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Report of the Subcommittee on Improving Air Quality for submission to the Panel on Environmental Affairs

Purpose

This report gives an account of the work of the Subcommittee on Improving Air Quality during the 2011-2012 legislative session.

Background

2. The ambient air pollution problem has all along been a public concern. It has a significant bearing on public health and the quality of life, and also on the long-term development of Hong Kong. Multinational enterprises are reluctant to set up their regional headquarters in Hong Kong due to the deteriorating air quality. The problem is compounded by a combination of factors, including high population density, high concentration of vehicles, as well as air pollution in the Pearl River Delta (PRD) Region. On the regional front, the Hong Kong Special Administrative Region Government (HKSARG) and the Guangdong Provincial Government (GPG) have jointly formulated the PRD Regional Air Quality Management Plan (Management Plan), which aims at achieving specific emission reduction targets by 2010. On the local front, the Administration has conducted a review of the Air Quality Objectives (AQOs) taking into account the World Health Organization (WHO)'s Air Quality Guidelines (AQGs). Other measures, including imposing emission caps on power plants, providing financial incentives to encourage early replacement of pre-Euro and Euro I diesel commercial vehicles, banning idling vehicles with running engines, promoting energy conservation and saving, are being undertaken or contemplated.

The Subcommittee

3. To enable focused discussion on the Administration's efforts in addressing air pollution, the Panel decided at its meeting on 27 October 2008 to set up a subcommittee to monitor and study policies as well as public concerns on improving air quality. The terms of reference and membership of the Subcommittee are given in **Appendices I and II** respectively. At the first meeting of the Panel in the 2011-2012 session on 13 October 2012, it was

decided that the Subcommittee should continue its work in the 2011-2012 session.

4. Under the chairmanship of Hon Audrey EU Yuet-mee, the Subcommittee has held six meetings to exchange views with the Administration and deputations.

Major work

Progress of measures to achieve the emission reduction targets under the Pearl River Delta Regional Air Quality Management Plan

5. To improve regional air quality, HKSARG reached a consensus with GPG in April 2002 to reduce, on a best endeavour basis, the emissions of sulphur dioxide (SO_2), nitrogen oxides (NO_x), respirable suspended particulates (RSP) and volatile organic compounds (VOC) by 40%, 20%, 55% and 55% respectively in PRD Region by 2010, using 1997 as the base year. In December 2003, the two governments jointly drew up the Management Plan with a view to meeting the emission reduction targets. The Pearl River Delta Air Quality Management and Monitoring Special Panel was also set up under the Hong Kong/Guangdong Joint Working Group on Sustainable Development and Environmental Protection (Joint Working Group) to follow up the tasks under the Management Plan.

6. In August 2009, the two sides agreed to assess the progress of emission reduction in the two places in 2010, and undertake a joint study to map out the emission reduction targets and plan for the next phase in the PRD Region. A science team was set up by the two sides to conduct the joint study under which the emission reduction potentials of major pollution sections in the region and the effectiveness of various reduction measures implemented in the two places had been thoroughly assessed, taking into account the monitoring results of the PRD Regional Air Quality Monitoring Network. The science team reported the preliminary findings of the joint study to the Expert Group under the Joint Working Group with a view to facilitating the drawing up of the objective and comprehensive reduction targets for the next phase.

7. The Subcommittee has been monitoring the progress of implementation of measures, including those under the Management Plan, to improve air quality and to meet the 2010 emission reduction targets. According to the Administration, the joint study and discussion between the two sides are in the final stage. Both sides have agreed to further reduce emissions in order to continuously improve the air quality of the PRD Region. It is expected that the emission reduction targets and plan for the four pollutants for the period between 2015 and 2020, using 2010 as the base year, will be promulgated shortly.

8. On the local front, it is noted that emission levels of all the four pollutants have dropped when compared with those in 1997. Details are as follows –

	Emission Level in 1997 (Tonnes)	**Change in Emission Level during 1997-2009**	**Emission Reduction Target for 2010**
SO_2	66 200	-24%	-40%
NO_x	124 000	-32%	-20%
RSP	11 500	-57%	-55%
VOC	68 800	-58%	-55%

Given that power generation is the main source of air pollutant emissions in Hong Kong, emission caps have been imposed on all power plants since 2005 in order to achieve the 2010 emission reduction target for SO_2 emissions. These emission caps will be progressively tightened during licence renewals through a Technical Memorandum (TM) issued under the Air Pollution Control (Amendment) Ordinance 2008 to give statutory effect to the emission caps for power plants in 2010 and beyond. The First TM was promulgated in December 2008 under which stringent emission caps for 2010 were imposed on the two power companies. Following a review of First TM in 2010, the emission caps for the power sector from 2015 onward were tightened by maximizing the use of existing gas-fired generation units and prioritizing the retrofitting of coal-fired generation units with emission abatement facilities. The Second TM promulgated in December 2010 further reduces the emission allowances for SO_2, NO_x and RSP by about 50%, 35% and 34% respectively. As the two local power companies have completed retrofitting their coal-fired power generation units with emission reduction facilities as planned, it is expected that these facilities can help the two power companies comply with the 2010 emission caps. The Panel has been consulted on the proposed Third TM to tighten the emission caps further starting from 2017 at its meeting on 4 July 2012.

