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Paper for the House Committee meeting on 4 December 2015

**Report of the Subcommittee on Fifth Technical Memorandum for
Allocation of Emission Allowances in Respect of Specified Licences**

Purpose

This paper reports on the deliberations of the Subcommittee on Fifth Technical Memorandum for Allocation of Emission Allowances in Respect of Specified Licences ("Fifth TM").

Background

2. The Air Pollution Control Ordinance (Cap. 311) ("APCO") empowers the Government to set emission caps for power plants¹ for improving air quality in Hong Kong. Section 26G of APCO provides for the Secretary for the Environment ("SEN") to allocate emission allowances for three specified pollutants, i.e. sulphur dioxide ("SO₂"), nitrogen oxides ("NO_x") and respirable suspended particulates ("RSP"), for power plants by way of a TM².

3. Four TMs were issued in 2008, 2010, 2012 and 2014 respectively as follows —

- (a) the First TM set the emission allowances for the emission years between 2010 and 2014;
- (b) the Second TM tightened the emission allowances starting from 1 January 2015;
- (c) the Third TM further reduces the emission allowances starting from 1 January 2017; and

¹ There are four power plants in Hong Kong at present, i.e. Lamma Power Station and Lamma Power Station Extension, Black Point Power Station, Castle Peak Power Station and Penny's Bay Gas Turbine Power Station.

² Under section 37B(6) of APCO, TM is not subsidiary legislation but is required to be published in the Gazette and tabled in the Legislative Council, and is subject to a scrutiny mechanism similar to that provided under section 34 of Interpretation and General Clauses Ordinance (Cap. 1).

- (d) the Fourth TM promulgates the new emission allowances to take effect from 1 January 2019³. Section 2.7 of the Fourth TM requires SEN to review the emission allowances in 2015.

The Fifth Technical Memorandum for Allocation of Emission Allowances in respect of Specified Licences

4. The Fifth TM was published in the Gazette on 23 October 2015 and tabled before the Legislative Council ("LegCo") on 28 October 2015 for negative vetting. The Fifth TM seeks to allocate for each emission year from 1 January 2020 the quantities of emission allowances for the three specified pollutants for each of the four existing power plants and possible new electricity works in Hong Kong. It also requires SEN to review in 2016 the quantity of these emission allowances.

5. The proposed emission allowances for the four power plants under the Fifth TM in 2020 and their reductions relative to the respective Fourth TM levels are set out in the table below –

		Sulphur dioxide	Nitrogen oxides ⁴	Respirable suspended particulates
Hongkong Electric Company, Limited	Lamma Power Station and Lamma Power Station Extension (mixed fuel)	3 130 [-26%] ⁵	6 350 [-29%]	145 [-28%]
CLP Power Hong Kong Limited ("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%]

³ Under the statutory requirement in section 26G(4) of APCO, an allocation of emission allowances made by a TM in relation to an emission year can only take effect at least four years after the commencement of the TM making the allocation.

⁴ Expressed as nitrogen dioxide

⁵ The figures in square brackets are the percentage of reduction compared to the emission allowances stipulated in the Fourth TM.

6. Compared with the emission allowances for 2019 under the Fourth TM, the Fifth TM will see a further tightening of 17% for both SO₂ and NO_x and 16% for RSP for the electricity sector.

The Subcommittee

7. At the House Committee meeting on 30 October 2015, Members agreed that a subcommittee should be formed to examine the Fifth TM. Under the chairmanship of Hon Kenneth LEUNG, the Subcommittee has held two meetings to discuss with the Administration, including one meeting to receive views from deputations. The Subcommittee has also received written submissions from three organizations. The membership list of the Subcommittee and a list of organizations which have given views to the Subcommittee are in **Appendices I and II**.

Deliberations of the Subcommittee

8. Members in general welcome the measure to further tighten the emission caps on the specified pollutants from electricity generation, which is vital to achieving the new Air Quality Objectives by 2020⁶. In examining the Fifth TM, the Subcommittee has focused on issues including the scope of specified pollutants, projected local electricity consumption, potential impact of the Fifth TM on electricity tariffs and the fuel mix for power generation.

