

Tackling Air Pollution

Purpose

This paper reports on the measures taken by the Government to tackle Hong Kong's air pollution problem.

Background

2. Hong Kong faces two different types of air pollution, namely, local pollution caused by vehicles and power plants and regional air pollution. Since late 1990s, we have already implemented a series of measures to improve local air quality, especially through effective controls on vehicles –

- (a) replaced diesel taxis with liquefied petroleum gas (LPG) taxis;
- (b) provided financial incentives for light buses to switch to LPG or electric models;
- (c) introduced ultra low sulphur diesel (ULSD) as the statutory standard;
- (d) made it mandatory for pre-Euro diesel vehicles to retrofit particulate removal devices after providing them with financial assistance;
- (e) tightened emission standards for new vehicles to Euro III;
- (f) more than doubled the fines for smoky vehicles to \$1,000 and stepped up enforcement;
- (g) required power plants to maximize the use of natural gas, allowing only gas-fired generating units to be built; and
- (h) required power companies to install emissions control devices such as desulphurization system.

3. These measures have borne fruit as far as localized pollution sources are concerned. Between 1999 and 2005, the levels of respirable suspended particulates (RSP) and nitrogen oxides (NO_x) at roadside were reduced by 14% and 17% respectively. The number of smoky vehicles also dropped by nearly 80%. However, the concentrations of RSP recorded at the general air monitoring stations increased by 6% from 1999 to 2005. It is evident that the

air quality of Hong Kong is increasingly affected by regional air pollution.

4. To improve regional air quality, the Environmental Protection Department (EPD) of Hong Kong and the Environmental Protection Bureau of Guangdong Province conducted a joint study on regional air quality during 1999-2002. The aim of the study was to analyze the relative significance of different industrial and commercial sources of pollution and their direct and indirect impacts on regional air quality so that air pollution control measures could be prioritized accordingly. This was done by quantifying the emissions of pollutants over an area of 42 800 km² in Pearl River Delta (PRD), collecting air samples and evaluating the regional distribution of air pollutants and changes by computer simulation. According to its findings, the economy, population, electricity demand and vehicle mileage in the PRD Region would grow by 150%, 20%, 130% and 180% respectively from 1997 to 2010. In terms of total emissions, Hong Kong accounted for about 5-20% of regional air pollution, while the PRD Economic Zone of the Mainland accounted for 80-95%. Given the continuous economic growth of the PRD Region, the extensive air pollution in the region could not be mitigated effectively even if the two governments continued to implement their then existing improvement measures.

5. In light of this, the Hong Kong SAR Government reached a consensus with the Guangdong Provincial Government in April 2002 to reduce, on a best endeavour basis, the emissions of four major air pollutants, namely sulphur dioxides (SO₂), NO_x, RSP and volatile organic compounds (VOC) by 40%, 20%, 55% and 55% respectively in the region by 2010, using 1997 as the base year. Achieving these targets will not only enable Hong Kong to meet its air quality objectives but also significantly improve the air quality of the Pearl River Delta and relieve the regional smog problem.

Progress of Reducing Emissions In Hong Kong

6. To fully achieve the 2010 emission reduction targets, the following additional emissions reduction measures are being pursued –

- (a) tightening the motor petrol standard to Euro IV with effect from 1 January 2005;
- (b) requiring the installation of vapour recovery systems for vehicle refuelling at petrol filling stations from 31 March 2005;
- (c) preparing for the introduction of Euro IV emission standards to newly registered vehicles in 2006;

(d) requiring the power companies to take measures to reduce emissions and increase the use of natural gas in electricity generation; and

(e) introducing a scheme to control VOC emissions from selected products.

