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Review of the Third Technical Memorandum for Allocation of Emission Allowances for Power Plants

PURPOSE

This paper seeks Members' views on our proposal to reduce emission allowances for power plants starting from 1 January 2019 by way of issuing a new Technical Memorandum (TM) (i.e. the Fourth TM) under section 26G of the Air Pollution Control Ordinance (Cap. 311) (APCO).

BACKGROUND

2. APCO empowers the Administration to set emission caps for power plants for improving air quality in Hong Kong. Its Section 26G provides for the Secretary for the Environment (the Secretary) to allocate emission allowances for three specified pollutants, i.e., sulphur dioxide (SO_2), nitrogen oxides (NOx) and respirable suspended particulates (RSP), for power plants by way of a TM.

3. Three TMs were issued in 2008, 2010 and 2012 respectively. The First TM sets the emission allowances for the emission years between 2010 and 2014, the Second TM tightens the emission allowances starting from 1 January 2015, while the Third TM further reduces the emission allowances starting from 1 January 2017.

4. The emission allowances in the Third TM were determined with due regard to the sustained effort of the power companies to use low emission coal and to upkeep the performance of their emission control devices while maximizing the use

of existing gas-fired generation units and prioritizing the use of coal-fired generation units equipped with advanced emission control devices. The emission allowances under the Third TM are at the **Annex**. The TM also allows the allocation of not more than 1% of the total emission allowances for the power sector in respect of each of the specified pollutants for new electricity works.

5. Section 2.7 of the Third TM requires the Secretary to review the emission allowances not less than once every two years after its commencement. If the new emission allowances for the emission years starting from 1 January 2019 are promulgated by a new TM within 2014, the new emission allowances will take effect from 2019 pursuant to section 26G(4) of the APCO, which requires a TM to be issued at least four years before the commencement of the emission year that it takes effect.

THE REVIEW

6. Under Section 26G(2) of the APCO, the Secretary, in making the emission allocations, shall:

(a) have regard to the best practicable means (BPM) for preventing the emission of that type of pollutant;

(b) have as his purpose the attainment and maintenance of any relevant air quality objective (AQO); and

(c) have regard to whether the emission of that type of pollutant would be, or be likely to be, prejudicial to health.

7. To meet the Third TM set with reference to the above considerations, the power sector should continue to keep the share of natural gas in the fuel mix of local electricity generation close to 50%, prioritize the use of coal-fired generation units equipped with advanced emission control equipment and upkeep properly their emission control devices. Retrofitting the existing generation units with further emission reduction devices is not a practicable option because of the extensive retrofit that the two power companies have undertaken in recent years. Moreover, the fuel mix for power generation in the long run is being reviewed by the Environment Bureau. The focus of this review is thus on what further

measures could be introduced as BPM, particularly the upkeeping of their emission control equipment, to further reduce the emission allowances under the electricity demand forecast for 2019. In anticipation that a new fuel mix for the long run could take shape in 2015, we plan to conduct another review of the emission allowances next year for 2020 and thereafter.

8. When undertaking this review, we took note of new developments or information revealed after the setting of the Third TM. These include:

(a) the emission reduction efficiency of the emission control devices retrofitted in recent years has been better than the design level;

(b) the natural gas delivered so far from the West-East Gas Pipeline II (WEP II) that was commissioned in 2013 contains less sulphur than the limit prescribed in the supply contract;

(c) by 2019, the power sector will complete the phasing out of heavy fuel oil by ultra-low sulphur diesel for assisting coal-burning.

9. Having taken these factors into account together with the projected local electricity consumption for 2019, we have worked out the respective emission allowances for 2019 for the two power companies as follows –

(a) For The Hongkong Electric Company, Limited (HEC), it is forecast that the electricity demand for the Hong Kong Island will be lower by around 4% in 2019 as compared to the projection for 2017 when setting the Third TM because there will be no major growth in demand by infrastructure development during the period and that the energy efficiency and conservation initiatives introduced by the Government, such as the Buildings Energy Efficiency Ordinance will help reduce electricity consumption. The operation of the company's coal-fired generation units will be reduced, thus providing scope for the reduction of the emission allowances. If its emission reduction devices are properly maintained, its emission allowances could be reduced by 18% for SO_2, 5% for NOx and 20% for RSP as compared to the levels in the Third TM.

