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Review of the Fourth 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 2020 by way of issuing a new Technical Memorandum (TM) (i.e., the Fifth TM) under Section 26G of the Air Pollution Control Ordinance (Cap. 311) (APCO).

BACKGROUND

2. APCO empowers the Administration to cap the emissions of power plants for improving air quality. 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. Four TM were issued in 2008, 2010, 2012 and 2014 respectively. The First TM set the emission allowances for the emission years between 2010 and 2014. The Second TM and Third TM have tightened the emission allowances starting from 1 January 2015 and 1 January 2017 respectively, while the Fourth TM will further reduce the emission allowances starting from 1 January 2019.

4. The emission allowances in the Fourth TM were determined with due regard to the sustained efforts of the power companies to uphold the performance of their emission control devices retrofitted in recent years. Besides, the phasing out of

heavy fuel oil by ultra-low sulphur diesel for assisting coal-burning and the sulphur content of natural gas delivered from the West-East Gas Pipeline II being lower than the limit prescribed in the supply contract, were also taken into consideration. The emission allowances under the Fourth TM are at the **Annex**. The TM also allows the allocation of not more than 1% of the total emission allowances for the electricity 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 at least once every two years. When setting the emission allowances under the Fourth TM last year, we committed to reviewing the TM in 2015 to take account of the latest developments, including the outcomes of the public consultation on the future fuel mix for the power generation. If the new emission allowances for the emission years starting from 1 January 2020 are promulgated by a new TM within 2015, the new emission allowances will take effect from 2020 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 ; 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 emission allowances set under the TM for 2015 and beyond, the power companies should continue to use low emission coal and uphold the performance of their emission control devices while maximizing the use of existing gas-fired electricity generation units (gas-fired units) and prioritizing the use of coal-fired electricity generation units (coal-fired units) equipped with advanced emission control devices.

8. The extensive retrofits that the power companies have undertaken to reduce

their emissions have made further retrofits impracticable. Revamping the fuel mix for power generation is the only practicable way to significantly reduce their emissions. Following a public consultation conducted in the first half of 2014 on two fuel mix options to meet the environmental targets in 2020, the Government set out its plan to implement the future fuel mix in March 2015. Having regard to public views and comments received at the public consultation on fuel mix, the Government intends to increase the proportion of natural gas generation to around 50% in 2020, and, subject to a reasonable import price, to maintain the current interim measure of importing 80% of nuclear output [1] from the Daya Bay Nuclear Power Station so that nuclear import would account for around 25% of the total fuel mix. Furthermore, subject to public views on the tariff implications, the Government is prepared to consider developing more renewable energy (RE), and will also enhance efforts to promote energy saving. The remaining demand will be met by coal-fired generation.

9. When determining the emission allowances for the two power companies under the new TM, we have taken account of the following –

(a) the progress of implementing the fuel mix plan for 2020, including the construction of new gas-fired units and replacement of some old power generation units, which are scheduled for retirement after reaching the end of their service life in the coming years;

(b) the practicability to maintain the current import of 80% of nuclear output from the Daya Bay Nuclear Power Station (DBNPS) after 2018;

(c) new technology to control NOx emissions from new gas-fired units [2]; and

(d) the projected local electricity consumption for 2020.

10. Based on the above parameters, our assessment for the Hongkong Electric Company, Limited (HEC) is as follows –

(a) the electricity demand for Hong Kong Island is forecasted to reduce by

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1 In addition to the original agreement to import 70% of the electricity output of Daya Bay Nuclear Power Station (DBNPS), CLP had made arrangement with DBNPS to import an additional 10% of nuclear power for a period of 4 years from 2015 to 2018 as an interim measure.

2 Natural gas (NG)-fired units have negligible emissions of SO2 and RSP. To reduce their NOx emissions, new NG-fired units shall be equipped with a Dry Low-NOx (DLN) combustion system and a Selective Catalytic Reduction (SCR) system, which in combination can have an NOx reduction efficiency of 90% to meet a new NOx emission standard of 5 mg/m^3.

around 4% in 2020 as compared to the demand projection for 2019 when setting the Fourth TM. This is because there will be no major growth in demand arising from infrastructure development during the period while 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 its coal-fired units will be reduced;

(b) a new gas-fired unit of around 335 MW would be required by the end of 2019 to meet electricity demand resulting from the scheduled retirement of old generating units. This new gas-fired unit has obtained the provisional approval from the Executive Council for installation and an environmental permit (EP) under the Environmental Impact Assessment Ordinance (Cap. 499) for its construction and operation;

(c) the service life of an existing gas-fired unit due for retirement in early 2020 would be extended for a few years having regard to its operational conditions with proper refurbishment; and

(d) the reduced electricity demand in 2020 and the availability of more gas-fired generation capacity could reduce its reliance on coal-fired units for power generation. It is estimated that HEC's emission allowances could be reduced by 26% for SO_2, 29% for NOx and 28% for RSP in 2020 as compared to the levels in the Fourth TM.