9. To encourage the two power companies to take further steps to reduce emissions and sustain strict compliance with the environmental requirements, a number of incentives and penalty arrangements have been set out in the Scheme of Control Agreements signed with the two power companies in January 2008. These arrangements include linking the permitted rate of return to their compliance with the emission caps, providing a higher rate of return for their investment in renewable energy facilities, and offering a bonus in permitted return depending on the extent of renewable energy in their electricity generation.

10. Details of progress of other measures are set out in LC Paper No. CB(1) 2342/11-12(02).

Measures to improve LPG refilling network

11. Motor vehicles are the second largest source of air pollution, and the main source of roadside air pollution in Hong Kong. To improve roadside air quality, the Administration announced in 1999 an incentive scheme to encourage taxi operators to replace their diesel taxis with liquefied petroleum gas (LPG) ones. Pivotal to the success of the replacement is the early availability of LPG filling service. To kick start the formation of an LPG filling network with a reasonable geographical coverage, the Administration set up at the start of the LPG vehicle programme 12 dedicated LPG filling stations (which operate on sites free of land premium but have their LPG retail prices capped by a pricing formula in the Design-Build-Operate (DBO) contract signed between the respective operators and the Administration) at strategic locations. However, as a free economy, the Administration holds that view the Hong Kong should rely on market principles for the long-term provision and enhancement of the LPG filling network. To incentivize oil companies to provide LPG refilling facilities at their existing/new petrol filling stations (i.e. non-dedicated filling stations), the Administration has adopted since June 2000 a policy to require new petrol filling stations on the land sale programme to provide LPG filling facilities, subject to meeting the safety requirements. As a result, there are now a total of 62 LPG filling stations (including 12 dedicated stations and 50 non-dedicated stations) providing 444 LPG filling nozzles.

12. The problem of queuing up for refilling during peak hours, particularly at dedicated LPG filling stations at popular locations at the time of shift-changing of taxi and public light bus (PLB) drivers has aroused much public concern. While the queuing problem can be resolved if the taxi and PLB trades can stagger their refilling hours, the Administration has completed a review on how best the existing LPG refilling network can be further expanded. To make a better use of available sites for providing LPG filling services, the Administration proposes to strengthen the existing policy by stipulating in the tender conditions of petrol-cum-LPG filling stations (for both new sites and old sites upon expiry of their current land leases) a minimum requirement for LPG filling facilities at 25% of the nozzles, subject to meeting the necessary safety requirements. It is expected that the number of LPG filling nozzles will be increased from 444 to some 500 in 2018 upon implementation of the proposal. This should help improve the overall provision of LPG filling facilities while not causing any major adverse impact on the filling services for petrol and diesel vehicles. The distribution and time frame for delivery of the additional LPG nozzles are given in Annex A to LC Paper No. CB(1) 846/11-12(09).

LPG prices and supply

13. The Subcommittee has held three meetings on 24 November 2011 and 17 January as well as 21 February 2012 to discuss the proposal. Deputations (including the taxi and PLB trades) have also been invited to express their views

at the meeting on 17 January. The Subcommittee notes from the trades that the queuing problem at dedicated LPG filling stations is mainly attributed to the difference in LPG prices between dedicated and non-dedicated filling stations. To bridge the price gap, the Administration has been requested to consider waiving the land premium for the proposed 25% filling nozzles for LPG to be provided at non-dedicated LPG stations. A better alternative is to apply a uniform LPG price across the board for both dedicated and non-dedicated LPG filling stations.

14. The Administration has advised that while no land premium has been charged for the 12 dedicated LPG filling stations, the terms of DBO contracts require the operators to set their LPG prices according to a formula which takes into account the prevailing international contract price of LPG of the preceding month and operating price that will be adjusted for inflation in February every year. Dedicated station operators are required to submit for approval by the Electrical and Mechanical Services Department (EMSD) each month the LPG ceiling prices of the following month set according to the pricing formula in the DBO contract, and observe the approved ceiling prices when setting the LPG prices of their dedicated filling stations. The Administration however holds the view that as a free economy, Hong Kong should rely on non-dedicated LPG filling stations operating on full commercial principles to expand the LPG filling network for better convenience to drivers of LPG vehicles. This can also avoid the problem of traffic congestion caused by LPG vehicles converging to dedicated LPG filling stations for refilling, particularly during the shift-changing hours. It is expected that upon implementation of the proposed allocation of at least 25% of the filling nozzles for LPG at non-dedicated LPG filling stations, prospective bidders will take into account all the relevant requirements and considerations (including the competition with dedicated LPG filling stations and land premium) when preparing their bids for the sites. The Administration therefore does not support waiving the land premium for the 25% LPG filling nozzles at non-dedicated LPG filling stations. The Administration has further advised that as a market economy, it is advisable to allow non-dedicated LPG filling stations to set their LPG prices on full commercial principles as in the case of petrol and diesel. In practice, the LPG prices of dedicated stations would have a leading effect on the LPG price of the local market as operators of non-dedicated stations would have to take into account the LPG prices of dedicated stations when setting their own LPG prices in order to compete for business.