(b) For CLP Power Hong Kong Limited (CLP), it is forecast that its local electricity generation in 2019 will increase by around 4% as compared to

the projection for 2017 when setting the Third TM, because of the electricity demand growth in Kowloon, the New Territories and Lantau as a result of population growth as well as infrastructure, commercial and new housing developments in the area. The increase in the electricity demand will have to be met by additional output from its coal-fired generation units. As for RSP and NOx, CLP can absorb the increase in emissions by properly maintaining their emission reduction devices so that their emission control performance that has been achieved in recent years can be sustained. As for SO_2, due to the fact that the natural gas supplied so far via WEPII has a lower sulphur content than the stipulated standard in the supply contract, its emission allowance for SO_2 could be reduced by 4% despite the increase in electricity demand in 2019 as compared with the 2017 levels.

10. Details of the proposed emission allowances for the existing electricity works of the two power companies in 2019 are presented in Table 1 below. To put these figures into perspective, we have also presented the reductions relative to the respective Third TM levels for reference.

Table 1: Projected Emissions for Existing Electricity Works in 2019 (tonnes per year)

		Sulphur dioxide	**Nitrogen oxides** [@]	**Respirable suspended particulates**
HEC	Lamma Power Station and Lamma Power Station Extension (mixed fuel)	4 250 [-18%]	8 980 [-5%]	200 [-20%]
CLP	Black Point Power Station (gas-fired)	290 [-80%]	4 140 [-0%]	110 [-0%]
	Castle Peak Power Station (coal-fired)	4 678 [+25%]	12 358 [-0%]	389 [-0%]
	Penny's Bay Gas Turbine Power Station (oil -fired)	2 [-0%]	2 [-0%]	1 [-0%]
	Total of CLP's Stations	4 970 [-4%]	16 500 [-0%]	500 [-0%]

[@] Expressed as nitrogen dioxide

Note: The figures in square brackets are the percent reduction comparing with the emission allowances stipulated in the Third TM.

11. For renewable energy (RE), facilities covered in the last review include the Lamma Winds and thin film photovoltaic solar system for the HEC; and the landfill gas utilization plant of the South East New Territories Landfill and the Sludge Treatment Facility at Tuen Mun to the grid of the CLP. New potential RE facilities are the proposed Integrated Waste Management Facility in Shek Kwu Chau and a number of Organic Waste Treatment Facilities which will generate biogas in the treatment process for electricity generation or other purposes. We will include these new facilities in our next review of TM when more details are available. We will also follow the mechanism established in the Third TM for ascertaining the emission allowances according to the actual intake of the electricity generated from RE based on the unit emission factors for coal-fired generation unit emission factors.

PROPOSED EMISSION CAPS FOR NEW TM

Emission Allowances for Existing Electricity Works

12. Based on the above review, we propose to promulgate a new TM to allocate the emission allowances from 2019 onwards to each of the existing power plants by the following method, which was also adopted in the compilation of the Third TM:

Emission allowances to be allocated and ascertained		
=	Emission allowances that are required with the use of BPM (i.e., those presented in Table 1 above)	
plus/minus	Emission allowances to be added / deducted due to deviation of the actual intake of RE from the anticipated intake (i.e., 2 GWh and 21 GWh for HEC and CLP respectively) in accordance with the unit emission factors of coal-fired generation units	

13. The specific formulae for allocating the emission allowances to the four existing electricity works are presented below.