7. Hong Kong has achieved good progress in reducing the total emissions of NO_x, RSP and VOC. For SO₂, however, much of the effort has been vitiated by the increase in emissions from the power plants. Details are presented in Table 1 below –

Table 1: Progress in Achieving the 2010 Emissions Reduction Target

	Emission Level in 1997 (tonnes)	Emission Level in 2004 (tonnes)	Changes in Emission Level during 1997-2004	Reduction Target for 2010
SO ₂	64,500	94,800	+47%	-40%
NO _x	110,000	92,500	-16%	-20%
RSP	11,200	8,040	-28%	-55%
VOC	54,400	41,900	-23%	-55%

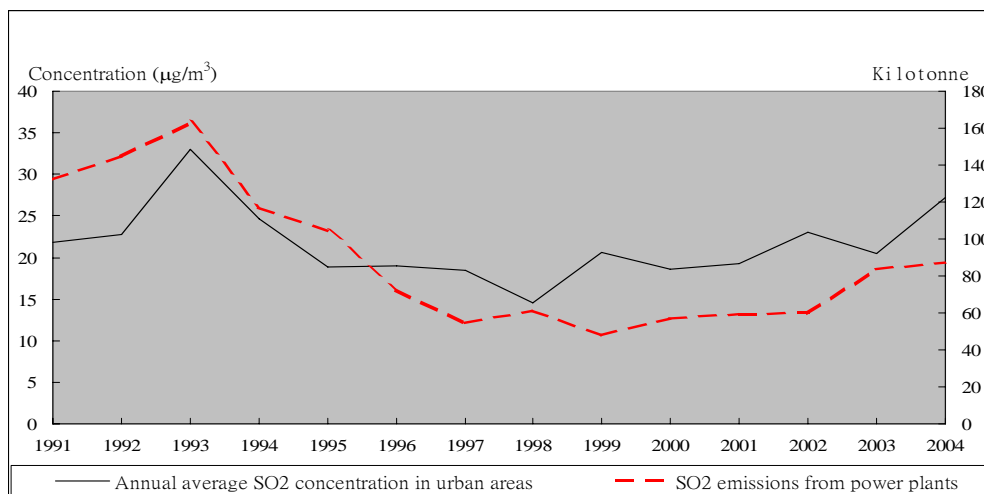
8. Electricity generation remains the biggest source of air pollution in Hong Kong, as shown in Table 2 below. It accounts for 92% of the SO₂ and half of the NO_x and RSP emissions –

Table 2: Composition of emission sources

Sources	Share of total emissions in 2004 (%)			
	SO₂	NO_x	RSP	VOC
Power Generation	92.3	48.5	50.8	0.9
Road Transport	0.1	26.6	24.9	16.8
Navigation	4.0	17.1	6.0	0.7
Others	3.6	7.8	18.3	81.6

Indeed, as shown by the following chart, the SO₂ emission by local power plants is highly correlated to the local urban concentration of SO₂. Therefore, to achieve the 2010 emissions reduction targets and sustained improvement in our air quality, the power companies must substantially reduce their emissions.

Chart: Trend of emissions and concentrations of SO₂



9. On 12 October 2005, in his Policy Address, the Chief Executive reiterated the Government's commitment to achieve the 2010 emissions reduction targets. We have asked the power companies to accelerate the timing of emissions reduction projects, increase the use of ultra-low sulphur coal and use natural gas for power generation as much as possible. In addition, the EPD is progressively tightening the emission caps upon the renewal of the power companies' Specified Process Licences (SPLs) issued under the Air Pollution Control Ordinance, to ensure that the 2010 emission reduction targets are achieved. A set of emission caps has already been imposed on the Castle Peak Power Station of China Light & Power (CLP) since 1 August 2005. As from 1 January 2006, emission caps have also been imposed onto Black Point Power Station similarly through renewal of the SPL.

10. The 2005 Policy Address has stated that in formulating the Scheme of Control Agreements (SCAs) between the Government and the two power companies which will expire in 2008, the Government will require the power companies to install effective emission reduction facilities to achieve emission reduction targets, as a precondition for licensing. In addition, the Government will explore options to avoid the costs of installing emission reduction facilities being passed onto consumers as far as possible.

11. In the Stage II "Consultation Paper on Future Development of the Electricity Market in Hong Kong" issued on 30 December 2005, we have proposed that the permitted rate of return on all fixed assets of the power companies be linked to their achievement of the emission caps stipulated in the SPLs, and reduced if they do not achieve the emission caps. As a corollary, financial incentives in the form of "bonus" returns will be provided to encourage

the power companies to reduce their emissions to levels below those required in the SPLs.