11. As for CLP Power Hong Kong Limited (CLP), the assessment is as follows –

(a) there will be around 1% increase in its local electricity demand in 2020 as compared to that of 2019;

(b) it made an application in April 2015 to carry out an Environmental Impact Assessment (EIA) for installing additional gas-fired units at its Black Point Power Station. At this stage, there are uncertainties as to whether additional generation unit could be ready for operation in 2020;

(c) DBNPS would continue supplying 80% nuclear power beyond 2018; and

(d) the relatively stable electricity demand in 2020 coupled with the continuation of the additional nuclear power import will help reduce CLP's

local generation. It is estimated that its emission allowances could be reduced by 9% for SO_2, 10 % for NOx and 12% for RSP in 2020 as compared to the levels in the Fourth TM.

12. The proposed emission allowances for the electricity works of the two power companies in 2020 and beyond are presented in Table 1 below, together with the reductions relative to the respective Fourth TM levels.

Table 1: Projected Emissions for Electricity Works in 2020 and beyond (tonnes per year)

		Sulphur dioxide	**Nitrogen oxides** [@]	**Respirable suspended particulates**
HEC	Lamma Power Station and Lamma Power Station Extension (mixed fuel)	3 130 [-26%]	6 350 [-29%]	145 [-28%]
CLP	Black Point Power Station (gas-fired)	279 [-4%]	4 074 [-2%]	108 [-2%]
	Castle Peak Power Station (coal-fired)	4 259 [-9%]	10 844 [-12%]	331 [-15%]
	Penny's Bay Gas Turbine Power Station (oil -fired)	2 [-0%]	2 [-0%]	1 [-0%]
	Total of CLP's Stations	4 540 [-9%]	14 920 [-10%]	440 [-12%]
Electricity sector		7 670 [-17%]	21 270 [-17%]	585 [-16%]

[@] Expressed as nitrogen dioxide

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

13. For renewable energy facilities, the Lamma Winds of HEC and its photovoltaic solar system at Lamma Power Station will continue to supply RE of about 2 GWh per year in total to HEC's power grid. CLP will have additional RE power from Phase 1 of Environmental Protection Department's (EPD) new Organic Waste Treatment Facilities in Siu Ho Wan, North Lantau, which will be commissioned in 2017, apart from EPD's Sludge Treatment Facility in Tuen Mun, which started operation in 2015. These two facilities will supply about 32 GWh of surplus electricity to CLP's power grid per year. As for the landfill gas from EPD's

South East New Territories Landfill, which was covered in the last review, it will be used by a gas company for local use instead of generating surplus electricity to the power grid. Besides, EPD's Integrated Waste Management Facility in Shek Kwu Chau is also a potential RE facility and is expected to start operation by 2022. That will be assessed in our next review of TM when more details are available. We will also follow the established mechanism in the Fourth TM for ascertaining the emission allowances according to the actual intake of the electricity generated from RE based on the unit emission factors of coal-fired units.

PROPOSED EMISSION CAPS FOR NEW TM

Emission Allowances for Existing Electricity Works

14. Based on the above review, we propose to promulgate a new TM to allocate the emission allowances from 2020 onwards to each of the existing power plants by the following method, which was also adopted in the Fourth 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 32 GWh for HEC and CLP respectively) in accordance with the unit emission factors of coal-fired units

15. The formulae for allocating the emission allowances to the four electricity works are presented in the tables below –

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

	Quantity of Emission Allowance for 2020 and thereafter
SO_2	3 130 + (2 – A) × 0.563
NOx [@]	6 350 + (2 – A) × 0.928
RSP	145 +(2 – A) × 0.019

Table 2(b): Black Point Power Station

	Quantity of Emission Allowance for 2020 and thereafter
SO_2	279
NOx [@]	4 074
RSP	108

Table 2(c): Castle Peak Power Station

	Quantity of Emission Allowance for 2020 and thereafter
SO_2	4 259 + (32 – B) × 0.422
NOx [@]	10 844 + (32 – B) × 1.073
RSP	331 + (32 – B) × 0.033

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

	Quantity of Emission Allowance for 2020 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

16. For any possible new electricity works [3], we will allocate emission allowances based on the emission performance of a new gas-fired unit adopting BPM for emission reduction. We also propose to retain the mechanism in the Fourth 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

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

the specified pollutants for possible new electricity works, with respect to the same reference installed capacity adopted in the previous TM, i.e., 300 MW, for emission years starting from 1 January 2020 would be as presented in the table below.

Table 3: New Electricity Works

	Quantity of Emission Allowance for 2020 and thereafter
SO_2	36 × (C/300) × (D/12) – E × 0.018
NOx [@]	55 × (C/300) × (D/12) – E × 0.028
RSP	14 × (C/300) × (D/12) – E × 0.007

[@] 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.

Next Review

17. CLP is currently undertaking an EIA study for installing new gas-fired units at its Black Point Power Station. Since the addition of new gas-fired units will affect the fuel mix for electricity generation and hence emissions in future years, we will review the TM again in 2016 when more information on the timing of their availability and capacity is available.

