For information
on 22 October 2010

LEGISLATIVE COUNCIL
PANEL ON ENVIRONMENTAL AFFAIRS

Proposal to Increase the Share of Nuclear Power in the Fuel Mix

Purpose

In light of Members' views raised at the meeting of 14 October 2010, this paper provides further information on the proposal to increase the share of nuclear power in the fuel mix for power generation, as recommended in the Administration's public consultation document on climate change.

Proposed Fuel Mix for Power generation

2. Power generation is the largest source of greenhouse gas (GHG) emissions in Hong Kong. It accounted for about 67% of our total emissions in 2008. Reducing carbon emissions relating to energy is, therefore, an indispensable element in our strategy for combating climate change. We have set out our detailed proposals on the promotion of energy efficiency and revamping the fuel mix for local power generation in the consultation document on "Hong Kong's Climate Change Strategy and Action Agenda", with a view to bringing down carbon emissions relating to energy from both supply and demand sides.

3. Revamping the fuel mix of local power generation is key to the reduction of GHG emissions and carbon intensity of Hong Kong. In seeking to improve the fuel mix, we will continue to uphold our energy policy objectives to ensure reliable, safe and efficient energy supplies at reasonable prices, while minimising the environmental impact caused by the production and use of energy. Simply put, our objective is to underpin the continuous economic development and prosperity of Hong Kong with clean, low carbon energy sources.

4. In 2009, coal dominates the fuel mix for power generation in Hong Kong (about 54%), followed by natural gas (about 23%) and nuclear power imported from the Mainland (about 23%). Amongst the various fuel components, coal assumes the highest carbon emission factor, and is a primary source of air pollution. According to the comparison made by the World Energy Council on different electricity generation systems, the life-cycle GHG emissions of power generation by coal is about 1,100 tonnes CO_2-e/GWh, whereas the corresponding figures for natural gas, solar energy and nuclear power are 500 tonnes, 100 tonnes and 50 tonnes respectively. Starting from 1997, power companies in Hong Kong had not been allowed, for environmental reasons, to build new coal-fired power plants. Alternative sources of cleaner, low carbon fuels will have to be identified in time to replace coal to meet the local demand for electricity supply. Having balanced the various objectives of our energy policy, we propose to improve the fuel mix for power generation, as follows –

(a) Our objective is to reduce the proportion of coal in the overall fuel mix and to retire coal-fired generating units in good time. Coal is expected to account for less than 10% of the fuel mix by 2020.

(b) As natural gas has lower GHG emissions when compared to other fossil fuels, we propose to increase the proportion of natural gas in the fuel mix for power generation. Following the conclusion of the Memorandum of Understanding on Energy Cooperation, the Central People's Government has pledged to increase the supply of natural gas to Hong Kong. With the Mainland's undertaking and assurance of adequate supply of natural gas for Hong Kong, we envisage that by 2020, it is possible to increase the proportion of natural gas to account for about 40% of Hong Kong's overall fuel mix.

(c) We also propose to substantially increase the share of non-fossil, low carbon fuel. While we have been actively promoting the use of more renewable energy (RE), given the natural constraints and geographical limitations, and taking

account of factors such as reliability, technical and financial viability, there is a limitation to the development of RE in such a scale as to generate sufficient energy to meet the total electricity demand. Compared with natural gas, nuclear power is less expensive and more reliable, and emits no GHG during the power generation process. The increase in the import of nuclear power would help improve the fuel mix, avoid over-reliance on natural gas as the largest single source of fuel supply, and achieve a lower carbon fuel mix. We will also strive to explore the application of RE (e.g. wind energy, solar power and waste-to-energy facilities) in the fuel mix, with a view to increasing its share in the fuel mix.

5. Since commissioning in 1994, the Daya Bay Nuclear Power Station (DBNPS) has been providing stable and reliable electricity supply to Hong Kong at a relatively low price. Hong Kong could take advantage of the development of more nuclear power generation projects in the Mainland for improving our fuel mix. As regards the mode of supplying nuclear power to Hong Kong, we may consider adopting the Daya Bay model, with power companies in Hong Kong investing and taking part in the management of the nuclear facilities, so as to enhance public confidence.

Costs of Power Generation

6. As regards the impact of change in fuel mix on electricity tariff, electricity tariff in Hong Kong covers the costs of power generation, price of imported energy, the costs of electricity transmission and distribution, and other operating and management expenses, etc. incurred by the power companies. The overall tariff implications of alternative electricity supply, be it by local generation or through electricity import, to replace coal-fired generating units to be decommissioned, therefore, could only be better assessed when certain key parameters are finalised subject to further studies and discussion. Such parameters include investment in new infrastructure, future price movements of natural gas and nuclear power, etc.

7. For illustration purpose, the current unit price of nuclear

power imported from the Mainland is about 50 cents/kWh. The power companies' current unit generation costs of coal-fired electricity are in the range of about 40 to 60 cents/kWh, and gas-fired electricity in the range of about 70 to 90 cents/kWh. Fuel costs are subject to market fluctuation, and future imported nuclear power prices, for instance, will be subject to commercial negotiation. They may change over time. In fact, as the fuel price of fossil fuels had been very unstable over the past few years, it may not be viable to provide accurate projection now on the price of natural gas over the next ten years. By comparison, the unit price of nuclear power is expected to be more stable and lower than the unit generation cost of gas-fired electricity.

