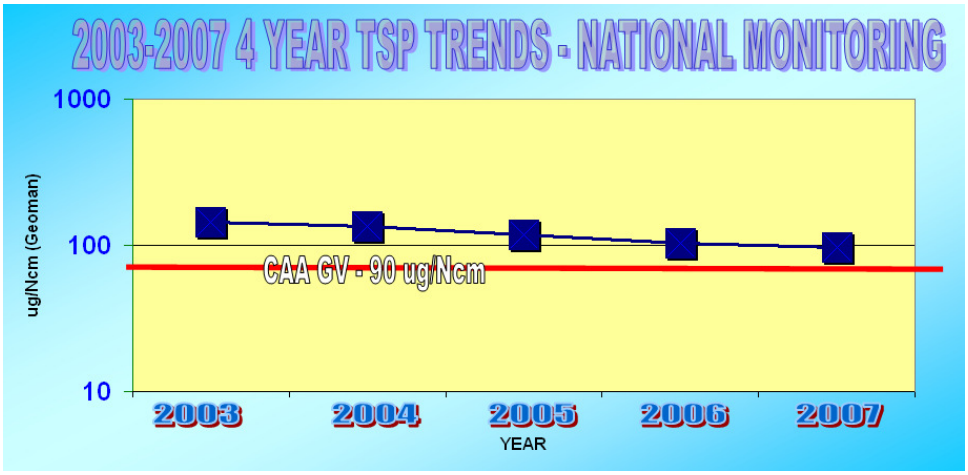


Figure 5. Trends in TSP levels in the Philippines (national average) between 2003 and 2007

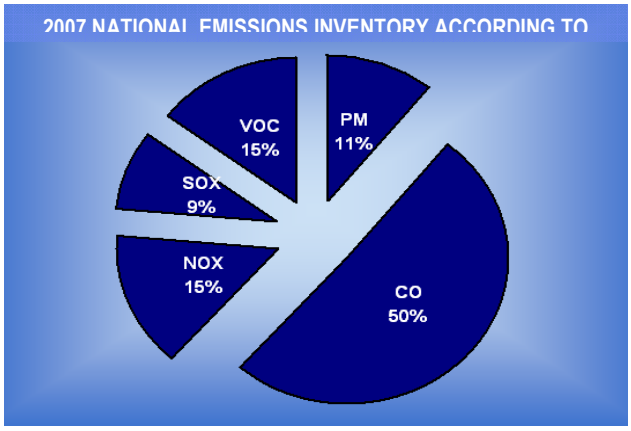


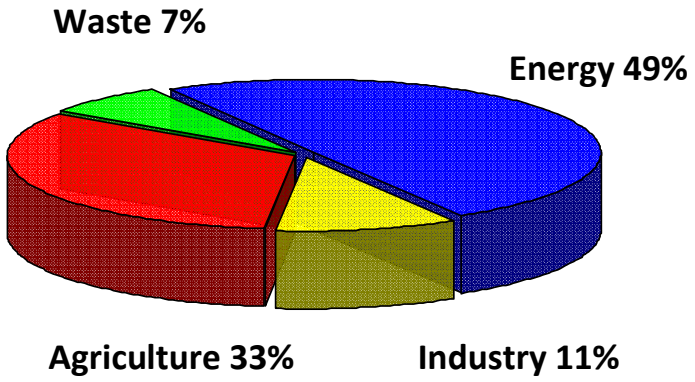
Figure 6. 2007 National Compilation of Emissions Inventory According to Criteria Pollutants

Table 2. 2007 National Compilation of Emissions Inventory According to Criteria Pollutants

Source	PM	SO_2	NO_2	CO	VOC	%	Total
Stationary	110,023.06	598,633.81	326,219.10	360,620.15	67,859.17	21%	1,463,385.29
Mobile	244,764.50	14,308.92	405,033.01	2,988,616.09	914,996.02	65%	4,567,718.55
Area	423,614.78	1,962.77	327,260.57	165,646.94	63,854.74	14%	982,339.81
Total	778,402.34	614,935.50	1,058,512.68	3,514,883.19	1,046,709.94	100%	7,013,443.65
%	11.10%	8.77%	15.09%	50.12%	14.92%		100%