Commencement Date of New Emission Caps

18. If the proposed new TM commences before the end of 2015, the new emission allowances would take effect starting from 1 January 2020, 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 which could only take effect at least four years after the commencement of the TM making the allocation.

Special Event

19. The emission allowances to be allocated under the proposed new TM are premised on the timely commissioning of the HEC's new gas-fired unit by the end of 2019 and the availability of the additional 10% nuclear energy from DBNPS to CLP in 2019 and beyond. Should there be any uncontrollable factors that affect the timely availability of the new gas-fired unit or additional nuclear power supply, we will deal with them under the existing mechanism of the APCO when the power companies invoke the special event provision under Section 26K of the APCO to adjust their emission caps. We will not lightly adjust the emission caps under the special event mechanism unless the incidents are clearly proven to be uncontrollable by power companies and the latter have made their best endeavour to avoid such happenings.

ENVIRONMENTAL IMPLICATIONS

20. As compared with the emission allowances for 2019 set under the Fourth TM, the proposed Fifth TM will see a further tightening of 17% for both SO_2 and NOx as well as 16% for RSP for the electricity sector. The reduction will help improve air quality given that emissions from the electricity sector account for 47%, 31% and 16% respectively of the territory-wide emissions of these pollutants in 2013.

21. CLP is undertaking an EIA study for installing additional gas-fired units with a view to increasing the use of natural gas for generation in response to government's fuel mix plan for 2020. As such, we have not taken into consideration its new units in setting the emission allowances under the proposed Fifth TM because of uncertainty on their readiness for operation by 2020. Due to this uncertainty, there might be a shortfall for meeting the 2020 emission reduction targets as agreed with Guangdong in 2012. We will keep in view closely CLP's preparation for installing the additional gas-fired units and the progress of other air quality improvement measures in the run up to 2020. If the development plan for CLP's new gas-fired units is firmed up in 2016, we shall prepare another TM next year to tighten the emission allowances.

TARIFF IMPLICATIONS

22. Meeting the proposed emission allowances for 2020 will involve new capital investment in the new gas-fired unit by HEC as well as a change on its fuel mix. As HEC's new gas-fired unit proposal is still being assessed by the government and CLP still needs to discuss with parties concerned on the intake price of additional nuclear import, it is premature to provide a meaningful assessment of the tariff implications for 2020 and beyond.

23. 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

24. We have consulted the two power companies about the proposal. Both companies consider the proposed new emission allowances extremely challenging. They are however supportive of Hong Kong's new fuel mix plan for 2020 and are committed to working closely with the Administration to ensure compliance while maintaining a reliable supply of electricity to the customers. HEC considers it important to have the Government's early approval for its new gas-fired unit for meeting a very tight work schedule as well as the extension of the service life of an existing gas-fired unit. While currently undertaking an EIA study and other development work for building additional gas-fired generation capacity, CLP considers assuming its readiness for setting the emission allowances in the proposed TM to be premature. However, it believes that importing additional nuclear energy on top of its existing supply contract of 70% of the annual output of the DBNPS before the start of 2020 a more realistic scenario.

25. Both power companies also see the compliance of the emission allowances contingent upon having the supply of fuels of the right quality. They have further explained that with the natural deterioration in the performance of its coal-fired units and pollution control equipment, any forced outages of the units or equipment will jeopardize their compliance with the new emission allowances. Should their operation encounter 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 natural gas supplied, less than expected additional nuclear energy made available to CLP for 2020, delay in the operation of HEC's new gas-fired unit to meet its schedule by the

end of 2019 and/or other related issues outside their control, they will have to resort to the special event provision under Section 26K of the APCO to adjust their emission allowances accordingly. When necessary, we will handle these special events in accordance with the APCO.

WAY FORWARD

26. We plan to submit the Fifth TM to the Legislative Council under Section 37B(1) of the APCO for negative vetting in late October 2015. Our target is to commence the Fifth TM before the end of 2015, thus fulfilling the statutory requirement to provide the power companies with at least four years' lead time for the tightened emission allowances to take effect from 1 January 2020.

Environmental Protection Department
October 2015

Annex

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

(a) Lamma Power Station and Lamma Power Station Extension

	2019 and thereafter
Sulphur dioxide	4 250 + (2 – A) × 0.548
Nitrogen oxides [(i)]	8 980 + (2 – A) × 0.973
Respirable suspended particulates	200 + (2 – A) × 0.022

(b) Black Point Power Station

	2019 and thereafter
Sulphur dioxide	290
Nitrogen oxides [(i)]	4 140
Respirable suspended particulates	110

(c) Castle Peak Power Station

	2019 and thereafter
Sulphur dioxide	4 678 + (21 – B) × 0.418
Nitrogen oxides [(i)]	12 358 + (21 – B) × 1.105
Respirable suspended particulates	389 + (21 – B) × 0.035

(d) Penny's Bay Gas Turbine Power Station

	2019 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.