Table 2(a): Lamma Power Station and Lamma Power Station Extension

	Quantity of Emission Allowance for 2019 and thereafter
SO_2	4 250 + (2 – A) × 0.548
NOx [@]	8 980 + (2 – A) × 0.973
RSP	200 + (2 – A) × 0.022

Table 2(b): Black Point Power Station

	Quantity of Emission Allowance for 2019 and thereafter
SO_2	290
NOx [@]	4 140
RSP	110

Table 2(c): Castle Peak Power Station

	Quantity of Emission Allowance for 2019 and thereafter
SO_2	4 678 + (21 – B) × 0.418
NOx [@]	12 358 + (21 – B) × 1.105
RSP	389 + (21 – B) × 0.035

Table 2(d): Penny Bay's Gas Turbine Power Station

	Quantity of Emission Allowance for 2019 and thereafter
SO_2	2
NOx [@]	2
RSP	1

[@] Expressed as nitrogen dioxide

where -

A is the aggregate of total net sent-out electricity output (in GWh) from individual RE to the electricity grid of Lamma Power Station and Lamma Power Station Extension in the emission year; and

B is the aggregate of total net sent-out electricity output (in GWh) from individual RE to the electricity grid of Castle Peak Power Station in the emission year.

Emission Allowances for New Electricity Works

14. Similar to the previous three TMs, we will provide an allocation of not more than 1% of the total emission allowances of the power sector in respect of each of the specified pollutants for any possible new electricity works [1] so as to ensure that they will not be debarred from starting their business even with the use of the most advanced emission reduction technology. We also propose to retain the same mechanism adopted in the Third TM to cater for the possible intake of RE by new electricity works. Accordingly, the formulae for allocating and ascertaining the emission allowances in respect of each of the specified pollutants for possible new electricity works, with respect to the same reference installed capacity adopted in all the three TM, i.e., 300 MW, for emission years starting from 1 January 2019 would be as follow:

Table 3: New Electricity Works

	Quantity of Emission Allowance for 2019 and thereafter
SO_2	90 x (C/300) x (D/12) – E x 0.047
NOx [@]	250 x (C/300) x (D/12) – E x 0.131
RSP	7 x (C/300) x (D/12) – E x 0.004

[@] Expressed as nitrogen dioxide

where –

C is the total installed capacity (in MW) of the New Electricity Works; or 300 (i.e., reference installed capacity), whichever is smaller;

D is the total number of months in the emission year after the commencement of operation of the New Electricity Works and part of a month is taken as a full month in the determination; and

E is the aggregate of total net sent-out electricity output (in GWh) from individual RE to the electricity grid of the New Electricity Works in the emission year.

Setting Emission Caps for PM2.5

15. We have also explored the feasibility of setting emission caps for PM2.5 having regard to the latest international practices. At present, environmentally

[1] "New electricity works" refers to new entrant comes into the electricity generation industry after the commencement of the proposed TM.

advanced countries such as USA, the European Union, etc. have not set limits on PM2.5 emissions from power plants. The measurement of PM2.5 in power plant emissions is still under development. As such, it would not be practicable to set limits on PM2.5 emissions at this stage. We will monitor closely the relevant developments for reviewing the feasibility for setting such emission caps.

16. As PM2.5 is a fraction of RSP, the emission caps for RSP set in the TM could indeed effectively limit the emissions of PM2.5 from power plants. Also, the emission control technologies on particulate matters installed in the major coal generation units in CLP and HEC would also reduce the emissions of PM2.5.

Next Review

17. In order to meet electricity demand in the long run and to improve the environment, the Environment Bureau launched in March this year a three-month public consultation on the Future Fuel Mix for Electricity Generation for Hong Kong. The Government has put forward two fuel mix options for public consultation. The first option is "grid purchase", under which importing electricity through purchase from the Mainland power grid (i.e., the China Southern Power Grid) is proposed. The second option is "local generation", under which use of more natural gas for local generation is proposed.

18. Since the findings of the consultation and the decision on the fuel mix in the long run will have significant implications for setting emissions allowances for electricity generation in 2020 and beyond, we will review the TM again in 2015 when the results of the fuel mix review are available.

