

JAKARTA AIR QUALITY MANAGEMENT : TRENDS AND POLICIES

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I. INTRODUCTION.

Jakarta is the capital city of Indonesia. Located in a low land area with average height around 7 meter above sea level, between 6 12' South latitude and 106 48' East longitude, comprised of 661,52 square km of land area and 6,977.5 km² of sea water area.

Jakarta is divided administratively into six municipalities i.e. South Jakarta, Central Jakarta, Eastern Jakarta, Western Jakarta, Northern Jakarta and one "Kabupaten" of Thousand Island regional government.

In year 2000 the population of the Jakarta Metropolitan Area was around 9,2 million to 10 million at night time and around 11 million to 13 million at daytime and expected to be doubled in the next two decade if no significant urban population policies taken.

As a metropolitan city, Jakarta inhabited by variety of races and tribes, with different socio-cultural background and continues developing, both in term of population size and of economic. Both factors exert powerful influences upon environmental problem. However, due to its development and urbanization, Jakarta has experienced serious air pollution problem associated with ever increasing use of energy in generated from transportation activity, industries and domestic. The concentrations of several pollutants along major roads in Jakarta have reached hazardous level.

Air quality in Jakarta severely degraded. Several studies shown air pollution both fumes and gases emitted from motor vehicles, industries and domestic activities. The major transportation problems in Jakarta, included increasing traffic congestion is believed related to a poor level of public transportation service. Private cars have been the popular ownership and significantly contributed to the traffic congestion and worsened the air quality.

A World Bank Study (1993) estimated that the costs of air pollution in Jakarta that mostly comes from motor vehicles amounted to US\$ 500 million per year.

The Government of Jakarta has tried to carry out a Clean Air Program (PRODASIH /Program Udara Bersih) in order to improve the air quality. However the predominantly role of the government and a lack of broad participation and support from urban communities has made this program expensive and beyond the capabilities of urban management resources to deal with.

The condition above brings the local government of Jakarta applied some guidelines on urban development by promoting environmentally sound & sustainable development program to be more simple by framing a great attention to the formulation of urban environmental policies, enforcement and promoting public participation and cooperation among various parties as well as improving international relation and cooperation.

II. TRENDS OF AIR POLLUTION IN JAKARTA.

Air pollution is the major problem in most developing country cities. It is primarily due to the use of energy in transportation and industry, although nature also contributes through such events as volcanic and forest fire.

The visitor to Jakarta will observe that the air quality is severely degraded. No distance views are visible and tall buildings appear to be covered by haze. The air quality monitoring data confirms this observation. The level of dust in the air shed at several areas is exceeding the local or national standard.

The main contributors to this air pollution are undoubted motorized vehicles and industry. Related to the above issues, quantitative figures for Jakarta are listed as follow:

2.1. Fuel Consumption in Jakarta

Fuel used by factory, household, commercial activities and automobile were quoted from statistical data Pertamina (State owned oil enterprise) and PN Gas (State owned gas enterprise) as shown in table 1.1.

Table 1.1. Fuel consumption by type in Jakarta, 2001

Type of fuel	Amount of consumption	Unit
1. Premium	1.999.624	Kl / year
2. Premix ,Super TT	250.532	Kl/year
3. Kerosene	1.538.984	Kl / year
4. Diesel	2.205.630	Kl / year
5. Gas	1.154.645	(1000 m3/year)

Source: Jakarta in figures, 2001

Fuel consumption in Jakarta/Jabotabek (Jakarta greater area) was analyzed to estimate emissions and exhaust gas volume from stacks. Fuel characteristics include its content of S, C, H, N, gross heating value and specific gravity as shown below:

Table 1.2. Characteristics of fuel used in Jabotabek (fuel used by motor vehicles)

Fuel	S (wt %)	Specific gravity	Reid vapor pressure	Lead metal g/L
1.Premium	0.015	0.735	7.4	0.09
2.Premix	0.019	0.737	7.8	0.27
3.Super-TT	0.008	0.735	6.9	< 10 ppb
4.Solar	0.396	0.848		

Source: The Study on The Integrated Air Quality Management for Jakarta Metropolitan Area; JICA & BAPEDAL, 1977

2.2. Motorized Vehicles: Categories and Numbers

The type of vehicle in Jakarta is categorized into: motor cycles, passenger cars, cargo, and buses. Both categories and numbers of vehicles in Jakarta as shown in table 1.3.

