

ITEM FOR FINANCE COMMITTEE

HEAD 44 – ENVIRONMENTAL PROTECTION DEPARTMENT

Subhead 700 General non-recurrent

New Item “Retrofitting Franchised Buses with Selective Catalytic Reduction Devices”

Members are invited to approve the creation of a new commitment of \$400 million for funding the capital costs of retrofitting selective catalytic reduction devices on Euro II and III franchised buses in Hong Kong.

PROBLEM

Euro II and III franchised buses are one of the major sources of roadside air pollution at busy corridors. We need to install new emission reduction devices for these franchised buses.

PROPOSAL

2. The Director of Environmental Protection, with the support of the Secretary for the Environment, proposes to create a new commitment of \$400 million for funding the capital costs of retrofitting selective catalytic reduction (SCR) devices for some 1 400 Euro II and III franchised buses, including the buses selected for the pre-qualification trial.

/JUSTIFICATION

JUSTIFICATION

Need for Improvement of Roadside Air Quality

3. We need to improve roadside air quality for protecting public health. With the continued implementation of a series of air quality improvement measures, the general air quality at the ambient level has been improving. As regards air quality at roadsides, the concentration levels of respirable suspended particulates (RSP) and nitrogen oxides (NO_x) were reduced by 29% and 12% respectively between 2006 and 2012. However, during the same period, the nitrogen dioxide (NO₂) level at roadsides increased by 23%. As a result, the number of days in a calendar year with air pollution index exceeding 100 (i.e. reaching very high level) at the roadside rose from 51 days to 142 days.

4. To tackle the NO₂ problem at the roadsides, we need to further reduce NO_x emissions from major emission sources including franchised buses, diesel commercial vehicles and liquefied petroleum gas (LPG) taxis and public light buses. The current proposal is one of the initiatives (as set out in paragraph 22 below) we are pursuing for the purpose of tackling the roadside air pollution problem.

Franchised Bus Fleet

5. As at end April 2013, there were some 5 700 franchised buses in Hong Kong which can account for up to 40% of the traffic flow in busy corridors. In 2011, franchised buses accounted for about 20% of NO_x emissions and 6% of RSP emissions amongst the whole vehicular fleet. To improve air quality at roadsides, we need to further reduce emissions from franchised buses.

Encl. 1 6. The profile of the franchised bus fleet is at Enclosure 1. Under the bus replacement programme, franchised buses will have to be replaced before reaching 18 years old. As a result, all Euro I buses will be replaced by Euro V or better buses by 2015. As for the remaining Euro II and III buses, they emit 7.5 to 5 times as much RSP and 1.75 to 1.3 times as much NO_x as compared with Euro IV buses. They will only be fully retired by 2019 and 2026 respectively.

7. The franchised bus companies have already retrofitted Euro II and III buses, where technically feasible, at their own cost with diesel particulate filters (DPF). These DPF can reduce the particulate emissions of the buses by about 80%, thereby upgrading their particulate emission performance comparable to that of Euro IV buses.

/Selective

Selective Catalytic Reduction Devices

8. SCR¹ is a proven technology in reducing NOx emissions. To meet the increasingly stringent emission standards for newly registered vehicles, SCRs have been incorporated in new Euro IV and Euro V vehicles. Some European countries and cities (e.g. Barcelona, Belgium and Sweden) have retrofitted some of their buses with SCR while others (such as London) are making preparations for a similar retrofit². To improve air quality at roadsides, the Government announced in the 2010 Policy Address the plan to fully fund the retrofit of SCRs on Euro II and III franchised buses on a one-off basis subject to satisfactory trial results. Franchised bus companies will have to bear the subsequent recurrent expenditure including operational (urea and extra fuel costs), repair and maintenance costs, and future replacement of SCR filters³.

The Trial

9. Together with three franchised bus companies⁴, we started in September 2011 a small-scale trial involving six buses from three major bus models to ascertain the technical feasibility and effectiveness of retrofitting Euro II and III buses with SCRs. The trial was completed in February 2013.

10. The trial results have demonstrated that the SCR retrofit is technically feasible for the three selected bus models. Though some maintenance and operation problems emerged in the trial, they were addressed through remedial actions and more frequent maintenance/servicing. As for the remaining major Euro II and III bus models, we have also completed an assessment with the franchised bus companies and SCR suppliers, and have identified another four potential bus models for the retrofit.

11. For the buses on trial, the SCR retrofit can on average reduce the NOx emissions by about 63% to 81%, which could raise their emission performance comparable with those of Euro IV buses. On the other hand, the average urea consumption rates for the trial buses range from about 3% to 7% of the corresponding fuel consumption rates. There is also an average increase in fuel consumption of about 3.9%.