15. To avoid undue disruption to LPG supply for refilling, some members stressed the need for the Administration to ensure seamless transition in re-tendering of old sites of petrol-cum-LPG filling stations upon expiry of the current land lease. Consideration could be given to advancing the tendering exercise. According to the Administration, the Lands Department is in close liaison with the Environment Bureau and relevant government departments in preparing for the re-tendering of existing petrol-cum-LPG sites in order to put

the re-tendered sites back to service as soon as possible. Tender invitation will precede the expiry of the lease of the existing site, and is programmed with a view to awarding the tender for the new 21-year lease at the earliest possible time. Nevertheless, there could still be a brief period of non-operation of the petrol-cum-LPG stations. The existing operator has to carry out decontamination study and, if required by the Environmental Protection Department (EPD), decontamination works on site before the lease expires. In the event that the new lease is awarded to another operator or the number of LPG filling nozzles has to be increased to meet the new requirement, more time (about 15 to 18 months) will be needed to set up the new station.

16. On members' concern about the possible disruption of LPG supply during revalidation of underground tanks of LPG filling stations, the Administration has advised that underground tanks of LPG filling stations are required to be tested and examined or revalidated under the Gas Safety Ordinance (Cap. 51) within 10 years after their installation and at five-year intervals thereafter. In order to minimize the disruption to LPG supply, operators are required to notify EMSD of their respective revalidation schedules and submit relevant information in advance for EMSD's advice or approval prior to the revalidation work. EMSD will coordinate with the operators to avoid or minimize the concurrent disruption of LPG supply of adjacent LPG filling stations under revalidation in the same locality as far as possible. Up to November 2011, 23 LPG filling stations have undergone revalidation with no major disruption on the LPG supply for refilling.

17. Noting from Annex A to LC Paper No. CB(1) 846/11-12(09) that the majority of the additional LPG filling nozzles to be provided under the proposed plan to expand the LPG filling network will be in Kowloon and the New Territories, some members have enquired if the Administration has further plans to increase the number of LPG filling nozzles in the Hong Kong Island to ensure an even distribution of LPG filling nozzles across the territory. According to the Administration, two potential sites (one at Fung Mat Road in Western District and the other at Tin Wan in Southern District) on Hong Kong Island have been identified during the recent search for additional suitable sites to provide petrol-cum-LPG refilling services. Subject to the completion of requisite procedures and arrangements, these two sites could be made available for setting up petrol-cum-LPG stations. Together with the proposed minimum requirement for petrol-cum-LPG filling stations to make available LPG filling facilities at 25% of the nozzles (subject to meeting the necessary safety requirements), the number of LPG filling nozzles on the Hong Kong Island could further be increased.

18. Some other members hold the view that the two additional sites on Hong Kong Island are far from enough to meet the demand. Consideration should be given to identifying more sites at Wong Nai Chung Gap Road, Happy Valley and Hoi Yu Street to provide for LPG refilling services. According to the

Administration, there are two existing petrol filing stations along Wong Nai Chung Gap Road – one located opposite to the Hong Kong Cricket Club and the other next to the Hong Kong Girl Guides Sandilands Centre. While the former is suitable for providing LPG filling services, the latter is not since it cannot meet the separation distance requirement under the Hong Kong Planning Standards and Guidelines. The former site will be required to provide LPG filling facilities when it is re-tendered upon expiry of the existing land lease in 2014. The Administration has also looked for new suitable sites in Wong Nai Chung Gap Road and in Happy Valley for setting up petrol-cum-LPG stations but to no avail. As regards the three vacant sites at Hoi Yu Street in Quarry Bay, all of them have been committed to other uses (including a waterfront promenade to link up existing one in Quarry Bay Park). The Administration has also taken on board members' view to continue its effort in identifying suitable sites in nearby area.

Outage of LPG nozzles

19. Apart from LPG prices, the Subcommittee notes that the trades have also expressed concern about nozzle outages at dedicated LPG filling stations. Some members have enquired if the DBO contract contains provisions in relation to the service delivery which can facilitate EMSD to monitor the services of dedicated stations, and whether an additional requirement on the utilization rate of LPG filling nozzles can be included in the contract. According to the Administration, section 28.7(2) of the DBO contract stipulates that "the station shall be manned during all working hours (i.e. 24 hours a day) by a responsible manager and such operatives as may be necessary to ensure the safe and effective operation of the station in accordance with the contract". EMSD has been monitoring the operations of dedicated LPG filling stations through various means which include requesting the operators to report any breakdown of LPG facilities affecting the filling services so as to monitor the nozzle availability at individual stations on a monthly basis, holding regular meetings with the operators to review their services and identify areas for improvement, visiting the stations to inspect nozzle and manpower conditions etc.

20. On the utilization rate of LPG filling nozzles, the Administration has advised that there is no specific term in the DBO contract governing the utilization rate as this depends on patronage which is beyond the control of operators. It is thus more sensible to check the availability rate[1] of nozzles and whether any nozzle unavailability is well justified. The overall average nozzle availability of the 12 dedicated stations was maintained at between 96% and 99% in 2011, while the availability rate of LPG filling nozzles at non-dedicated LPG filling stations was above 97.5% between October and December 2011

[1] The nozzle availability for a given period is worked out according to the following formula –

$$\frac{\text{Total nozzle-hours available} - \text{nozzle-hours outage}}{\text{Total nozzle-hours available}} \times 100\%$$

according to the returns from five out of the six operators of non-dedicated stations in Hong Kong.