Source: EMB

Greenhouse gas (GHG) emissions, expressed as Carbon dioxide (CO_2)-equivalents, are rapidly increasing. Increased energy consumption is expected to be the main contributor. In 1994, GHG emissions were 100.8 million tons based on the Philippines' Initial National Communications submitted to the United Nations Framework Convention on Climate Change. This year, the Philippines is conducting its Second National Communications which will include its GHG inventory based on 2000 data.



Sector	CO_2 Emissions (103 tons)
Energy	50.0
Agriculture	33.1
Industry	10.6
Waste	7.1
Total	**100.8**

Figure 7. 1994 GHG Emissions from the Four Non-LUCF Sectors of Energy, Agriculture, Industry, and Waste
Source: Philippines' Initial National Communication on Climate Change, December 1999

1.3 Impacts of Air Pollution

World Bank estimated in 2001 that the health costs of PM_{10} pollution in Metro Manila, Cebu, Davao, and Baguio cities reach more than $400 million. This cost is equivalent to almost 0.5% of the 2004 Philippine GDP. A Department of Health Study (2004) reported, "considerable morbidity and mortality due to respiratory and cardiovascular diseases could have been prevented with better air quality in Metro Manila in 2002." The report estimated the following numbers of morbidity and mortality attributable to PM_{10} level higher than 50 $\mu g/m^3$.

Table 3. Air Pollution Impacts on Public Health of Metro Manila

Morbidity	Mortality
10,000 excess cases of acute bronchitis	40-200 persons due to cardiovascular causes
300 excess cases of asthma	300-330 persons due to respiratory causes
9 excess cases of chronic bronchitis	

Source: DOH, 2004 (as cited in CAI-Asia's Philippines Country Synthesis Report on Urban Air Quality Management)

2. CLEAN AIR NETWORK PHILIPPINES

2.1 Introducing the Clean Air Network Philippines

The Clean Air Network of the Philippines, more known as the Partnership for Clean Air (PCA), is the national network of the Clean Air Initiatives for Asian Cities (CAI-Asia) in the Philippines. The PCA keeps track of air quality drivers, trends, impacts and responses. In doing so, it works together with a wide range of stakeholders with an interest in better air quality in the Philippines and who have a role to play in achieving this: government agencies, development partners (including donors, foundations, development agencies), civil society (including non-governmental organizations or NGOs, academia, research institutes) and the private sector. Stakeholder groups are shown on the next page.

The PCA evolved from the Lead-Free Coalition, then the Coalition for Cleaner Fuels. The core members started out as the group of concerned citizens who lobbied for the phase-out of lead in gasoline, as mandated in the Philippine Clean Air Act. Building on the success of a multi-sector co-opting strategy, the idea of a "Partnership for Clean Air" was born. The PCA was formally launched on 8 June 2001. On 23 November 2003 it became a non-stock, non-profit corporation registered in the Philippines.

PCA received support from development agencies and the private sector: USAID/US-Asia Environmental Partnership, Asian Development Bank (ADB), World Bank, Pilipinas Shell, Manila Observatory, and Mirant.

2.2 Main Achievements and Challenges

The main achievements in improving air quality in the Philippines since 2006 are

- **Enactment of the Republic Act No. 9367 otherwise known as the "Biofuels Act of 2006.** The Biofuels Act of 2006 was ratified on 29 November 2006 which mandates a minimum 1% biodiesel blend and 5% bioethanol blend by volume in all diesel and gasoline fuels, respectively, being distributed and sold in the country. President Arroyo signed the Bill into law on 12 January 2007.
- **Availability of Alternative Fuels.** The Alternative Fuels Program of the Department of Energy is one of the five (5) key components of the Arroyo Administration's Energy Independence Agenda, which outlines the roadmap that will lead to the country's attainment of 60% energy self-sufficiency by 2010.