12. We have also proposed that all capital expenditure for emission reduction facilities will be subject to the lowest rate of return. This approach retains the incentives for the power companies to invest in such facilities to help achieving the emissions reduction targets, while lessening the financial burden on consumers.

Emissions Trading

13. Emissions trading is an effective market-based tool aiming to achieve the emissions reduction at a minimum cost while providing flexibility to the power companies in the selection of reduction strategies and management of reduction plans. The Government has proposed emissions trading as an optional measure for CLP and HEC to achieve their 2010 reduction targets.

14. To facilitate discussions on matters relating to setting up an emissions trading pilot scheme between power plants in Hong Kong and the PRD area, a Joint Task Force with members from CLP, HEC and EPD was formed in end 2005.

Cooperation with the Mainland

15. At the Sixth Meeting of the Hong Kong – Guangdong Joint Working Group on Sustainable Development and Environmental Protection (JWG) held on 20 December 2005, the two sides noted that there had been significant progress in implementing the PRD Regional Air Quality Management Plan (the Management Plan) during 2005.

16. Since 30 November 2005, the Regional Air Quality Monitoring Network jointly established under the Management Plan had been formally commissioned and the PRD Regional Air Quality Index published on a daily basis. The enhanced control measures under the Management Plan were well on schedule. Moreover, the two sides exchanged ideas and know-how on air quality monitoring, air emissions inventory compilation, preventive measures on vehicles emissions and continuous emissions monitoring of stationary pollution sources.

17. The JWG has agreed to include additional measures in the Management Plan. They include introducing emission caps for the power plants in Hong Kong, tightening control over pollutant emissions from major pollution sources in the PRD, studying the feasibility of advancing the implementation of more

stringent motor vehicle emission standards in Mainland cities, and stepping up regular inspection of in-use motor vehicles. The two governments will also strengthen exchanges and co-operation on continuous emissions monitoring of stationary pollution sources and enhance the reliability of the systems on both sides and the comparability of data. The progress of enhanced control measures of the HKSARG and the Guangdong Provincial Government is set out in **Annexes A and B** respectively.

18. In 2006, the major tasks under the Management Plan include the following –

- (a) On combating air pollution from the power generation industry, Phase I construction of the liquefied natural gas (LNG) trunk pipeline in Guangdong Province will be completed in 2006 and a number of LNG power plants are expected to be commissioned in phases. This will substantially reduce the PRD's reliance on the more polluting fuel oil and coal. Moreover, existing oil-fired and coal-fired power plants in Guangdong Province will continue to install flue gas desulphurization systems;
- (b) On controlling emissions from motor vehicles, the Guangdong Provincial Government will strive to advance the implementation of National III motor vehicle emission standards (on a par with Euro III ones) in PRD cities while Hong Kong will implement Euro IV motor vehicle emission standards in line with the EU in 2006;
- (c) The data collected by the Regional Air Quality Monitoring Network will be analyzed by the environmental protection authorities of the two governments. A regional air quality monitoring report will be submitted on a half-yearly basis, providing the public with more information on the air quality in the PRD;
- (d) The environmental protection authorities of the two governments will continue to strengthen technical exchanges and joint studies, especially on the continuous emissions monitoring of stationary pollution sources and commissioning studies on regional air pollution on a need basis; and
- (e) Details of the Emission Trading Pilot Scheme for Thermal Power Plants in the PRD Region being jointly developed by the two sides are expected to be finalized in 2006. Subject to agreement of the two governments, details will be presented to the power plants in Hong Kong and Guangdong in the third quarter of 2006 so that prospective participants can identify their trading partners and draw up emission

trading agreements.

A summary of the 2006 Action Plan is in **Annex C**.