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¹ SCR is a system which is placed on the exhaust pipe. It can reduce NOx into nitrogen and oxygen. It uses a reagent, urea, to facilitate the chemical reaction.

² More than 400 buses have been upgraded by SCR retrofit in Barcelona, Spain. In Belgium and Sweden, about 250 and 300 buses have been retrofitted with SCR respectively. After conducting successful trials recently, London has decided to retrofit about 900 buses with SCR by March 2014.

³ According to SCR suppliers, the expected life of the filter of the SCR could be about 5 to 6 years, depending on usage and maintenance condition of the vehicle.

⁴ Participating franchised bus companies include The Kowloon Motor Bus Company (1933) Limited (KMB), Citybus Limited (CTB) and New World First Bus Services Limited (NWFB).

The Retrofit Programme

12. After discounting those buses with a remaining service life less than two years⁵ and bus models that are not technically feasible for retrofit or with a relatively small number (i.e. below 100 buses for each model), we have identified six bus models suitable for the large-scale retrofit, involving a total of some 1 400 buses. Details of these bus models are at Enclosure 2.

Encl. 2

13. Subject to the funding approval by this Committee, we plan to work with the franchised bus companies for taking forward the retrofit. To ensure that the SCRs are of the right design for individual bus models which is critical to their satisfactory performance afterwards, it is prudent to identify qualified SCR suppliers through a pre-qualification trial on the selected bus models before inviting tenders for the large-scale retrofit. This prudent approach is commonly adopted in major vehicle retrofitting exercises. Tentatively, the pre-qualification trial would start in end October 2013 and last for about twelve months. At the end of the pre-qualification trial, the franchised bus companies will undertake a tender exercise to select suitable SCR suppliers, with a view to starting the large-scale retrofit in April 2015 and completing it on a best endeavour basis by the end of 2016. We will strive to complete the retrofitting exercise as soon as practicable so that public funds invested into the SCR devices would have the maximum-possible life span before the Euro II and III buses are fully retired by 2019 and 2026 respectively. A tentative timetable for the retrofit exercise is at Enclosure 3.

Encl. 3

14. Given that the large-scale SCR retrofit programme is a new initiative, we consider it reasonable to ask the suppliers to provide a 4-year warranty. The actual warranty period for individual SCR units will be reduced if the remaining service life of individual buses upon retrofit is less than four years, and be finalized prior to undertaking a tender exercise.

15. The retrofit programme will be monitored by the Environmental Protection Department (EPD) and the Transport Department (TD), including conducting emission tests on selected retrofitted buses.

/Implications

⁵ In consideration of the cost effectiveness of the retrofit and the seriousness of roadside air pollution, we suggest that a bus should have at least two years of remaining service life after the retrofit. The buses identified for the retrofit will have remaining service lives ranging from two to eight years after retrofit.

Implications on Operating Cost

16. On the basis that the large-scale retrofit will cover some 1 400 buses from KMB, CTB, NWFB and Long Win Bus Company Limited (LW), the urea consumption and extra fuel as well as increased maintenance could cost about \$131 million and \$19 million for KMB/LW and CTB/NWFB respectively over the remaining serviceable life of the buses to be retrofitted. On average, the additional expenses amount to about \$13 million and \$3 million⁶ a year for KMB/LW and CTB/NWFB respectively, accounting for only about 0.2% and 0.1% of their annual operating costs. The franchised bus companies will absorb these costs as part of their operating costs. This could affect bus fare increases, as operating cost is one of the six factors under the Fare Adjustment Arrangement for franchised buses that the Government would take into consideration, but the impact shall be insignificant.

Air quality benefits

17. If these 1 400 eligible Euro II and III buses are retrofitted with SCRs, we expect that the NO_x emissions of the whole franchised bus fleet could be reduced by about 14%. The SCR retrofit, together with other air quality improvement measures under planning can reduce the NO₂ level at the busy corridors by about 40%, which is crucial to help attain the proposed new Air Quality Objectives for NO₂ at the ambient level by 2020. The retrofitted Euro II and III buses will also be deployed to routes serving the pilot low emission zones in Causeway Bay, Central and Mong Kok to help meet the target of having only low emission franchised buses operating there by end 2015.

FINANCIAL IMPLICATIONS

18. The latest estimated cost of retrofitting a bus with SCR is about \$250,000, having regard to the current prices of precious metals which are essential ingredients of SCR components, the complexity of the work in the congested engine compartment, and the 4-year warranty arrangement. Since there would be some 1 400 buses eligible for retrofitting, about \$350 million will be required. To allow for about 15% contingency, the total budget for the proposed retrofit programme for Euro II and Euro III franchised buses is about \$400 million.