21. The Subcommittee is not convinced of the Administration's response, adding that the transport trades will not have complained about nozzle outages if the average availability rate has been maintained at over 96%. Instead of relying on the information provided by LPG filling station operators, the Administration should conduct surveys on the availability of LPG filling nozzles at popular dedicated and non-dedicated LPG filling stations during rush hours for a period of three months to ascertain the actual situation. Subcommittee members have also enquired about the channel through which the trades can lodge complaints against malpractices of dedicated LPG filling stations (particularly nozzle outages), the actions to be taken by EMSD upon receipt of complaints, and the consequences of operators upon substantiation of the complaints.

22. According to the Administration, the Gas Standards Office of EMSD will conduct site visits to assess the operation of dedicated LPG filling stations taking into factors such as traffic control, LPG filling nozzles in operation, manning level etc. In 2011, 57 site visits (including 23 surprise visits) were carried out. EMSD generally found the operation of the 12 dedicated LPG filling stations satisfactory without any non-compliance with contractual obligations. Notwithstanding, the transport trades can lodge complaints about the operation of dedicated LPG filling stations via the government hotline 1823 and EMSD's hotline 2333 3762, both of which operate on a 24-hour basis. Upon receipt of complaints, EMSD would immediately assess the nature of the complaints and conduct follow-up investigation (including site visit, the lead time of which depend on the nature of the complaint) where deemed necessary. If an operator is found to have failed to comply with the contractual requirements for his LPG dedicated filling station, EMSD can issue a warning letter to him. In case the operator has persistently failed to improve his services despite receipt of the warning letters, the Administration may consider terminating his contract. In 2011, 12 complaints cases were received on nozzle outages at dedicated LPG filling stations. In response to these complaints, EMSD has requested the respective operators to take necessary remedial actions and implement preventive measures as appropriate to avoid recurrences. It is worth noting that most nozzle outages were due to maintenance and repair works of station equipment. In this connection, EMSD has advised the operators to inform the relevant transport trades in advance of any service interruption through various communication channels, and to avoid carrying out any planned maintenance and repair works during peak hours to minimize inconvenience to the trades. The Administration has also taken on board members' suggestion of requiring operators to post EMSD's hotline in a conspicuous place at all dedicated LPG filling stations to facilitate the trades to communicate with EMSD.

Other measures

23. Some other members hold the view that the predicament being faced by the taxi trade originates from the LPG vehicle programme rolled out by the Administration. Instead of only targeting at the taxi trade, the Administration should adopt a macro approach to reduce emissions from all vehicles (including taxis, PLBs, franchised buses, commercial vehicles and private cars) as a whole. The Administration has advised that following significant reduction in roadside SO_2 and RSP levels, NO_x has become the major air pollution issue at the roadside, particularly at busy corridors. Given that LPG taxis and PLBs account for about 44% of the NO_x emissions at busy corridors, and that the emission can be reduced by up to over 90% through replacement of aged catalytic converters and sensors, the Administration has proposed to strengthen the emission control of LPG and petrol vehicles and subsidize owners of LPG taxis and PLBs to replace their catalytic converters once. Meanwhile, a trial scheme to retrofit Euro II and III franchised buses with selective catalytic reduction devices was underway.

24. To enhance competition, some members have asked if consideration could be given to re-introducing diesel taxi models which can meet the prescribed emission standards. According to the Administration, there are diesel vehicles on the market that are of comparable emission performance with LPG taxis. However, these diesel models are luxurious private cars which are too costly for taxi operation as confirmed by the taxi trade. To facilitate better understanding, the Administration has been requested to provide a comparison on the emission performance of LPG and EuroV/VI diesel vehicles which is given in the Annex to LC Paper No. CB(1) 1086/11-12(02).

<u>Retrofitting of separate air-conditioning system for vehicles while engines are switched off</u>

25. To reduce air pollution, heat and noise nuisance, the Motor Vehicle Idling (Fixed Penalty) Ordinance (Cap. 611), which came into operation in mid-December 2011, requires drivers to switch off idling vehicle engines when waiting. During the scrutiny of the relevant Bill by LegCo, Members expressed interest in the development of retrofit devices for enabling the air-conditioning (A/C) system to run after the engine of a vehicle is switched off. Local institutes engaged in the development of retrofit devices for on-board A/C include a joint venture between the Hong Kong Polytechnic University (PolyU) and Green Power Industrial, as well as the Hong Kong Productivity Council (HKPC).

26. To better understand the progress of development of retrofit devices for on-board A/C, the Subcommittee has invited representatives from PolyU/Green Power and HKPC to the meeting on 6 January 2012 to brief members on their retrofit devices. The Subcommittee notes that the Solar Powered

Air-conditioning System for Vehicles (SAV) developed by PolyU and Green Power is powered by solar energy. A vehicle retrofitted with this system will automatically collect solar energy through the photovoltaic panels fitted on roof top when it runs on the road or parks outdoor. The solar energy will be converted into electrical energy for storage in a tailor-made battery system for backup or immediate cooling by a compressor. Since the A/C system is completely separated from the petrol engine of the vehicle, it can operate independently regardless of whether the vehicle is running or when the engine is switched off without consuming any motor vehicle fuel. Since retrofitting with SAV involves change of voltage and installation of heavier equipment, this may affect the electrical safety and structure of the vehicle and hence an application to the Transport Department (TD) is necessary to ensure that the modification complies with the statutory requirements. Since April 2011, TD has approved applications for the retrofit of SAV on medium goods vehicles and a minibus. Depending on the vehicle type, the price of SAV is about $40,000 to $120,000.