*Table 1.3. The number of registered motor vehicles in Jakarta, 1997 – 2001
(Excluding Army and Corps Diplomatic vehicles)*

Categories	1997	1998	1999	2000	2001
1. Motor cycles	2.055.332	1.527.906	1.543.603	1.619.516	1.813.136
2. Passenger cars	1.095.170	952.264	965.058	1.052.802	1.130.496
3. Cargo cars	380.788	319.31	320.438	334.013	347.443
4. Buses	311.371	253.718	253.574	253.593	253.648
Total	3.842.661	3.053.189	3.082.679	3.259.924	3.544.723

Source: Jakarta in figures, 2001

Since 1990 (total: 1,649,037), the number of motorized vehicles has been increasing rapidly in Jakarta. The average increase rate is around 15 % but in the period of 1997 –2000 relatively constant because of the economics crisis.

Almost 50 % of motorized vehicles registered in Jakarta are motorcycles, within which more than 60 % are two-stroke motorcycles. They are the worst contributor for suspended particulate matter and hydrocarbon emissions. Motorcycles become very popular due to its maneuver ability, not very expensive and affordable among medium and low-income people. They are not used only for personal transportation but also become “informal public transportation services” and goods delivery.

Most of motorized vehicles in Jakarta use carburetors and the engine model are highly fuel consuming and emitted more toxic pollutant. Yet the new cars do not use catalytic converter as exhaust-treatment due to lead contents on fuel (TEL).

This condition and insufficient roadways increase air pollution especially carbon monoxide, hydrocarbon and particulate matter.

2.3. Other Stationary Sources of Air Pollution in Jakarta

There are about 2143 factories categorized as stationary sources of air pollution as shown in Table 1.4

Table 1.4. Number of factories in Jakarta, 2000

No	Type of Industry	Number
1	Food and beverages	225
2	Textiles and wearing apparel	808
3	Wood and wood products except furniture	59
4	Paper and paper products, printing and publishing	224
5	Chemicals, petroleum, coal, rubber and plastic product	228
6	Non metallic mineral products, except petroleum and coal product	21
7	Basic metal	33
8	Fabricated metal product, except machinery and equipment	139
9	Machinery and equipment	48
10	Motor vehicles, trailers and semi trailers	37
11	Rubber and plastic product	172
12	Radio, television and communication equipment	15
9	Furniture and manufacturing	134
	TOTAL	2143

Source: Jakarta in figures, 2001

Notes:

Most of factories in Jakarta are textiles/clothing/leather, plastic product and machinery/equipment industries.

Mostly emission from power plant, glass factories, steel melting industries emitted from their utilities such as boilers, generators, diesel engine, gas turbine, dryer and incinerator

2.4. Load of Air Pollution in Jakarta

Estimated load of air pollution by source, total emission and proportions originating from each source is shown in Table 1.5.

Table 1.5. Emission of pollutants in Jakarta, 1999

Pollutant	Stationary sources * Ton/year	Mobile sources Ton/year	Industry Ton/year	Solid waste Ton/year	Total Ton/year
Particulate	16,777.29	6143.47	56,563.09	936.18	80,510.03
SO ₂	103,929.70	411,139.90	1354.35	57.16	516,483.11
NO ₂	59,421.35	33,219.13	3.42	158	92,801.89
HC	3511.51	30,163.86	3398.18	770.73	37,844.26
CO	14,697.82	599,180.12	70,886.51	2100.02	686,864.46

Notes: *) Estimated load of air pollution from electrical power plant/generators, factory utilities.

III. AIR QUALITY MANAGEMENT IN JAKARTA

Air quality in Jakarta is severely degraded. Several studies shown that the air quality is becoming worst. This condition is due to fumes, gases and other pollutant emitted from motorized vehicles, industries and domestic activities.

To deal with this problem Jakarta has carried out several efforts to improve the air quality. Recently this effort was initiated and predominated by government and committed as a program in The Five Year Regional Development Plan (Repelita) of Jakarta, and known as Program Udara Bersih/Prodasih (Clean Air Program). The program includes private cars Inspection and Maintenance Program (I&M Program); industrial emission control; traffic management; managing land use development; promoting the use of clean fuel gasoline includes unleaded gasoline and fuel gas; expanding the urban greenery

3.1. Policy Formulation

All policies concerning efforts to improve the air quality was formulated and accommodated in an official development documents namely Five Year Regional Development Plan. For the time being air quality management has been stated as a new priority of the Jakarta Strategic Plan.