  The Department of Energy (DOE) is implementing a long-term Alternative Fuels Program to (1) reduce the country's dependence on imported oil and (2) provide cheaper and more environment-friendly alternatives to fossil fuels. Through this program, the DOE intends to tap the country's domestic produce as viable sources of energy. The goal is to develop indigenous and renewable energy fuels for long- term energy security, which will be a pillar for the country's sustainable growth. The four (4) major subprograms are: Biodiesel Program, Bioethanol Program, Natural Gas Vehicle Program for Public Transport (NGVPPT), and Autogas Program. Other technologies advocated under the program are hybrid, fuel cell, hydrogen and electric vehicles. There are now commercially available supplies of bioethanol, biodiesel and LPG for use of vehicles.

- **Fuel Switching.** As a result of higher fuel prices and the availability of alternative transport technologies, there has been a switch in the transport sector to use alternative fuel sources. Hence, vehicle owners and primarily taxi fleets are converting and retrofitting their vehicles to LPG. Some public utility vehicles now use biodiesel. The Philippine government rolled out in the early part of 2008 11 CNG-run buses which are plying the Metro Manila route. It is projected that a city bus running for 200 kilometers per day will have daily fuel savings of about P4,568.
- **Switching from incandescent lamps to Compact Fluorescent Lightbulbs (CFLs).** The SWITCH Movement was launched by the Department of Energy to fast-track a campaign for a switch from incandescent bulbs and inefficient lighting technologies to CFL. By using energy efficient lighting systems, the country would realize significant savings and considerable reduction in its greenhouse gas emissions. This program—which is supported by the Asian Development Bank with counterpart government funding from proceeds of the value-added tax—will feature, among others, the replacement of nine million incandescent bulbs with CFLs. Along with the other components of the program, this will result in savings of about 90 million US dollars per annum from avoided fuel cost. This means that the Philippines can defer 1.3 billion US dollars in investments in power generation and associated network capacity of 320 megawatts, which represents about two percent of the Philippines' total generation capacity. The program is projected to earn for the Philippines about 4.5 million US dollars annually in terms of carbon credits. This is equivalent to an emission reduction of 250,000 tons of carbon dioxide per year. (Taken from speech of Sec. Angelo Reyes during SWITCH Movement launch)
- **Clean Transport Technology shifts**. There are several projects that have been implemented to promote the use of cleaner technologies such as the retrofit of motorcycles to direct injection which aimed at reducing emissions from two-stroke tricycles. This particular project had a grant partially already given by the Philippine Institute of Petroleum. Other projects include the pilot electric jeepneys in the Cities of Makati and Bacolod and a new pilot project involving the use of electric tricycles in Bicol.

According to DENR's National Air Quality Status Report 2005-2007, despite of progress made, several challenges remain, the most important ones being

- **Improved enforcement of roadside inspection and transport planning and management.** The contribution of the transport sector to the worsening air pollution requires immediate attention inasmuch as mobile sources account for the bigger percentage of the pollutants present in the air particularly in Metro Manila, not to mention its effects to the health of the city dwellers. It is also a reality that there is a direct correlation between the worsening traffic situation and increasing emission of pollutants. Unsustainable urbanization leads to growing traffic congestion necessitating costly transport planning and management.
- **Improved air quality monitoring and assessment and dissemination of air quality status results to the public.** There is a need to re-assess the siting of existing monitoring stations to ensure they conform to the guidelines for site selection adopted by the DENR. Air quality monitoring and assessment still needs improvement as most of the monitoring stations are traffic exposed. Results of air quality monitoring should be made known to the cities concerned and to the general public as well.
- **Need for continued awareness raising and active stakeholder involvement in air quality management.** Stakeholders play important roles in reducing pollution from vehicles, industries, and

open burning. A campaign on the impact of air pollution to public health is needed move stakeholders (especially the influencers in Philippine society) to lead society toward less air polluting ways.