Application of Nuclear Technology

8. At present, nuclear power is contributing approximately 14% to global power supply. Around 30 countries are now operating over 440 nuclear power generating units. As at end August 2010, a total of 60 nuclear power generating units are under construction. In 2009, nuclear power provided a total of 2,558,000 GWh of electricity for the world.

9. There are now a total of 13 nuclear power generating units in operation in the Mainland. According to the Medium-to-Long Term Development Plan of Nuclear Power issued by the National Development and Reform Commission in July 2007, more nuclear power stations are planned to be built in the Mainland. It is expected that nuclear power would meet 4% of the Mainland's electricity demand by 2020.

Nuclear Safety and Notification System

10. Given the importance the world is attaching to nuclear safety, international organizations on nuclear safety have been set up and international conventions on various nuclear-related issues are in place. The International Atomic Energy Agency (IAEA) is responsible for providing technical support, organising researches and formulating safety regulations on the use of nuclear power for its member countries (including China). IAEA has also concluded safeguards agreements with more than 140 countries (including China) and regional

organisations. China is also a signatory of a number of IAEA's conventions on nuclear, including the Convention on Nuclear Safety, Convention on Early Notification of a Nuclear Accident and Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.

11. The construction and operation of nuclear power stations in the Mainland are regulated by relevant national safety regulations for civilian nuclear facilities, and have to comply with national regulatory requirements before the plants could obtain the construction and safety operation approval. The Ministry of Environmental Protection (MEP) is responsible for monitoring nuclear facilities in the country, including environmental protection-related duties such as prevention of radiation pollution. MEP is in charge of setting limits on the radiation level to which the public could be exposed to and the radioactive emissions from nuclear facilities. It is also responsible for the environmental monitoring of the nuclear power stations. The National Nuclear Safety Administration (NNSA) is a regulatory body under MEP and responsible for the safety of nuclear facilities. NNSA is in charge of overseeing the safety operation of nuclear power stations, and carrying out on-site safety inspection and monitoring through its regional offices. The requirements on construction and operation as well as handling of nuclear wastes meet the international standards.

12. As regards the notifications of nuclear accidents, the HKSAR Government and the Guangdong authorities have established an official contingency notification channel. The Prevention and Emergency Administrative Commission Office of Guangdong Province for Nuclear Accident of Civil Nuclear Facility (PEACO,GD) is responsible for coordinating contingency actions to be taken by various Guangdong authorities in response to events at nuclear power stations in Daya Bay. In case of a contingency event or accident at the station, the operator in the Daya Bay Nuclear Power Station (DBNPS) will inform the PEACO, GD and other relevant state organisations immediately. The PEACO, GD will notify Hong Kong authorities in accordance with the arrangements agreed between the two sides.

13. In addition, pursuant to the Convention on Early Notification

of a Nuclear Accident, China is obliged to notify the IAEA of any accident at a nuclear facility in China from which a release of radioactive material occurs or is likely to occur. The IAEA, after receiving such a notification, will inform Hong Kong Observatory (HKO). The Hong Kong authorities will then follow-up on the report with the Guangdong authorities through the liaison channel.

14. Apart from the above notification system, the Administration has also set up its own standing warning systems. The Radiation Monitoring Network of HKO, consisting of ten field stations, continually monitors the ambient gamma radiation level in Hong Kong. An alarm will immediately sound if the radiation level exceeds the preset level. The Water Supplies Department has two on-line water contamination monitoring systems at Muk Wu Pumping Stations to monitor and check whether incoming drinking water has been contaminated by radioactive materials. Moreover, an unscheduled power interruption from the relevant nuclear power station in Guangdong may indicate an abnormality at the power station, though this does not necessarily mean the occurrence of a nuclear incident. If such power interruption occurs, apart from being notified by the DBNPS, the System Control Centre of CLP Power will also be able to detect it immediately through its own monitoring system. The Control Centre will alert the Electrical and Mechanical Services Department and HKO in accordance with the established notification mechanism and will commence assessment work. Details of relevant contingency measures are set out in the Daya Bay Contingency Plan, which is available on the website of the Security Bureau. The Government will review the existing arrangement for handling nuclear events and the notification mechanism with a view to strengthening coordination with all concerned parties.

Handling of Nuclear Waste

15. In the Mainland, NNSA is the monitoring body overseeing nuclear power stations and their handling of nuclear wastes. NNSA monitors and regulates the handling of radioactive wastes according to existing regulation. It also vets, monitors and inspects nuclear-related activities, in particular radioactive waste handling activities in nuclear facilities. The national regulations on the construction of nuclear power

plants, the licensing arrangement for their operation, as well as the handling arrangements of nuclear waste meet the international standards.

16. Each nuclear power station has its own waste processing facilities to properly treat the gas and liquid wastes generated during daily operation of the plant. The waste treatment process includes filtering, clean-up, storage, decay and dilution depending on the characteristics of the wastes and its radioactivity. Solid nuclear wastes (including spent fuel) produced by the nuclear power station will not be released to the environment.

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