3.2. Air Quality Monitoring

Since 1985, regular air quality monitoring was operated by the Jakarta Environmental Management Agency (BPLHD).

There are 12 periodical monitoring stations and 4 continuous monitoring stations which monitor the air quality in the certain area representing housing, industrial, recreation and mix area. It is planned to commission five further continuous stations and one mobile unit. Data from the continuous monitoring station inform the public the pollutant standard index in order to increase public awareness on air pollution problem.

The parameters measured are SO₂, NO_x and TSP. The monitoring instruments are permanently installed and 24 hours measurements are recorded every eight days.

Since 1992, hourly average continuous measurement has been made to monitor the quality of SO₂, NO, NO₂, CO and PM-10 at Central Jakarta where the monitoring station situated in a strongly influenced heavy traffic (road side air quality monitoring).

In order to improve the monitoring capacity and resulted information of air quality in Jakarta, BPLHD has set-up another three continuous monitoring stations at residential areas.

The result of air quality monitoring in 2001 showed none of SO₂, and CO below the Ambient Air Quality Standard. However, the concentration of TSP at mostly area

exceeds the standard. Except annual monitoring on SPM (PM-10) concentration at Pulo Gadung (industrial area) is exceeding the National Ambient Air Quality Standard.

The air quality standard, both ambient air quality and emission standard regulated by Gubernatorial Decrees as follows:

- ✍✍ The standard of Ambient Air Quality and noise
- ✍✍ The standard of mobile source emission
- ✍✍ The standard of stationary sources emission

3.3. Promotion of Alternate Clean Fuel Gasoline

Basically, the increasing use of motorized vehicles increases the mobility. However, the use of poor quality gasoline increases the air pollution and damage to the ecosystem and human health, offsetting economics and health benefits. Jakarta now is examining options to deal with vehicular pollution reduction by adopting a cleaner fuel program.

At the time being, 90 buses of Perum PPD (State owned public transportation company), use gas fuel; whilst 1377 taxis are equipped with LNG/CNG fuel converters, and these year another 1208 taxis will be equipped with the same converters. 700 units official car of local government is also equipped with LNG/CNG fuel converters.

Started from July 1st, 2001, Pertamina (National Oil Enterprise) has introduced and supplied unleaded gasoline in Jabotabek (Jakarta and its suburb) area, without increasing the gasoline fuel price as a public incentive.

Since lead in the urban air practically comes from the combustion of leaded gasoline in gasoline vehicles, phasing out of lead gasoline has substantially reduced emissions of lead into the air.

3.4. Industrial and Vehicles Emissions Control

Under the Blue Sky Program which issued by The Ministry of Environment, there are intensively 20 industries under control i.e. steel melting factories (7), power plant (3), glass melting factories (4) and textile industries (6). All has signed the agreement with the Government of Jakarta that they will fulfill the emission standard by the end of 2004.

At present compulsory to have emission test is limited to public transportation, cargo, truck and buses. However due to the economics crisis not all the vehicles follow the test and this condition makes the air quality getting worse.

The institution for vehicle emission test has several efforts to strengthening the capabilities and facilities for roadworthiness and implementing law enforcement.

A recent study done by JICA and Bapedal (1997), reveals that more than 50 % of CO emitted from passenger car group, and around 20 % from motorcycles. Passenger car group and motorcycles contribute respectively around 40 % of HC emission load.

More than 50 % of NO_x are emitted from the passenger group and around 30 % from buses. Passenger cars, buses and trucks almost equally share SO_x and PM-10 emissions.

Due to this condition, since 1997 Local Government of Jakarta introduced the Inspection and Maintenance Program (I&M) and legalized through the Gubernatorial Decree Number 95 year 2000 and will be effectively implemented in year of 2002. The objective of the I&M is clearly the protection of the environment by reducing exhaust emissions of in-use car addressing the correct engine adjustment by regular testing and maintenance of the vehicle.

The implementation of I&M will be delegated to private workshops, to guarantee the quality of the services delivered, and a high standard, the operators and the workshop will be constantly monitored by private surveillance organization.

The high degree of involvement of the private sector shall ensure that I&M program is efficiently implemented with a minimal investment of the government.