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⁶ Based on the remaining serviceable lives of the buses to be retrofitted, the costs of \$131 million and \$19 million would be spent between 2015 and 2024 (ten years) for KMB/LW and between 2015 and 2020 (six years) for CTB/NWFB.

19. We propose to create a new commitment of \$400 million for the proposed retrofit programme. With reference to the tentative timetable for SCR retrofit programme as set out at Enclosure 3, the estimated cash flow for planning and budgetary purpose is as follows –

Financial year	(\$ million)
2013-14	23
2014-15	3
2015-16	134
2016-17	163
2017-18	20
2018-19	20
2019-20	17
2020-21	20
Total	400

20. Additional staff resources will be allocated to EPD and TD for supporting and monitoring the retrofit programme. The additional manpower resources will be reflected in the Estimates of the relevant years.

PUBLIC CONSULTATION

21. We consulted the Legislative Council Panel on Environmental Affairs (the Panel) on 14 June 2013. The Panel agreed that EPD could seek funding approval from this Committee. Some members were concerned about the upkeeping of the satisfactory functioning SCRs and the recurrent cost implications of SCR retrofit on bus fare. We have provided the Panel with supplementary information on these two issues. We also consulted the Advisory Council on the Environment, which supported the proposal, on 17 June 2013.

BACKGROUND

22. To improve roadside air quality, we have been pursuing a combination of measures as follows –

- (a) adopt the most stringent vehicle emission and fuel standards where practicable;

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- (b) provide a one-off grant to encourage commercial vehicle owners to replace their old vehicles with new ones complying with the prevailing emission requirements;
- (c) plan to phase out progressively pre-Euro IV diesel commercial vehicles (excluding franchised buses) through an incentive-cum-regulatory approach;
- (d) provide tax incentives to encourage the use of environment-friendly vehicles;
- (e) mandate pre-Euro diesel vehicles to be equipped with emission reduction devices;
- (f) ensure proper maintenance of in-use vehicles through a combination of voluntary and regulatory measures;
- (g) strengthen the emission control on petrol and LPG vehicles and provide a one-off subsidy to assist petrol and LPG taxi and light bus owners to replace the catalytic converters and oxygen sensors of their vehicles;
- (h) set up a \$300 million Pilot Green Transport Fund to support the testing of green and innovative technologies applicable to the public transport sector and goods vehicles;
- (i) plan to implement pilot low emission zones for franchised buses along the busy corridors in Causeway Bay, Central and Mong Kok; and
- (j) fund the full cost of procuring six hybrid buses and 36 electric buses for trial by the franchised bus companies.

**Profile of Franchised Buses according to Emission Standards
as at end April 2013**

Emission Standard	Total
Euro I	749
Euro II	2 612
Euro III	1 265
Euro IV	221
Euro V	859
Electric Bus	1
Total	5 707

**Profile of Franchised Buses Selected for the
Selective Catalytic Reduction Retrofit**

Bus Model	No. of Buses as at April 2013	Estimated no. of buses with a remaining service life of two or more years after retrofit
Euro II Trident 12m	856	237
Euro II Trident 11m/10.3m/10.6m	178	177
Euro II Super Olympian 12m	198	198
Euro III Trident 12m	101	101
Euro III Trident Enviro500 12m	278	278
Euro III Super Olympian 12m	393	393
Total	2 004	1 384 say (1 400)

Remarks:

- (1) Total no. of buses selected for retrofit: 1 384
- (2) Based on bus fleet information as at April 2013
- (3) Disposal year is based on bus life of 18 years.
- (4) Buses are under the following four franchised bus companies –
The Kowloon Motor Bus Company (1933) Limited (KMB)
Citybus Limited (CTB)
New World First Bus Services Limited (NWFB)
Long Win Bus Company Limited (LW)
- (5) Estimated no. of buses selected for the SCR Retrofit –
KMB: 1 103 buses
CTB: 18 buses
NWFB: 254 buses
LW: 9 buses

**Tentative Timetable
for Selective Catalytic Reduction Retrofit Programme**

	Milestone
End of October 2013	Subject to FC's approval, franchised bus companies (FBCs) to start the pre-qualification (PQ) exercise.
End of October 2014	FBCs to complete the PQ exercise and tender for the large-scale retrofit.
1 April 2015	FBCs to start the large-scale retrofit.
End of 2016	Complete the large-scale retrofit.