Specified licence for electricity generation

9. The Subcommittee notes that the quantity of emission allowances for each type of specified pollutant are allocated in respect of each specified licence which is defined in APCO to mean a licence to conduct the process of electricity generation where the installed generation capacity of such works exceeds 5 megawatts ("MW"). The Subcommittee has sought clarification whether each specified licence is approved with reference to the number of power generation units or other criteria.

10. The Administration advises that each specified licence is differentiated by the location of the electricity works concerned, and not the number of power generation units. Accordingly, one specified licence is granted to the Hong Kong Electric Company, Limited ("HEC") which operates one electricity works (i.e. the Lamma Power Station and Lamma Power Station Extension), whereas each of the three electricity works of CLP Power Hong Kong Limited ("CLP")

⁶ The new Air Quality Objectives are benchmarked against a combination of interim and ultimate targets under the World Health Organization's Air Quality Guidelines and have taken effect from 1 January 2014.

(i.e. the Black Point Power Station, Castle Peak Power Station and Penny's Bay Gas Turbine Power Station) is operated under an individual specified licence. As such, three sets of emission allowances are required to be made for CLP.

Scope of specified pollutants in TMs

Setting emission caps for PM2.5

11. The Subcommittee notes that the Environmental Protection Department currently includes PM2.5⁷ in the measurement of air pollutants for compilation of the Air Quality Health Index and the regular monitoring of certain pollutants by the general and roadside air quality stations. The Chairman and some other members have enquired about the feasibility of setting emission caps for PM2.5 in respect of power plants under TMs, having regard to the potential adverse impact on public health arising from high concentrations of PM2.5 in the air.

12. The Administration advises that unlike the measurement of ambient PM2.5 concentrations, there are no established methods for measuring the PM2.5 concentrations in a stack where water droplets are present. Local power plants have adopted wet flue-gas desulphurization systems to reduce SO₂ emission and the treated flue-gas is wet. The water droplets could dissolve some of the PM2.5, rendering these particles not collected by the PM2.5 particle-sizing device for measurement. Without a reliable measurement method, it is not practicable to set limits on PM2.5 emissions from local power plants. The Administration further points out that even in developed countries like the United States and member states of the European Union, there is still no reliable method to measure PM2.5 emissions from power plants with wet stacks nor emission caps set on their PM2.5 emissions.

Reducing carbon emission

13. Members note that according to the "Hong Kong Climate Change Report 2015" released by the Environment Bureau on 6 November 2015, Hong Kong's annual greenhouse gas emissions in 2012 was 43.1 million tonnes of Carbon Dioxide Equivalent or about six tonnes per capita. While this per capita rate is relatively low compared to other developed economies, members are concerned that electricity generation remains the largest source of local greenhouse gas emissions (mainly in the form of carbon dioxide ("CO₂")) in Hong Kong, accounting for as much as 68% of the total in 2012, followed by local transportation (17%). Stressing the need to tackle the challenge of climate change (i.e. limiting average global temperature increases and coping with the relevant impacts), members opine that the Administration should consider more proactive ways to de-carbonize, including setting limits for carbon emission from power plants. The Chairman has suggested that the

⁷ PM2.5 is a fraction of RSP (also known as PM10).

Administration should study the feasibility of applying in the electricity sector the "carbon capture and storage" technology, i.e. trapping CO₂ produced by power plants and then storing it.

14. The Administration explains that there is currently no practicable technology available for controlling CO₂ emissions from power generation and hence CO₂ reduction can only be achieved by adjusting the fuel mix, such as by increasing the use of cleaner fuel (e.g. natural gas) and decreasing the use of fuel with higher carbon contents (e.g. coal). The Administration is aware of the emerging "carbon capture and storage" technology to sequester CO₂ emissions. As this technology commonly involves the injection of CO₂ into the ground⁸ such as deep geological formations or declining oil fields, it is questionable as to whether it can be deployed in Hong Kong having regard to physical constraints, let aside the substantial energy and storage costs concerned. The Administration considers that before a more practicable technology is identified to measure and store CO₂ emitted from power generation, it will not be feasible to set emission caps for CO₂ in TMs.