A Supervisory Commission, includes members of all stakeholders will be established to oversee the whole I&M program

Figure 1 Illustrates the I&M system and relationship between the government, private sector, NGO's and public.

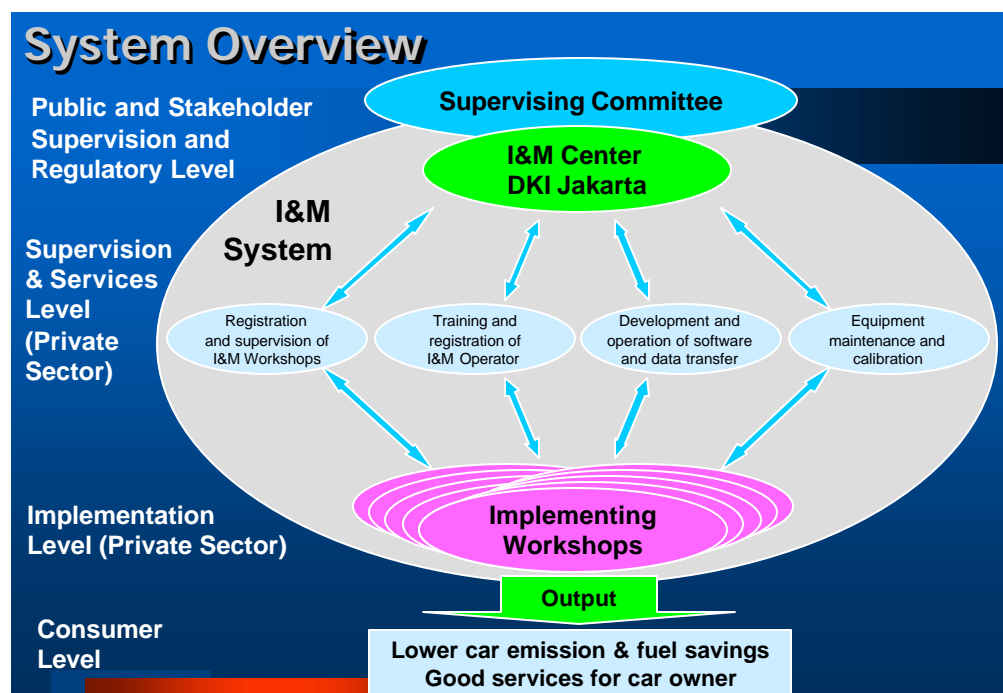


Figure 1: The I&M System in DKI Jakarta

Figure 1. shows the I&M program largely depends on the involvement of the private sector. The development and regulation of the system will be the Governments task through the Management Team.

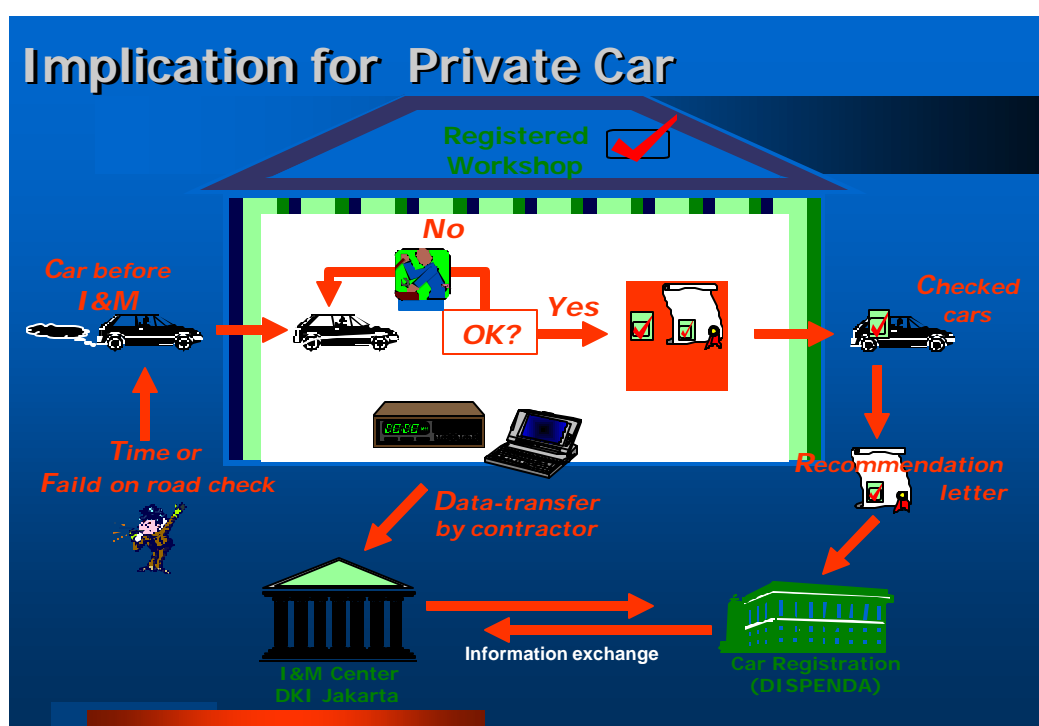
The workshops have to be registered and to employ at least two registered operators. They will then have to measure the vehicle exhaust emissions before and after the maintenance/service.