Environmental Protection Department
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Annex A

Cooperation with Mainland 《Pearl River Delta Regional Air Quality Management Plan》 2005 Work Progress

Enhanced Control Measures of the HKSARG

Measures	Implementation Programme	Progress (Up to 31.12.2005)
Encourage the replacement of diesel light buses with cleaner fuel ones	Since 2002, the Government has offered incentives to public light bus owners to encourage replacement of diesel light buses with liquefied petroleum gas (LPG) or electric ones.	An incentive scheme was introduced in August 2002 and completed by end 2005. Up to end December 2005, there were 2390 public LPG light buses, 125 private LPG light buses and 1 electric light bus. Over 80% of the newly registered public light buses run on LPG.
Require the retrofitting of particulate removal devices on pre-Euro diesel vehicles	Since 2002, financial assistance has been provided for retrofitting pre-Euro heavy diesel vehicles with particulate removal devices.	<p>Financial assistance was provided in phases from December 2002 to December 2004 to over 34000 non-long-idling pre-Euro heavy diesel vehicles retrofitting with catalytic converters. The HKSARG passed legislation in December 2005 requiring the installation of approved emissions reduction devices on these vehicles starting 1 April 2006.</p> <p>A programme for the installation of particulate removal devices for long-idling pre-Euro heavy diesel vehicles (including lorries with cranes mounted, concrete mixers, pressure tankers and gully emptiers) was started in June 2005 and completed by end 2005. About 2500 vehicles participated in the programme. The HKSARG is working on legislation to require the installation of approved emissions reduction devices for these vehicles.</p> <p>Besides, all pre-Euro franchised buses have been installed with catalytic converters to reduce the emission of particulates.</p>

Measures	Implementation Programme	Progress (Up to 31.12.2005)
Enhance the vapour recovery systems in petrol filling stations	Legislation requiring the recovery of petrol vapour emitted during vehicle refueling at petrol filling stations was introduced in 2003/04.	The Regulation came into effect on 31 March 2005.
Tighten motor fuel standards	Motor fuel standards will be tightened to Euro IV by 2005 (motor diesel standard has already been tightened to Euro IV since 2002).	Euro IV motor fuel standards came into effect on 1 January 2005.
Tighten tailpipe emission standards	To adopt Euro IV standards for tailpipe emissions from 2006.	Euro IV standards will be introduced in phases from 1 January 2006 for tailpipe emissions.
	To be in line with EU in adopting Euro V standards for tailpipe emissions.	[New item included in December 2005] To be in line with EU to adopt Euro V standards for tailpipe emissions.
Reduce VOC emissions from the printing process, paints and consumer products	Phase I : To introduce legislation in 2004 or 2005 to require labeling of VOC-containing products.	During public consultation held in September 2004 and subsequent discussions with stakeholders, members of the trade generally agreed to advance Phase II and impose limits on the VOC content of VOC products, and to set appropriate levels and technical details at an earlier date. Law drafting work has commenced and the legislative process is expected to complete in 2006. All VOC-containing products under control will be subject to the statutory limits in phases with effect from 2007.
	Phase II: To introduce legislation in phases to reduce the use of products with high VOC contents and to impose emission standards for the printing process.	

Measures	Implementation Programme	Progress (Up to 31.12.2005)
Reduce emissions from power stations	Effective and flexible mechanisms (which may include emissions trading) will be set up to control the total emissions of SO ₂ , NO _X and RSP from power stations to achieve respective reduction targets by 2010.	The emissions reduction options set out in the financial plans of the two power companies were approved by the Government in June 2005. CLP Power Hong Kong Limited will provide desulphurization and de-NO _X systems for four of its coal-fired generating units each of 677MW. Hong Kong Electric Co. Ltd. will provide low-NO _X burners and desulphurization systems for two of its coal-fired generating units each of 350MW. In order to achieve the 2010 emissions reduction targets, the Government will continue discussions with the two power companies on other options, including the speeding up of emissions reduction projects and participation in emissions trading etc. Furthermore, CLP will increase the use of ultra low sulphur coal and seek to increase natural gas supply through the development of liquefied natural gas facilities.
	Introduce caps on total emissions from power plants.	(New item included in December 2005). An emission cap has been included in the licence for CLP's Castle Peak Power Station starting from 1 August 2005. EPD will continue to introduce emission caps on power plants upon licence renewal with a view to gradually reducing emissions to the level set for 2010.