27. As regards the Automatic Engine Idle-stop and Supplementary Air-conditioning System (ISACS) developed by HKPC, the Subcommittee notes that the retrofit device comprises three parts. These include an automotive engine idle-stop system (which automatically stops the engine when a motor vehicle becomes stationery and restarts the engine when the vehicle moves again so as to reduce fuel consumption and emissions), an A/C system powered by an auxiliary battery (to keep the A/C system running on an additional lithium battery when the engine stops), and an A/C system driven by phase change materials[2]. HKPC has conducted trial tests of ISACS on a private car and a light goods vehicle, and approval is being sought from TD. As a start, HKPC plans to put into production the retrofit device equipped with an automated engine idle-stop system and the A/C system powered by an auxiliary battery. Subject to further research to enhance the performance of ISACS, HKPC will conduct trial tests on LPG taxis in the first quarter of 2012. For the time being, HKPC would act as a supplier but it would identify interested parties for collaboration in commercialization of ISACS. It is expected that the price of ISACS (including the costs of modification and installation of parts) is about $20,000 to $30,000 at mass production.

28. Some members have enquired if EPD will engage the transport trades to test out the performance of the two retrofit devices and if so, the plan to carry out such test. The Administration has advised that as part of the product development and verification, HKPC and PolyU/Green Power have already successfully engaged the local transport trades to test their retrofit devices under local operating conditions. The tests undertaken by PolyU/Green Power involve two corporate goods vehicles, a light bus and a taxi while HKPC a taxi.

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[2] Building on the principle that material absorbs heat when changing from solid to liquid form and releases heat when changing from liquid to solid form, phase change materials (PCMs) release heat when the engine is running, thus creating a thermal differential which is stored in the materials. When a vehicle stops with the engine switched off, PCMs will absorb heat in the air passing over it.

These tests will provide useful local trial data for the two product developers to refine their retrofit devices as necessary, and to explain to the local transport trades the applicability of these devices to their vehicles, including the potential savings in fuel consumption and other environmental benefits.

29. As to whether assistance, including financial subsidy, will be provided to facilitate testing/use of these retrofit devices by the transport trades and the general public, the Administration has advised that the local trades may seek subsidy from the Pilot Green Transport Fund (PGTF) if they wish to test out these retrofit devices. While there are limits on the number of applications from a transport trade for testing a type of green technology under PGTF, an eligible application can apply funding for installation of a retrofit device in a maximum of six vehicles, among which up to three can be from the same supplier. In addition, a maximum of 15 fleet operators from the taxi trade can each apply for six taxis for testing the device. Hence a total of 90 taxis can participate in the trial under PGTF. As the same arrangement is applicable to other transport trades, this will enable a large-scale trial to build up users' confidence in the devices.

30. Some members hold the view that the Administration should allocate suitable vehicles from the Government fleet to test out the two retrofit devices with a view to enhancing public confidence on the effectiveness of these devices. According to the Administration, information on the specifications of SAV for various vehicle models, projected fuel saving, costs of installation and maintenance, methodology of collecting trial data etc. is being sought from PolyU/Green Power while ISACS is undergoing roadworthiness vetting by TD. The Government Logistics Department, EMSD and EPD will consider trying out these retrofit devices on Government vehicles upon resolving the aforementioned issues and confirmation of feasibility. Given that the retrofit devices will require approval from TD, these members also stressed the need for concerted efforts from relevant government departments to facilitate testing of these devices. The Administration has advised that TD has already been handling expeditiously the applications from HKPC and PolyU/Green Power for installing the retrofit devices in vehicles based on roadworthiness considerations.

31. In view of the relatively high prices of the two retrofit devices, members have sought elaboration from HKPS and PolyU/Green Power on the estimated reduction in cost if these devices are installed in a large scale and the threshold of economy of scale. According to HKPC, the primary role of HKPC is to develop the technology for ISACS and not the mass production of the system which would be conducted by licensee(s) through technology commercialization. The estimated cost range of $20,000 to $30,000 for ISACS in small-batch production (i.e. 200 to 300 sets) is based on the price of some commercially available parts and some of the self-developed components by HKPC. The estimated cost for large-scale production will depend on the cost structure of

technology commercialization by the specific licensee(s). As regards the estimated cost for repair and maintenance of ISACS, this will mainly involve the lithium battery pack which will have to be replaced in around five to seven years' time, the replacement cost of which is about $7,000. As for SAV, PolyU/Green Power has advised that while the prices of SAV for taxi and minibus can be reduced by $2,000 and $10,000 respectively as a result of reduction in size of photovoltaic panel by 25%, similar price reduction is not applicable to trucks since the size of photovoltaic panel for trucks cannot be reduced. Further reduction in price to $29,000 for taxi and $90,000 for minibus can be achieved through mass production of at least 5 000 and 2 000 sets respectively.