Challenges involving the harmonization of national standards with international standards such as use of mass rate standard versus concentration standard are also being currently addressed through consultations among varied stakeholders. The strengthening of the Philippine Clean Air Act is likewise being looked into, not only by the implementing agencies, but also by the legislative branch through the Joint Congressional Committee on the Philippine Clean Air Act by reviewing the law, the current state of its implementation, and the difficulties faced in its enforcement. One of the initiatives spearheaded by the PCA through a World Bank grant is the drafting of an Administrative Order on operationalizing the Citizen Suit provision of the R.A. 8749.

On energy and fuel use, there are also certain issues involving the use of bioethanol which must be addressed squarely while pushing for its use. There is still the on-going "Food versus energy" debate which will hopefully be looked into by a multi agency group. Other issues involve the environmental impact of said use with some sectors noting that the National Biofuels Board guidelines on these concerns are either vague or weak. Meanwhile, the country policy on fuel quality involving the shift towards Euro IV standards is still the subject of discussion, with the Philippine Department of Energy already conducting at least two national fora in 2008, one in Manila and another in Cebu, to thresh out the concerns involving the move. Stakeholders have deliberated that the most feasible time frame for the shift is in 2012.

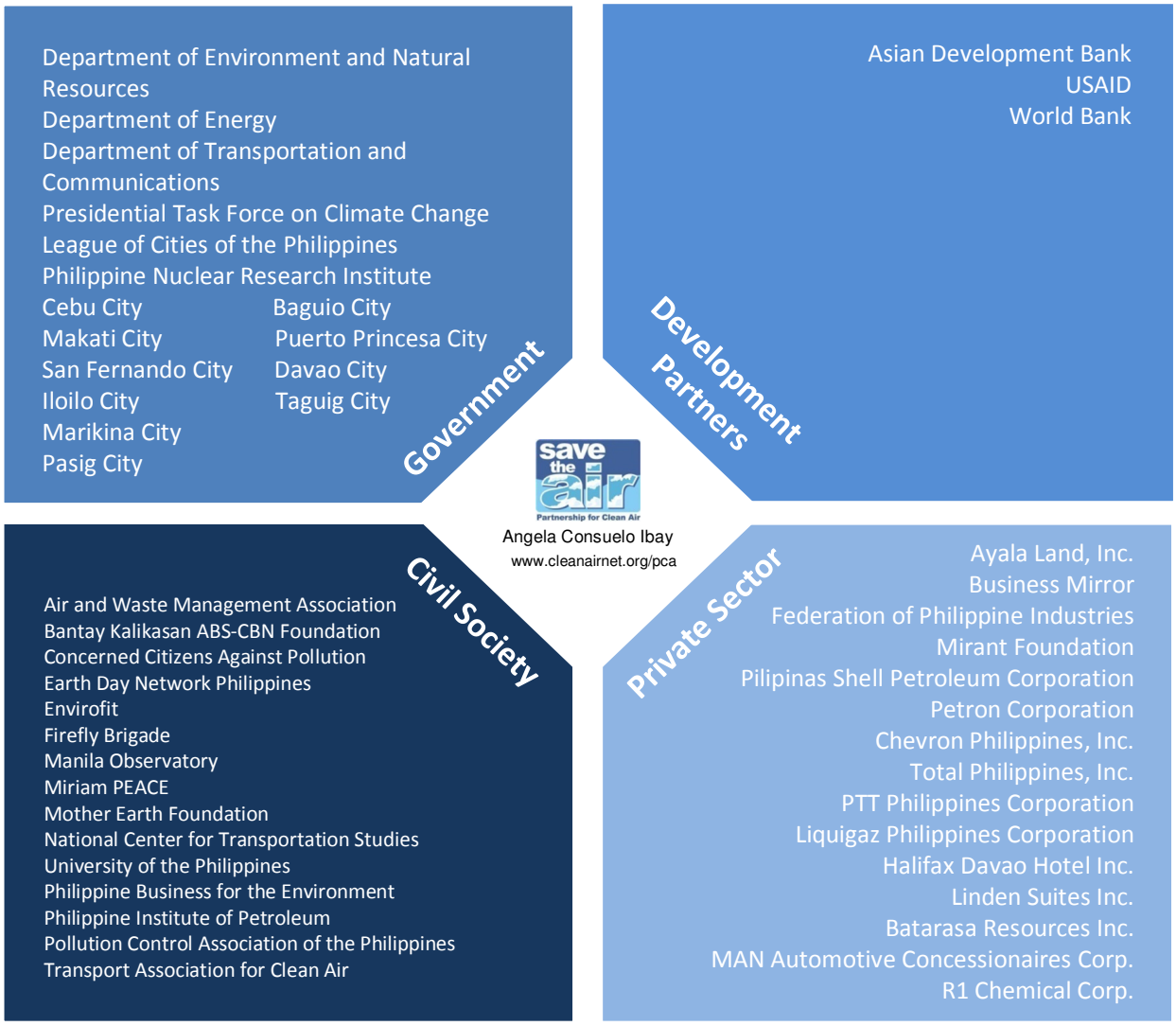


Figure 8. Clean Air Network of Stakeholders in the Philippines

3. RESPONSES TO IMPROVE AIR QUALITY

Countries and cities can address air pollution in several ways, such as, policies, programs, training courses, and on-the-ground measures.

3.1 Policies

The Philippines has a range of policies relevant to air quality management. Policies can be directly aimed at improving air quality, or policies cover related areas (such as health, climate change, energy management, environment) or sectors (such as transport, industry, construction) that affect air pollution indirectly. The most important ones are:

- Republic Act 8749 (Clean Air Act of 1996)
- Republic Act 9367 (Biofuels Act of 2006) and its implementing Rules and Regulations (Department of Energy Circular, DC 2007-05-0006)
- The Department of Environment and Natural Resources has issued a number of administrative orders relative to air quality management as shown below:
    - Amended Guidelines and Procedures for the Monitoring of Accredited and Authorized Private Emission Testing Centers (PETC) and LTO Emission testing Activities (DENR-DTI-DOTC Joint Administrative Order No. 1 Series of 2007) issued in May 2008
    - Revised Emission Standards for Motor Vehicles Equipped with Compression- Ignition and Spark-Ignition Engines (DAO 2007-27) issued in July 2007
    - Guidelines for DENR Accreditation of Third Party Source Emission Testing Firms (DAO 2007-25) issued in July 2007
    - Guidelines on the Requirements for Continuous Emission Monitoring Systems (CEMS) and other Accepted Protocols thereby Modifying and Clarifying Certain Provisions (DAO 2007-22) issued in July 2007
- The Department of Energy has issued a number of administrative orders relative to environmental management. It has also its own environmental management program with the following components: (a) Fuel Conservation and Efficiency Program, (b) Electricity Conservation and Efficiency Program, (c) Renewable Energy Program, and (d) Clean Coal Technology Program
- The Land Transportation Office-DOTC Air Quality Improvement Program which is being implemented pursuant to pertinent provisions of R.A. 8749. Under the Clean Air Act, the LTO-DOTC shall enforce compliance with the emission standards for motor vehicles. It has three (3) components namely: Roadside Smoke Emission Apprehension and Testing, Motor Vehicle Inspection System (MVIS) Project and the Private Emission Testing Center (PETC) Project. Other activities also involve the implementation of the Chlorofluorocarbon (CFC) Phase-out Plan and Clean Air advocacy.
- The Renewable Energy Bill just recently was approved by both Houses of the Philippine Congress. It is expected before the year ends that this will be signed by the President as a law.