Annex B

**Cooperation with Mainland
《Pearl River Delta Regional Air Quality Management Plan》
2005 Work Progress**

Enhanced Control Measures of the Guangdong Provincial Government

Measures	Implementation Programme	Progress (Up to 31.12.2005)
Use cleaner energy	To reduce gradually the energy consumption per 10000 Yuan GDP. To establish by 2010 a diversified energy production and supply system that is safe, stable, economical, efficient and clean.	Work in progress.
	To construct liquefied natural gas (LNG) trunk pipeline and carry out the associated works. To complete Phase I in 2005 that will have a capacity of 3 million tonnes/year. In 2009, to complete Phase II that will increase the total capacity to 6 million tonnes/year and finish construction of a number of LNG power plants.	Phase I works are expected to be completed in 2006 and the four LNG power plants at Daya Bay in Huizhou, Shenzhen East, Qianwan in Shenzhen and Zhujiang in Guangzhou are under construction as scheduled.
	To improve by 2005 the 500KV dual circuit annular core transmission grid to ensure transmission of electricity from western provinces.	The 5 AC 3 DC main transmission channels from western provinces have been completed.
Control the sulphur content of fuel	To control the use of high sulphur fuel (sulphur content of coal and fuel oil should be below 0.8% in the acid rain control zone by 2005).	Being implemented.

Measures	Implementation Programme	Progress (Up to 31.12.2005)
Reduce emissions from coal-fired and oil-fired power stations	To phase out small-scale thermal power generating units. Power plants with a capacity of over 300MW to account for over 70% of the total installed capacity in the region in 2005, which is 35% higher than that in 2000.	Expected to be completed in 2007 due to electricity demand well exceeding estimation.
	To install flue gas desulphurization systems at the power plants in Shajiao, Huangpu, Taishan and Zhuhai by 2005.	Flue gas desulphurization systems installed in Shajiao Power Plant A (Unit 5), Shenzhen Xibu Power Plant (Units 4, 5 and 6), Guangzhou Hengyun Power Plant, Guangzhou Ruiming Power Plant, Guangzhou Power Plant, Yuancun Thermal Power Plant Boiler 2, Guangzhou Papermaking self-use thermal plant and Taishan Power Plant Units 1 and 2. Flue gas desulphurization systems are being retrofitted to all other generation units.
	To require all oil-fired and coal-fired generation units of capacity above 125MW to be equipped with flue gas desulphurization systems by 2007.	
	To require all coal-fired and oil-fired power plants to adopt low-NO _x combustion technologies in case of alteration or expansion.	(New item included in December 2005).
Control emissions from industrial boilers and industrial processes	To phase out coal-fired boilers with a capacity of less than 2 tonnes/hour in the urban areas of cities. By 2005, to stop using such coal-fired boilers in build-up areas of key cities. To require all large and medium-size industrial boilers to install desulphurization systems or adopt clean combustion technologies to reduce emissions.	Have generally phased out and stopped the operation of coal-fired boilers of less than 2 tonnes/hour in the urban areas of cities in the region.

Measures	Implementation Programme	Progress (Up to 31.12.2005)
	To continue phasing out various production technologies and installations that have caused serious pollution by emitting sulphur dioxide, smoke and particulates.	Work in progress.
	To actively study the technologies for controlling emission of nitrogen oxides from stationary sources such as power plant boilers, industrial boilers and restaurant boiling water furnaces.	(New item included in December 2005).
Reduce the emission of VOC from paints	To replace by 2003 paints using VOCs like xylene as solvents.	Work completed.
Reduce tailpipe emissions from motor vehicles	To commence the construction of a regional rapid light-rail system by 2005. To construct expressways in major cities, such as the district expressway in Southern Guangzhou and the Shenzhen-Shenping Express Trunk Road.	The "Planning of the Transport Routes for Inter-City High Speed Railway Network in the PRD Region (2005-2020)" was endorsed by the State Council in March 2005 and incorporated into the State's medium to long term railway network planning. The Pearl River Delta High Speed Transportation Network Project has started.