Update of Air Quality Objectives

32. In 2007, the Administration commissioned a consultancy study to recommend a new set of AQOs for Hong Kong with reference to WHO AQGs, and an air quality management strategy to achieve the new AQOs. The Review has recommended a new set of AQOs and a host of air quality improvement measures required for attaining the proposed new AQOs. In July 2009, the Administration launched a four-month public consultation on the recommendations. The summary of comments on the proposed Phase I air quality improvement measures is given in Annex D to LC Paper No. CB(1) 2324/09-10(06) issued for the meeting of the Panel on Environmental Affairs on 28 June 2010.

33. On 17 January 2012, the Administration announced that the following proposed new AQOs will be adopted together with the package of air quality improvement measures listed in Annex B to LC Paper No. CB(1) 1532/11-12(01) subject to resource availability –

Pollutants	**Avg. Time**	**Existing AQOs**		**Proposed AQOs**				
		(µg/m^3)	**No of Exceed-ances Allowed**	**WHO IT-1[3] (µg/m^3)**	**WHO IT-2[3] (µg/m^3)**	**WHO IT-3[3] (µg/m^3)**	**WHO AQG (µg/m^3)**	**No of Exceed-ances Allowed**
Sulphur Dioxide	10-min	--	--	-	-	-	**500**	3
	24-hr	350	1	**125**	50	-	20	3
Respirable Suspended Particulates (PM10)	24-hr	180	1	150	**100**	75	50	9
	Annual	55	NA	70	**50**	30	20	NA
Fine Suspended Particulates (PM2.5)	24-hr	--	--	**75**	50	37.5	25	9
	Annual	--	--	**35**	25	15	10	NA

Pollutants	Avg. Time	Existing AQOs		Proposed AQOs				
		($\mu g/m^3$)	No of Exceed-ances Allowed	WHO IT-1[3] ($\mu g/m^3$)	WHO IT-2[3] ($\mu g/m^3$)	WHO IT-3[3] ($\mu g/m^3$)	WHO AQG ($\mu g/m^3$)	No of Exceed-ances Allowed
Nitrogen Dioxide	1-hr	300	3	-	-	-	**200**	18
	Annual	80	NA	-	-	-	**40**	NA
Ozone	8-hr	240 [1]	3	**160**	-	-	100	9
Carbon Monoxide	1-hr	30,000	3	-	-	-	**30,000**	0
	8-hr	10,000	1	-	-	-	**10,000**	0
Lead	Annual	1.5 [2]	NA	-	-	-	**0.5**	NA

Proposed new AQOs

[1] There is no existing 8-hour AQO for ozone in Hong Kong. The figure presented above is the 1-hour AQO.

[2] There is no annual AQO for lead in Hong Kong. The figure presented above is the 3-month AQO.

[3] The WHO accepts the need for governments to set national standards according to their own particular circumstances. The WHO guidelines therefore also suggest ITs on SO2, PM10, PM2.5 and O3 to facilitate a progressive approach for achieving the ultimate AQGs and provide milestones in achieving better air quality.

34. At the Subcommittee meeting on 16 April 2012, members have sought elaboration on the rationale for adopting different Interim Targets (IT)s of WHO AGQs as the proposed new AQOs. The Administration has advised that while WHO AQOs are released for global application for the protection of public health, WHO accepts the need for governments to set national standards according to their own particular circumstances. To facilitate a progressive approach for achieving the ultimate AQGs, the WHO guidelines have suggested ITs for certain pollutants. So far, no countries are able to adopt the ultimate AQGs in entirety as their legal standards. The proposed new AQOs for Hong Kong are derived taking into account WHO's guidelines and practices in other advanced countries. WHO IT-1 is adopted for fine suspended particulates (PM2.5) and ozone because their levels in Hong Kong are subject to strong regional influence.

35. The Administration has further advised that to give effect to the new AQOs, there is a need to amend the Air Pollution Control Ordinance (Cap. 311) (APCO), the Amendment Bill of which will be submitted for scrutiny by the Legislature in the 2012-2013 legislative session. As the introduction of the new AQOs might have impact on projects already granted with an Environmental permit (EP) issued under the Environmental Impact Assessment (EIA) Ordinance (Cap. 499) (EIAO), a further provision would need to be included in the Amendment Bill to provide for a time-limited transitional period such that the new AQOs shall not apply to an application for variation of the EP submitted within 36 months from the commencement date of the new AQOs.

To underscore the Administration's commitment to adopting the best practices as well as providing greater certainty to works department in planning new development projects, all Government projects for which EIA studies have not yet commenced would endeavour to adopt the new AQOs as the benchmark for conducting the air quality impact assessment under the EIA studies. To deliver the long-term target of progressively achieving the WHO AQGs, a review mechanism will be put in place to regularly ascertain the extent to which the new AQOs have been achieved, the progress of the air management strategy, as well as the need and practicality of further tightening AQOs. The frequency of review should be no less than every five years to allow reasonable time to assess the impacts of the earlier emission control measures on air quality. Taking into account the lead time for completing the legislative process and other necessary preparatory work (including formulation of modelling guidelines and compilation of emission inventories), it is expected that the new AQOs will take effect in 2014.