3.2 Programs/projects and Training Courses

The CAI-Asia Center and country networks compiled a Compendium of air quality management (AQM) organizations, programs/projects, and training courses, which was published in January 2007. For the

Philippines, 36 programs and projects were identified. In Asia, 28 air quality training courses delivered on a regular basis were identified. For more information see www.cleanairnet.org/compendium.

3.3 Research and Development

Scientific research on air quality and its management are currently being undertaken by academe and research institutions implementing particular projects.

- **ARRPET (Asian Regional Research Programme on Environmental Technology)**

  ARRPET (Asian Regional Research Programme on Environmental Technology) was initiated to conduct a study to assess the growing concern on environmental degradation (wastewater, solid waste, air pollution, and hazardous waste) in Asia by a working group composed of research institutions from 8 countries (China, India, Indonesia, Malaysia, Philippines, Sri Lanka, Thailand, and Vietnam). AIRPET is the air pollution project component of ARRPET, entitled: "Improving Air Quality in Asian Developing Countries". In the Philippines, this was implemented by the Manila Observatory. Using Source Receptor Models such as Chemical Mass Balance (CMB) and Positive Matrix Factorization (PMF) which try to determining the source of (particle) pollution at a certain site (receptor site), CMB and PMF results for Manila Observatory $PM_{2.5}$ samples in both the dry and wet seasons both identified traffic and $(NH_4)_2SO_3$ as the greatest contributors. Both models also identified soil and construction as the main sources of coarse fraction particles for both dry and wet season samples in MO. The CMB was also used for the Phase I and II database. Among the $PM_{2.5}$ sources identified by CMB, traffic has the highest contribution in all the sites in Metro Manila for both seasons. For Cebu (mixed site) and Gabaldon (background site), biomass burning has the highest contribution for both seasons. Moreover, the traffic contribution seems to increase in Cebu and in all but one site in Metro Manila during the wet season. For the coarse fraction sources, construction has the highest contribution for the mixed sites MO and Cebu while seasalt is highest for the background site.

  The dispersion modeling experiments of ozone concentration for Metro Manila have produced good correlation with observations in terms of time series but yielded extremely small values compared to measured values. The meteorological input data is currently being improved by including a land surface model in MM5 options. (ARRPET 2008)

- **Particulate Matter Monitoring and Source Apportionment by Nuclear and Related Analytical Techniques**

  The Philippine Nuclear Research Institute (PNRI) of the Department of Science and Technology (DOST) continued to monitor particular matter in the PM_{10} and $PM_{2.5}$ ranges using the Gent dichotomous sampler used in the International Atomic Energy Agency (IAEA) programs on air pollution. Monitoring is performed presently at three sites in Metro Manila with two stations co-located with those of the Environmental Management Bureau. Air filters are analyzed by X-Ray Fluorescence Spectrometry or by Particle Induced X-Ray Emission to generate data for about 18-20 elemental components of particulate matter. Black Carbon analysis is also performed. The PNRI has contributed data for PM_{10} and $PM_{2.5}$ and for toxic elements such as Pb to the National Air Quality

Status Reports published periodically by the EMB. The PNRI has generated multi-year data for PM_{10} and $PM_{2.5}$ which could be used as basis for standard setting. $PM_{2.5}$ annual means for PNRI stations exceed the US EPA long term standard.

The principal objective of the PNRI study is to identify the major sources of air pollution and estimate their contribution to air particulate pollution through the application of receptor modeling tools (Positive Matrix Factorization) using the multi-elemental database generated. The application of back trajectories ensemble methodologies allows the determination of the physical location of the pollutant sources.