The result of measurement will be stored together with the vehicle and owner data on a database and all the data will be transferred to the I&M Center.

All private cars registered in DKI Jakarta will be required to do the inspection and maintenance of their cars, on a yearly basis in order to comply the standard.

All the data at the I&M Center will be analyzed and distributed to relevant Institutions. The data is accessible to the public to guarantee transparency.

The car owners will be treated by the system as client; i.e. they will receive high quality services. Therefore the workshops should supervise the correctness of the procedures and the quality of services. While the car owners have the rights to choose the workshop delivering the I&M. In the future the existing workshop who delivers car service and repair will be developed as a one stop service workshop. The rate of these services will be determined by market.



The car owners have to follow the I&M regulation and bear all consequences if they refuse include.

3.5. Public Campaign

Public campaign is to encourage people awareness and increase public participation on the Clean Air Program and disseminate through all media.

Since 1992 to 1997, 21000 cars has actively involved in the emission test campaign which conducted by local government agencies together with relevant business community, Police Department, Academia and NGO's.

As a pilot project, Swisscontact, a Not-Profit Organization from Switzerland, has implemented this program involving buses (1850 units) and taxis (700 units). The result shows the emission reduced almost 90 % and reduces 10 % of fuel consumption.

Currently, the Swisscontact is organizing a program called “Segar Jakarta–ku” (My Fresh Jakarta) in order to increase public concern on air pollution management issues.

3.6. Urban Greenery

During the last two decades Jakarta has been actively promoting the urban greening program via land use planning polices and targeting about 35 % of the total urban area. The existing green area of Jakarta is now only around 14 %.

3.7 Low Cost Traffic Management

Excessive use of automobiles has caused problems for cities. Increased demand for roads and parking has resulted in the paving over valuable and productive urban spaces. The development of urban and regional transportation systems is to provide an integrated system that can ease and increase the safe mobility of people and goods, as well as promoting the healthy air quality and public health. By improving the traffic management it is believes the traffic congestion and the impact it may caused will be minimized.

IV. CONCLUSION

- ✍️ Parallel with the urban development and urbanization, Jakarta has experienced serious air pollution problem associated with the use of energy in transportation sector and industries. The concentrations of several pollutants along major roads have reached hazardous level while at several locations, TSP concentration exceed the standard.
- ✍️ The Government of DKI Jakarta has carried out The Clean Air Program/Prodasih in order to improve air quality in Jakarta and to promote the public awareness on a specific urban environmental issues i.e. air pollution.
- ✍️ The overall design and implementation of The Clean Air program is initiated and predominated by the role of the government yet creating room for public participation and private sector to play their role in the provision and the operation of the necessary facilities.
- ✍️ The implementation and enforcement of the regulation is not fully effective yet and it has been restrained by inadequate expert, funds and equipments, political will, limited public support and participation, unclear or overlapping and uncoordinated institutional responsibilities.
- ✍️ Local institutions will require substantial strengthening in terms of human resources, organizational structure, facilities and financial resources based on cooperation among various parties (private sectors, NGO's, international cooperation, etc.)
- ✍️ Public awareness and information dissemination are of importance to be progressed continually in order to implement the entire program such as inspection and maintenance, using fuel gas, unleaded gasoline, greening program and other environmentally sound program.
- ✍️ The polluter-pays principle should be considered to be implemented as an economics instrument in order to success the Clean Air Program.