36. Some members have expressed concern about the long lead time for the proposed new AQOs to take effect. To facilitate better public understanding of the air pollution level, these members have enquired the feasibility of benchmarking the existing Air Pollution Index (API) against the proposed new AQOs, and expanding the air quality monitoring network to cover all 18 districts in Hong Kong. According to the Administration, the current air quality monitoring network in Hong Kong comprises 14 air quality monitoring stations (AQMSs) (including 11 general stations for monitoring ambient air quality and three roadside stations for measuring street level air quality) covering major areas in the territory from East to West and South to North. In term of land uses, the network covers different types and density of development (such as residential areas, mixed residential/commercial areas, mixed residential/commercial/industrial areas, rural areas, and busy urban roadside areas). In deciding the locations of AQMSs, factors (such as spatial distribution of air quality monitoring stations, coverage of different types of development areas, distribution of local population, traffic flow, and pollution sources) have been taken into account to ensure the representativeness of air quality data. Reference has also been made to the United States Environmental Protection Agency's guidelines in determining the locations, design and operation of individual AQMSs. The Administration has further advised that it will correspondingly review and improve the existing API system to tie in with the updating of AQOs.

37. Noting that subsequent reviews of AQOs will take place in no less than every five years, some members have asked if consideration could be given to conducting more frequent reviews (say in every two years) and if not, whether a mid-term review can be carried out during the interim to take account of the changes in air quality in Hong Kong and PRD Region. According to the Administration, the review will serve as an opportunity to take stock of the progress of air management strategy, as well as the latest technological

developments, guidelines of WHO, international experiences and the prevailing local circumstances. It is therefore necessary to allow reasonable time for the relevant air quality improvement measures to take effect before considering follow-up actions in relation to the implementation of AQOs. Given the complex and wide ranging issues involved, the review frequency of every five years is considered appropriate. Besides, a similar review frequency has also been adopted in the United States.

Proposed AQOs for PM2.5

38. While welcoming the introduction of standard on PM2.5 under the proposed new AQOs, members have expressed concern about the impacts of implementation of the AQOs for PM.25 on the transport sector which is the major source of PM2.5 emissions. The Administration has advised that the PM2.5 level in Hong Kong has been under strong regional influence. It is worth noting that emissions of particulate in Hong Kong and the PRD Region are in the proportion of 1:99. HKSARG and GPG have already implemented various measures to improve regional air quality, but it will take time for the concentration of suspended particulates to improve progressively. The introduction of standard on PM2.5 under the proposed new AQOs (pitched at the WHO IT-1 level) would serve as a starting point and will be subject to review in future.

39. The Administration has further advised that since 1999, a series of measures to reduce particulate emissions from vehicles (in particular PM2.5) have been implemented. These include the introduction of LPG taxis and light buses, progressive upgrading of the quality of motor vehicle diesel and emission standards of newly registered vehicles, mandatory retrofitting of particulate removal devices in pre-Euro diesel vehicles, and strengthening of the smoke emission control for diesel vehicles. As a result, the particulate concentration at roadside (which comprises both PM10 and PM 2.5) has been substantially reduced. During the period from 1999 to 2011, a decline of 28% and 18% of PM 2.5 and PM 10 has been recorded at the Central roadside station. The monitoring results and how these could translate to the proposed AQOs for PM 2.5 and PM10 are given in LC Paper No. CB(1) 2367/11-12(01).

40. The Subcommittee has sought elaboration on the progress of the various measures to reduce vehicular emissions, inter alia, the two incentive schemes to encourage early replacement of pre-Euro, Euro I and Euro II commercial vehicles, as well as the setting up of low emission zones (LEZ). According to the Administration, the estimated average ages of serving pre-Euro, Euro I and Euro II diesel commercial vehicles are 19.6 years, 15.6 years and 12.7 years respectively. Of the $3.2 billion of fund approved for the incentive scheme for pre-Euro and Euro I diesel commercial vehicle, $770 million were spent upon conclusion of the scheme in March 2010. About 11 300 and 5 800 pre-Euro and Euro I diesel vehicles respectively were replaced, representing a take-up rate

of about 30%. For the on-going incentive scheme for Euro II diesel commercial vehicles, about $264 million were spent (i.e. 49% of the allocated fund) while about $275 million are still available for application by eligible vehicle owners. About 3 300 Euro II diesel vehicles were replaced so far, representing a take-up rate of about 12%. The Administration is discussing with relevant stakeholders and bureaux/departments in mapping out measures (including financial disincentives such as increase in vehicle licence fee) to reduce the number of pre-Euro, Euro I and Euro II diesel commercial vehicles in Hong Kong.

41. On LEZ, the Administration has advised that pilot LEZ are to be set up in busy districts (such as Causeway, Central and Mong Kok) in 2015. Starting from 2011, franchised bus companies have been requested to increase the ratio of low-emission franchised buses (i.e. those meeting the emission level of a Euro IV or above) running in these zones as far as possible, with the target of having only low-emission buses in these zones by 2015. As a result, the number of low emission buses running in these zones has increased from about 240 in January 2011 to about 440 at end March 2012, representing an increase of about 80% over the period. According to the franchised bus companies, about 2 400 low-emission buses will be required for the pilot LEZ in 2015. Apart from the regular bus replacement programme, consideration will also be given to retrofitting Euro II and III franchised buses with selective reduction devices (which will upgrade their emission performance to Euro IV standards and higher). Subject to satisfactory trial results, the retrofitted Euro II and III buses will be deployed to meet the target of implementing the pilot LEZ in 2015.