PMF analysis of data for the fine fraction from the Ateneo de Manila University indicates major contribution of vehicular emissions and other combustion sources (50%) and secondary sulfate (34%) which could come from the burning of heavy oil fraction. Other components of the fine fraction are aged salt (8%) and soil (7%). In the coarse fraction, soil contribution is predominant (73%). Data also documented high levels of Pb in Valenzuela as compared to the other sites. PMF results indicate Pb sources in both the coarse and the fine fractions. PNRI has provided assistance to end-users primarily from local government units in addressing air pollution issues.

The PNRI participates in the IAEA Regional Cooperation Agreement (RCA), which conducts a regional project on air pollution with the participation of 14 member states: Australia, Bangladesh, China, India, Indonesia, Korea, Malaysia, Mongolia, Myanmar, Pakistan, Philippines, Singapore, Sri Lanka, Thailand and Vietnam. All participating countries share a common methodology using the same type of sampler. The regional project has generated a long-term database which will be made available to air quality stakeholders in the near future.

- **Technology Options for Two-stroke Powered Tricycles**

In 2006, a quasi participatory research was conducted entitled, “Technology Options for 2-Stroke Powered Tricycles”. Made up of three components, namely: Market Scan and Information Dissemination, Technology Verification and Social Benefit Cost Analysis, the research project studied the effectiveness of four current technologies, namely: a) Alternative fuel (Ethanol 10), b) Bio 2T oil (CME-blended), c) Air Bleed Technology (Cyclos) and d) Retrofit Technology (Direct Injection). Findings showed that the four technologies – Direct Injection, Air Bleed, Bio 2T and E10 – brought about improvement on specific parameters in varying degrees, with Direct Injection technology topping positive changes in all parameters. However, it was recommended that a large scale pilot testing should be undertaken to ensure that technical problems resulting to long-term use are addressed and costing can be refined. The Social Benefit Cost Analyses also showed remarkable benefits to the general public as well as to the tricycle operators.

The research project was sponsored by Peace and Equity Foundation (PEF) and undertaken mainly by academic institutions, headed by the Environmental Studies Institute (ESI) of Miriam College in collaboration with National Center for Transport Studies (UP-NCTS), Technological University of the Philippines (TUP), Don Bosco Technical College (DBTC) and the SKY Group (Suzuki, Kawasaki and Yamaha).

3.4 Enforcement Mechanisms/Local Legislation

Roadside smoke emission apprehension and testing entails the deployment of LTO law enforcers and other deputized agents from the DOTC, the Metro Manila Development Authority, and local government units in strategic points in Metro Manila and in other regions nationwide. For 2005, a total of 15,858 apprehensions were conducted by the LTO with collected fines amounting to Php26.7 million. Meanwhile, for 2006, a total of 15,276 vehicles were apprehended with corresponding fines amounting to Php34.1 million. For 2007, apprehensions reached a total of 11,556 with fines amounting to Php23.3 million.

The strict enforcement of clean air standards for Diesel and Gas-fuelled vehicles is exemplified by the untiring effort of the Metro Manila Anti-Smoke Belching Association (MMASBA) with members from the 17 local government units (LGUs) in Metro Manila, LTO-Central Office, DENR-Environmental Management Bureau-National Capital Region and supported by PCA and USAID-Energy and Clean Air Program (ECAP).

There are six active LGUs in Metro Manila who are very active in road side apprehensions with a maximum of 50-100 apprehensions everyday. In Makati City alone, the three teams can apprehend about 50-150 smoke belching vehicle same with the case of Pasig City, Mandaluyong City, Muntinlupa City, San Juan City and Quezon City. Almost all Local Government with in Metro Manila adopted their own vehicle emission ordinance incorporating the clean air standards.

3.5 Case Studies of Concrete Actions

Noiseless, smoke-free rides on Makati's E-Jeepneys

Ten electric jeepneys (E-jeepneys) will be plying the streets of Makati before the busy Christmas season rolls in. Makati officials plan to buy seven locally manufactured E-jeepneys, bringing to 10 the city's present fleet of electric battery-powered jeeps. The local E-jeepney is designed and built by the Motor Vehicle Parts Manufacturers Association of the Philippines (MVPMAP), a group of about 130 automotive parts and components manufacturing companies.