Projected local electricity consumption for 2020 and energy saving initiatives

15. The Subcommittee notes that when reviewing the emission allowances for power companies, the Administration has considered the updated demand forecast made by the power companies, including the 4% reduction in the updated demand forecast for Hong Kong Island for 2020 as compared to the forecast for 2019 made in the last TM, as well as the 1% increase in the demand forecast for Kowloon and the New Territories over the period. The Subcommittee notes the concern from some green groups that the forecasted demand for 2019 might have been over-estimated, and asks how the emission allowances for a particular emission year can be rectified if the relevant electricity demand in that year has been under- or over-estimated.

16. The Administration has advised that as in the reviews of previous TMs, it has considered the best available information at the time of the review. The reduction in the latest electricity demand projection for Hong Kong Island has taken into account that there will be no major growth in demand arising from infrastructure development while the energy efficiency and conservation initiatives taken by the Government and other sectors will help reduce electricity consumption.

17. The Administration has further advised that the current mechanism already allows for review of the emission allowances at least once every two years, and further tightening of the emission caps where practicable in the light of the latest electricity demand projections and other relevant factors. In the case of the Fifth TM, it will be reviewed one year after its promulgation taking

⁸ Other types of storage include ocean storage and mineral storage.

into account the planned development of installation of new gas-fired units for which an Environmental Impact Assessment study is being undertaken by CLP.

18. The Subcommittee has sought clarification whether the power companies are exporting electricity currently and if emission allowances are allocated for the electricity generated for export. The Administration informs members that CLP sells electricity to Shekou (蛇口). The Administration points out that emission allowances are prescribed in respect of electricity generation for local consumption only and hence no emission allowance will be provided for export sales. As defined in paragraph 1.3 of the Fifth TM, electricity generation for local consumption is the gross electricity generation of an electricity works minus the electricity sales for export outside Hong Kong irrespective of whether the export sales are directly conducted by the subject specified licence holder or indirectly dealt with by other dealers. The quantity of a specified pollutant emitted from generation of electricity for export is counted into the total quantity of that pollutant emitted from each electricity works.

19. In connection with local electricity consumption, Members have discussed with the Administration energy saving and green building initiatives in Hong Kong. At the request of the Subcommittee, the Administration has provided supplementary information for members' reference on how it sets energy saving targets for government buildings and public facilities, and ensures that these targets can/will be achieved⁹, as well as the development of smart meters (i.e. Advanced Metering Infrastructure)¹⁰ which can provide consumers with more information on their electricity consumption patterns.

Formula for allocating emission allowances

20. The Subcommittee notes that the formula for determining emission allowances in respect of each specified licence for each emission year from 1 January 2020 ("the formula") is as follows –

Emission allowances to be allocated and ascertained	=	Emission allowances that are required with the use of best practicable means	plus / minus	Emission allowances to be added / deducted due to deviation of the actual annual intake of renewable energy ("RE") from the anticipated annual intake in accordance with the unit emission factors of coal-fired generation units
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⁹ See item (d) of LC Paper No. CB(1)175/15-16(02)

¹⁰ See item (c) of LC Paper No. CB(1)175/15-16(02)

21. Hon WU Chi-wai has enquired whether the Administration will consider incorporating incentives in the formula to encourage energy saving by the power companies. Mr WU also observes that under the mechanism of the formula, if the actual intake of RE turns out to be larger than assumed, the emission allowances will be lowered. Mr WU has expressed concern whether this may in effect disincentivize the power companies from developing more RE.