Measures	Implementation Programme	Progress (Up to 31.12.2005)
	To develop green transport by implementing clean vehicle action programmes in major cities of the region. To encourage the use of clean fuels, develop electric vehicles and actively promote the use of advanced clean fuel motor vehicles.	<p><u>Shenzhen</u></p> <ul style="list-style-type: none"> • Formulated the “Medium to Long Term Planning for the Development of Clean Vehicles in Shenzhen”. Drew up and implemented the 2003-2008 general work programme for the use of clean fuel in public transport vehicles. 2000 public buses will be replaced by Euro III vehicles by end 2005. • All public transport vehicles must use diesel with sulphur content of less than 500 ppm. • Introduction of motor diesel with sulphur content of less than 500 ppm. • Preparations for promoting installation of vapour recovery systems at petrol filling stations being pursued. <p><u>Guangzhou</u></p> <ul style="list-style-type: none"> • Motorcycles are prohibited from using certain road sections in the urban areas. Introduction of motor diesel with sulphur content of less than 500 ppm. • Active promotion of LPG public transport and hired vehicles. As at 30 May 2005, there were 3,547 LPG public transport vehicles and 8,100 LPG hired vehicles.

Measures	Implementation Programme	Progress (Up to 31.12.2005)
	<p>To require all new motor vehicles to fully meet emission standards. To step up annual inspection and on-road spot checks of in-use vehicles. To strengthen the control of in-use vehicles to ensure that over 90% of motor vehicles in the cities within the region will meet tailpipe emission standards by 2005.</p>	<p>National II emission standards have already been adopted since 1 July 2005, and will strive to adopt National III standards by end 2006.</p> <p><u>Shenzhen</u></p> <ul style="list-style-type: none"> All newly registered public transport vehicles are required to comply with the National III emission standards. Established the reporting and joint investigation system for smoky vehicles. Implemented the I/M system. Adopted a labeling system on the environmental categorization of motor vehicles. <p><u>Guangzhou</u></p> <ul style="list-style-type: none"> Initiated control actions against smoky motor vehicles.
	<p>To study the feasibility of advancing the implementation of the National IV emission standards for light-duty vehicles by 2010.</p> <p>To study the feasibility of advancing the implementation of the National V emission standards for heavy-duty vehicles by 2010.</p> <p>To strengthen management on regular inspections of in-use motor vehicles to make sure that the required environmental performance is met.</p>	<p>(New item included in December 2005).</p>

**Pearl River Delta Air Quality Management and Monitoring Special Panel
Summary of 2006 Action Plan**

Assess the Progress of the Management Plan

- Conduct at least 2 site inspections to assess the progress of implementing various measures in the Management Plan.
- Review the progress and effectiveness of the Management Plan and recommend additional measures.

Regional Air Quality Monitoring Network

- Publish on a daily basis the Regional Air Quality Index to the public.
- Submit the Monitoring Report on the PRD Regional Air Quality Monitoring Network and the Report on the Operation of the Regional Air Quality Monitoring Network in April and October 2006.
- Carry out thematic studies by making use of the data collected by the Regional Air Quality Monitoring Network, where necessary.
- Recommend and commence thematic research projects.

Regional Emissions Inventory

- Complete the 2003 PRD Regional Emissions Inventory in the first quarter.
- Complete the review and amendment of the 1997 Emissions Inventory.
- Evaluate the trend of regional emissions with reference to the audit results and draw up corresponding strategies and follow-up actions.

Enhance Technical Exchanges and Training of Personnel

- The scope of technical exchanges includes –
 - Operation of the regional monitoring network and compilation of emissions inventories;
 - Studying the feasibility of adopting National IV/V motor vehicle emission standards in the PRD Economic Zone in 2010;
 - In-use vehicles emissions inspection technologies and management;
 - Continuous emissions monitoring systems for stationary pollution sources;
 - Flue gas de-NO_x technology for thermal power plants; and
 - Emissions reduction technology for industrial pollution sources.

Emission Trading Pilot Scheme for Thermal Power Plants in the PRD Region (the “Pilot Scheme”)

- Report the study findings on the implementation details to both governments by mid-2006.
- As agreed by the two governments, details of the Pilot Scheme will be presented to the power plants in Guangdong and Hong Kong in the third quarter of 2006 so that prospective participants can identify trading partners and draw up emissions trading agreements.