The city government is currently operating three E-jeepneys at the heart of the Makati Central Business District (CBD), servicing mostly office workers for FREE while its application for franchise is being processed. The acquisition of seven more E-jeepneys will enable the city to expand its services and cover other busy areas of the business district.

The city government and an environmental group, Green Renewable Independent Power Producers, Inc. (GRIPP), and Greenpeace Phils, introduced the E-jeepneys in Makati in July 2007 and ran the E-jeepneys on a pilot basis in 2008.

Operated by 12 72-volt batteries, an electric jeepney can carry 17 passengers. With an eight-hour charge from an ordinary electrical outlet, the vehicle can run for three days, at least 100 kilometers a day, at the speed of 40 kilometers per hour. The E-jeepneys are noiseless and smoke-free and look like large golf carts. A

locally-built E-jeepney costs P550,000 while a new 14-seater diesel-run jeepney costs an average of P750,000.

The battery-driven jeepneys will be loaned to local jeepney operators. Many jeepney operators have expressed interest to switch to E-jeepneys because they are much cheaper and easier to maintain compared to their diesel counterparts. For a full charge, an E-jeepney can run up to three days at only less than P200.

A similar project is also being piloted in Bacolod City.

(Source: www.pr-inside.com/more-electric-jeepneys-for-makati-s-streets-r818525.htm)

Marikina City: Cycling its way to Clean Air

The bikeways program of Marikina City is a holistic social and advocacy campaign that promotes cycling as an alternative public transport. It is holistic because it not only creates the physical requirements for the adoption of bicycling, but also provides an opportunity for people to own bicycles, educates the public on the social dimension and safety of riding the bicycle, and puts in place policies that make this program a sustainable one.

Aside from the construction of bikeways, the program offers activities focusing on safe cycling education especially for the youth, bicycle loan and lending program, bicycle ownership survey, Marikina cycling festival, cyclists organization, bicycle clinics, and creating an ordinance mandating the use of bicycle lanes.

In 2006, Marikina City had constructed 46.6 km of bikeways (out of the 66 km target) which connects residential areas to major transport terminals, markets, schools, commercial and industrial establishments. The Bikeways program is partly funded by the GEF/World Bank grant of USD1.1 million. It has been reported that 55% of Marikina households have bicycles and 22% use them to get to work.

Volunteers catch smoke belchers by surprise

Using the precept of volunteerism, the “Bantay Kalinisan” (Cleanliness Watch) Task Force conducts on-the-spot vehicle emission testing and roadside apprehensions during surprise but planned “operations” at identified major roads and entry points to the City of Baguio.

Since its operation on 1 August 2005 until 8 September 2005, the group reported 632 apprehensions of smoke belching vehicles; 475 already paid their fines (76.37%) amounting to PhP 493,000.00. In 2006, there were 942 vehicles flagged down and tested and 709 (75.27%) of these failed the emission test. The simultaneous roadside apprehensions conducted by five teams of the Task Force helped improve the air quality in the City but also more importantly served as warning to the transport group, and owners of private motor vehicles, that indeed, violators are apprehended and penalized.

The Bantay Kalinisan Task Force, Inc., an organization of concerned volunteers, was conceptualized and initiated by the Department of Environment and Natural Resources Regional Office in mid-2005.

CAI-Asia Center
Unit 3510, 35th floor
Robinsons-Equitable Tower
ADB Avenue, Pasig City
1605 Metro Manila, Philippines
Tel +66 2 3952843
Fax +66 2 3952846
center@cai-asia.org
www.cleanairnet.org/caiasia

Partnership for Clean Air
PCA Secretariat
Manila Observatory
Ateneo de Manila Campus
Loyola Heights, Quezon City
Tel +63 2 426 5921 to 23
Fax +63 2 426 0847
pca@observatory.ph
www.cleanairnet.org/pca