22. The Administration explains that TMs are meant to control the emission of specified pollutants from power plants whereas energy saving initiatives or RE development by the power companies could be dealt with in another context, including the Scheme of Control Agreements ("SCAs") signed between the Government and the power companies. The current SCAs provide the two power companies with financial incentives in respect of energy saving and energy audits, as well as RE development. As the SCAs will expire in end 2018¹¹, the Administration launched on 31 March 2015 a "Public Consultation on the Future Development of the Electricity Market in Hong Kong". It will announce the outcome of the public consultation shortly and, having regard to the views received, will commence discussion with the power companies on the future regulatory arrangements for the electricity market, including how the power companies should help promote energy efficiency performance and RE development.

23. The Subcommittee notes that the formula caters for possible new electricity works by allocating emission allowances based on the emission performance of a new gas-fired unit adopting best practicable means for emission reduction, with respect to the same reference installed capacity adopted in the Fourth TM, i.e. 300 MW. The Administration advises that this reference is drawn from the installed capacity of a typical gas-fired unit. As each TM is reviewed at least once every two years, it is unlikely that there will be substantial increase in new electricity works before the next review and shortfall in the emission allowances allocated. At the request of the Subcommittee, the Administration has provided for members' reference supplementary information on the installed capacity of each power generation unit and the total installed capacity in respect of each electricity works of the two power companies¹².

24. Noting that the quantity of emission allowances determined in TMs for allocation to a specified licence is rounded up, Hon WU Chi-wai has queried

¹¹ The Government has the option to extend the current SCAs for five more years, i.e. until 2023. The Government may exercise such option by giving the power companies a written notice before 1 January 2016. Meanwhile, the Government may introduce changes to the electricity supply regulatory framework after the expiry of SCAs in 2018. The Government will discuss with the power companies market readiness, potential future changes to the electricity supply regulatory framework, and transition issues before 1 January 2016.

¹² See item (a) of LC Paper No. CB(1)175/15-16(02)

whether the rounding-up may in effect result in allocation of more emission allowances than necessary. The Administration explains that as the figures are only rounded up to the next whole number, the implications on the emission allowances should be negligible given the sizes of these allowances.

Fuel mix for electricity generation¹³

Importing more nuclear power

25. The Subcommittee notes that in order to meet electricity demand in the long run and improve the environment, the Government launched in March 2014 a three-month public consultation on the Future Fuel Mix for Electricity Generation for Hong Kong. Having regard to public views and comments received at the public consultation, the Government plans 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 from the Daya Bay Nuclear Power Station ("DBNPS") so that nuclear import will 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 RE, and will also enhance efforts to promote energy saving. The remaining electricity demand will be met by coal-fired generation.

26. Noting that under the interim measure, CLP has made an agreement with DBNPS to import an additional 10% of nuclear power output of DBNPS to Hong Kong up to 2018 in addition to the original agreement to import 70%, Hon CHAN Hak-kan suggests the Administration/CLP explore the feasibility of importing more nuclear power from DBNPS, say, up to 100% of DBNPS's output, with a view to relieving the pressure to increase electricity tariffs in the near future due to changes in the fuel mix towards a greater use of natural gas which is more costly.

27. The Administration advises that the 80% of nuclear output from DBNPS being imported is an average figure. During the peak period in summer time of Hong Kong, the level of supply from DBNPS exceeds 90% of its output. The Administration has discussed with CLP and the latter has advised that there will be operational difficulties to cope with an even higher level of nuclear power import from DBNPS.

¹³ The fuel mix for electricity generation means the mix of energy sources used to generate electricity. Hong Kong does not have any indigenous sources for electricity generation and has been meeting its electricity demand through importing fuel for local electricity generation or importing electricity from the Mainland. In 2013, coal-fired generation contributed to around 57% of the fuel mix on sent-out basis, followed by 21% natural gas and 22% nuclear power imported from DBNPS in the Mainland.