42. While acknowledging that the deployment of low-emission buses to the pilot LEZ will help improve the roadside air quality, some members are concerned that this may be at the expense of other districts since the ratio of cleaner buses running in these districts will be reduced. According to the Administration, low-emission buses will be deployed to routes cutting across the three pilot LEZ at the busy corridors in Causeway Bay, Central and Mong Kok. Since these buses will also serve districts outside the pilot LEZ, these districts will also benefit from the cleaner buses running through them.

<u>Interim findings of the trial of retrofitting franchised buses with SCR devices</u>

43. At present, about 67% of the existing franchised bus fleet are Euro II and III buses. Reducing their emissions could help improve roadside air quality, particularly at busy corridors where franchised buses could account for up to 40% of the traffic flow. To this end, franchised bus companies have already retrofitted their Euro II and III buses with diesel particulate filters to upgrade their particulate emission performance to that of Euro IV buses. As overseas experience shows that retrofitting Euro II and III buses with SCR devices can upgrade their NO_x emission performance to that of Euro IV buses, the Administration is conducting a trial jointly with the three franchised bus

companies to assess the technical feasibility and effectiveness of SCR devices. The trial will last for 12 months for assessing the full performance of the SCR devices. Subject to the satisfactory trial results, the Administration will fund the full cost of retrofitting these buses with SCR devices.

44. At the Subcommittee meeting on 27 June 2012, members received a briefing on the progress of the trial. In gist, four Euro II and two Euro III buses have been retrofitted with SCR devices and put on trial on normal bus routes comprising both urban and highway traffic conditions. The buses on trial come from three major bus models (namely Euro II Volvo Olympian, Euro II Dennis Trident and Euro III Dennis Trident) which account for about 58% of the current Euro II and III franchised buses. Up to end April 2012, the trial shows that SCR retrofit can effectively reduce the emissions of the three models of franchised buses without excessively increasing the backpressure on the bus engine. The trial also reveals that the design and construction of the SCR system is critical to successful operation. While some mechanical problems (such as broken heat shield and mounting rubber, and excessive filter movement causing damages to the filters) have been identified during the initial period, these have since been rectified by the relevant SCR supplier through modifying the design and construction of the SCR devices. Details of the interim results are set out in LC Paper No. CB(1) 2200/11-12(03).

45. Given the positive findings from the trial, the Administration has sought the support of the franchised bus companies to start preparation for launching a large-scale retrofit for Euro II and III buses with an aim to completing, on a best endeavour basis, the retrofit by end 2015. Meanwhile, arrangements are being made to assess the feasibility of retrofitting another six models which account for about 34% of the Euro II and III franchised buses. The same assessment will also apply to the remaining models which cover only a very small number of buses afterwards. The Administration plans to report the findings of the trial to the Panel by end of 2012 with a view to seeking funding approval from the Finance Committee in early 2013 for the large-scale retrofit.

46. Some members have enquired about the cost of the trial, the anticipated funding in the event of a full-scale retrofit, and the parties which will be responsible for future replacement of the SCR devices. According to the Administration, the cost of the SCR trial for the six franchised buses is about $2.1 million which covers the design, supply and installation of the SCR devices, as well as manpower support for conducting on-road emission tests and compilation of test reports. For the proposed large-scale retrofit of some 3 700 Euro II and III buses, the current estimate is around $555 million. A more detailed cost estimate will be made upon completion of the trial. The Administration will fully subsidize the capital cost of retrofitting while the franchised bus companies shall be responsible for the subsequent operation, maintenance and repair (including the replacement of worn-out catalyst) costs.

47. Given the many uncertainties on the performance of the SCR system and other operation parameters (including urea consumption rate, urea dosing control, fuel consumption rate, durability of the SCR system components, and frequency of maintenance), some other members are sceptical about the viability of the trial let alone the large-scale retrofit. These members remain of the view that it would be more cost-effective to use the funding to subsidize the franchised bus companies to accelerate their bus replacement programmes rather then proceeding with the large-scale retrofit. The Administration has advised that at present, the franchised bus companies are required to operate their franchised bus services with buses under the age of 18 years. This arrangement has taken account of the maintenance, operational and financial capability of the bus operators and their obligations to provide a proper and efficient service to the public. In accordance with such arrangement, it is estimated that over 3 000 buses will retire and be replaced between 2013 and 2017. When considering whether the bus replacement programme should be accelerated, the Administration will need to take into account the implications over cashflow and the related financial costs for franchised bus companies, lead time for delivery, as well as the potential impacts of bunching in orders may have on costs, operations and delivery schedules etc.

Advice sought

48. Members are invited to note the work of the Subcommittee.

Council Business Division 1
Legislative Council Secretariat
16 July 2012

Appendix I

Panel on Environmental Affairs

Subcommittee on Improving Air Quality

Terms of Reference

To monitor and study policies as well as public concerns on improving air quality.

Appendix II

Panel on Environmental Affairs

Subcommittee on Improving Air Quality

Membership list

Chairman	Hon Audrey EU Yuet-mee, SC, JP
Members	Hon Miriam LAU Kin-yee, GBS, JP Hon LEE Wing-tat Hon KAM Nai-wai, MH Hon Cyd HO Sau-lan Hon CHAN Hak-kan, JP Hon CHAN Kin-por, BBS, JP Hon Tanya CHAN (Total : 8 Members)
Clerk	Miss Becky YU
Legal Adviser	Miss Kitty CHENG
Date	1 July 2012