Commencement Date of New Emission Caps

19. If the proposed new Fourth TM commences before the end of 2014, the new emission allowances would take effect starting from 1 January 2019, having regard to the statutory requirement in section 26G(4) of the APCO that an allocation of emission allowances made by the TM in relation to an emission year (other than an allocation made under the First TM) could only take effect at least four years after the commencement of the TM making the allocation.

ENVIRONMENTAL BENEFITS

20. As compared with the emission allowances for 2017 set under the Third TM, the proposed Fourth TM will see a further tightening of 11% for SO2, 2% for NOx and 7% for RSP for the power sector. The reduction will help improve local air quality given that emissions from the power sector account for 47%, 28% and 16% respectively of the territory-wide emissions of these pollutants in 2012.

TARIFF IMPLICATIONS

21. Attaining the proposed emission caps for 2019 does not involve new capital investment by power companies nor major changes on the fuel mix of power companies. The power companies will present their tariff assessment to the Administration annually in accordance with the prevailing regulatory mechanism under the Scheme of Control Agreement.

CONSULTATION

22. The two power companies have been consulted on the proposal. Both companies consider that the proposed new emission allowances are extremely challenging. They are however committed to working closely with the Administration to ensure compliance while maintaining a reliable supply of electricity to the customers. They also see the compliance of the emission allowances contingent upon having the supply of fuels of the right quality. In the case of CLP, a sufficient supply of natural gas that is of properties consistent with the current level is also important. HEC further explained that with the natural deterioration in the performance of its coal-fired generation units and pollution control equipment, any forced outages of the units or equipment will jeopardize its capability of achieving the new emission targets. Both power companies consider that the proposed emission allowances are very tight. Should their operation encounters events that are beyond their control and with significant emission implications, e.g., cessation or insufficient supply of low emission coal, unexpected increase in power demand, increase in sulphur content of the WEPII gas, etc., they will have to resort to the special event provision under Section 26K of the APCO to adjust their emission caps accordingly. EPD will handle these special events in accordance with the APCO.

WAY FORWARD

23. We plan to submit the Fourth TM to the Legislative Council under section 37B(1) of the APCO for negative vetting in late October 2014. Our target is that the new Fourth TM shall commence before the end of 2014, thus providing at least four years' lead time for the revised emission allowances in respect of the specified pollutants in relation to the emission years from 1 January 2019 to take effect.

Environmental Protection Department
October 2014

Annex

Emission Allowances for Existing Electricity Works under the Third TM (tonnes per year)

(a) Lamma Power Station and Lamma Power Station Extension

	2017 and thereafter
Sulphur dioxide	5 200 + (2 – A) × 0.614
Nitrogen oxides [(i)]	9 450 + (2 – A) × 0.941
Respirable suspended particulates	250 + (2 – A) × 0.027

(b) Black Point Power Station

	2017 and thereafter
Sulphur dioxide	1 440
Nitrogen oxides [(i)]	4 140
Respirable suspended particulates	110

(c) Castle Peak Power Station

	2017 and thereafter
Sulphur dioxide	3 757 + (21 – B) × 0.367
Nitrogen oxides [(i)]	12 358 + (21 – B) × 1.208
Respirable suspended particulates	389 + (21 – B) × 0.038

(d) Penny's Bay Gas Turbine Power Station

	2017 and thereafter
Sulphur dioxide	2
Nitrogen oxides [(i)]	2
Respirable suspended particulates	1

[(i)] Expressed as nitrogen dioxide

where –

A is the aggregate of total net sent-out electricity output (in GWh) from the Renewable Energy Systems to the electricity grid of Lamma Power Station and Lamma Power Station Extension in the emission year; and

B is the aggregate of total net sent-out electricity output (in GWh) from the Renewable Energy Systems to the electricity grid of Castle Peak Power Station in the emission year.