Use of low-sulphur coal

28. In view of the possibly long lead time required to develop more RE in Hong Kong before its share in the fuel mix can be substantially raised, and taking into account the volatilities of natural gas prices, Hon TANG Ka-piu has enquired whether the two power companies can increase the use of low-sulphur coal for power generation. Mr TANG considers that this option, together with the emission control devices retrofitted for coal-fired power generation units ("coal-fired units"), may reduce SO₂ emission in a less costly yet still environmental-friendly manner. He requests the Administration to assess the cost-effectiveness in quantifiable terms of using more low-sulphur coal vis-à-vis natural gas for the power companies to attain the emission caps under the Fifth TM.

29. The Administration advises that while using low-sulphur coal will generate less pollutants, such coal has relatively low electricity output and its burnt residues will accelerate the wear and tear of the mechanical parts of a coal-fired unit. Moreover, the supply of low-sulphur coal is limited and uncertain as it can be procured from certain countries/regions only and not globally. Besides, using more low-sulphur coal may not be practicable taking into account the service life of existing coal-fired units and the technical difficulties of further extending the service life of retiring units in the long run¹⁴. As such, the Administration maintains that a more realistic and long-term solution is to increase the use of natural gas to reduce emissions from power plants. The Administration further points out that although the retrofitting of emission control devices will help reduce pollutants from coal-fired power generation, the fact remains that using low-sulphur coal for power generation emits more pollutants than the gas-fired option.

Development of renewable energy

30. Members in general call upon the Administration to promote RE more proactively. They note that members of the Advisory Council on the Environment have expressed similar views while being supportive of the Fifth TM to tighten the emission allowances.

31. The Administration has responded that as an incentive to the power companies to develop more RE, the permitted rate of return ("RoR") on assets¹⁵ under the current SCAs for investments on RE facilities by the power companies is higher than the 9.99% for their other investments. The Administration

¹⁴ For environmental reasons, it has been the Government's policy since 1997 that no new coal-fired units will be allowed and all new power generation units should be powered by natural gas.

¹⁵ Under the SCAs, electricity tariffs are set in such a way that they cover the power companies' costs of production and include an RoR on assets. The primary advantage of RoR regulation is that it incentivizes the power companies to invest in providing reliable electricity supply and at the same time sets an agreed limit on return that can help maintain affordable tariffs.

reiterates that it will take into account the public views received during the Public Consultation on the Future Development of the Electricity Market in considering, among other things, how to further promote RE.

Stabilizing fuel prices

32. Referring to the downward trend of international fuel prices, including natural gas prices, in the recent period, some members are concerned whether the price adjustment has been/will be reflected in the supply contract for importation of natural gas through China's Second West-East Natural Gas Pipeline and the extent of adjustment, if any. The Administration advises that the relevant supply contract between CLP and China's Second West-East Natural Gas Pipeline contains provisions for fuel price adjustment taking into account international fuel price movements. As the pricing information is commercially sensitive, the Administration cannot disclose the information for members' reference.

33. The Subcommittee urges the Government to play a more proactive role in stabilizing the prices of imported natural gas thereby minimizing their potential impact on electricity tariffs. Hon TANG Ka-piu has suggested the Government negotiate purchase agreements for a longer period with the jurisdictions or enterprises concerned. The Administration points out that international fuel prices are already taken into account when it considers new fuel contracts and electricity tariff adjustments proposed by the power companies. The Administration also seeks advice from an independent energy consultant in scrutinizing fuel contracts to ensure that they are in line with international fuel market trends and practices.

Tariff implications

34. The Subcommittee has asked for an assessment of the potential impact on electricity tariff arising from the further tightening of the emission allowances for power plants by the Fifth TM. The Administration explains that electricity tariffs are determined having regard to a number of factors such as the fuel mix plan for 2020, the future fuel costs and the power companies' RoR on assets. As the Administration will also discuss the future regulatory arrangements with the power companies, it is premature at this stage to provide a meaningful assessment of the tariff implications for 2020 and beyond.

Power grids

Interconnection of power grids

35. Hon TANG Ka-piu considers that the Administration should strengthen the interconnection between the power grids owned by the two power

companies, with a view to enhancing the cost-effectiveness in the deployment of the existing power generation units, i.e. minimizing the risk of under-utilization of HEC's units while the electricity demand in its power grid continues to drop, and obviating the need to construct additional units to meet the projected increase in electricity demand in CLP's power grid.

36. The Administration advises that the transmission grids of CLP and HEC have already been interconnected since early 1980s. The interconnection is already serving the functions of providing mutual support between the two power grids, reducing the reserve capacity each power company requires, and allowing economy power interchange between the companies, such as when the marginal generation cost of one company is substantially lower than the other.

37. The Administration further advises that the current SCAs provide a framework for the Government to monitor the financial affairs of the power companies through, amongst others, the development plans submitted by the latter. Investment proposals in the development plans are subject to the Administration's approval. With the assistance of an independent energy consultant, the Administration examines these proposals closely to avoid investments that are excessive, premature or unnecessary.

Connection of distributed RE systems¹⁶ to power grids

38. The Subcommittee notes that the existing SCAs contain provisions to enable owners of distributed RE systems to connect such systems to the grid of the power company concerned. The power companies are required to offer standardized arrangements for back-up power supply for customers with distributed RE systems in Hong Kong. According to the Administration, it will discuss with the power companies on better ways to facilitate connection by distributed RE facilities with the existing power grids. The Chairman has enquired about the Administration's action plan in this regard.

39. The Administration notes that there are concerns on the liability that has to be borne by owners of distributed RE systems connected to the grid. The Administration advises that it has invited views on related issues during the Public Consultation on the Future Development of the Electricity Market. The Administration will take into account the public views received in considering how to facilitate access by distributed RE facilities to the power grids.

40. Hon Cyd HO and Hon WU Chi-wai have expressed concerns about the slow progress made by the Administration in taking forward Feed-in-Tariff whereby eligible RE generators, including homeowners, will be paid a

¹⁶ Distributed RE refers to RE generated or stored by a variety of small, decentralized and grid-connected RE devices and often located close to the load they serve, which is different from energy generated from conventional and centralized power stations and transmitted over long distances to users.

cost-based price for the RE they supply to the grid. The Administration advises that it is aware of suggestions from the community to introduce Feed-in-tariffs, and notes that the tariff implications of such an arrangement should warrant careful consideration.

Connection of surplus electricity generated by the Integrated Waste Management Facilities to power grids

41. The Subcommittee has sought the Administration's plan, if any, for connecting the surplus electricity generated by the Integrated Waste Management Facilities ("IWMF") at Shek Kwu Chau to the power grids. The Administration advises that after meeting the plant's internal power consumption, it is estimated that IWMF can supply about 480 million kilowatt-hours of surplus electricity to the power grid per year. The Administration is discussing with a power company on the technical arrangements and requirements for the grid connection and power export.

Recommendation

42. The Subcommittee has no objection to the issue of the Fifth TM and will not propose any amendment. The Subcommittee notes that the Administration will not move any amendment to the Fifth TM.

Advice sought

43. Members are invited to note the deliberations of the Subcommittee.

Subcommittee on Fifth Technical Memorandum for Allocation of Emission Allowances in Respect of Specified Licences

Membership list

Chairman Hon Kenneth LEUNG

Members Hon Cyd HO Sau-lan, JP
Hon CHAN Hak-kan, JP
Hon WU Chi-wai, MH
Hon Dennis KWOK
Hon TANG Ka-piu, JP

(Total : 6 members)

Clerk Ms Angel SHEK

Legal Adviser Miss Winnie LO

Date 9 November 2015

Appendix II

Subcommittee on Fifth Technical Memorandum for Allocation of Emission Allowances in Respect of Specified Licences

List of deputations who have given views to the Subcommittee

- *1. Advisory Council on the Environment
- *2. Green Sense
- *3. New People's Party
- 4. WWF Hong Kong

* views given by written submission only