For discussion
on 3 July 2001

LegCo Panel on Environmental Affairs

Greenhouse Gas

PURPOSE

The purpose of this paper is to inform Members of greenhouse gases (GHG) emission levels in Hong Kong and measures taken by Government to control such emissions.

BACKGROUND

2. GHG refers to gaseous constituents of the atmosphere, both natural and human-induced, that absorb and re-emit infrared radiation. Human activities release GHG into the atmosphere. The general consensus among researchers is that industrial, vehicular and agricultural emissions of carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), chlorofluorocarbons (CFCs) and other GHG will change global climate over the next 100 years and beyond.

3. GHG controls the flow of natural energy through the climate system by absorbing infrared radiation. The climate will adjust to adapt to a "thicker blanket" of GHG in order to maintain a balance between the energy arriving from the sun and that escaping back into space. The result is that the heat energy trapped on the surface of the Earth will increase. According to the latest assessment by the Intergovernmental Panel on Climate Change (IPCC)[1], the globally-averaged surface temperature over the period 1990 to 2100 is projected to increase by 1.4°C to 5.8°C, and global mean sea level is projected to rise by 0.09 m to 0.88 m.

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[1] IPCC was established in 1988 by the World Meteorological Organization and the United Nations Environment Programme to conduct rigorous surveys of latest technical and scientific literature on climate change.

4. Climate change is likely to have a significant impact on the global environment. Human society will face new risks and pressures. People and ecosystems will need to adapt to future climatic regimes.

GREENHOUSE GAS EMISSIONS IN HONG KONG

5. According to a study on GHG Emission Control that the Environmental Protection Department (EPD) commissioned in 1998, Hong Kong is only a small emitter of GHG on a global scale, contributing only about 0.18% to global emissions. In 1990, total emissions were about 38 713 Gg CO_2-equivalent[2] (eq) (1Gg = 1000 tonnes). The emissions peaked at 47 201 Gg CO_2-eq in 1993, but decreased to about 40 318 Gg CO_2-eq in 1997. Total GHG emissions (in Gg CO_2-eq) in Hong Kong from 1990-2000 are shown in the following table[3]:

GHG species[4]	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Carbon dioxide	33 729	36 141	40 757	41 457	34 966	35 609	34 517	33 381	31 367	29 868	31 134
Methane	4 493	4 691	4 930	5 189	5 416	5 549	5 632	5 522	4 490	3 502	3 701
Nitrous Oxide	490	503	533	555	557	665	768	961	1 048	1 147	1 180
Hydrofluorocarbons	N/a	N/a	n/a	n/a	n/a	214	269	339	476	569	709
Perfluorocarbons	N/a	N/a	n/a	n/a	n/a	0.73	0.95	1.24	2	2	3
Sulphur hexafluoride	N/a	N/a	n/a	n/a	n/a	112	112	113	119	119	119
Total (Gg CO_2 -eq)	**38 713**	**41 336**	**46 220**	**47 201**	**40 939**	**42 150**	**41 299**	**40 318**	**37 502**	**35 207**	**36 846**

6. Hong Kong experienced an obvious reduction of GHG emissions in 1994 as a result of the commissioning of the Daya Bay Power Station. The use of natural gas for electricity generation in the Black Point Power Station and the migration of manufacturing industries out of Hong Kong have further reduced the emissions since 1996. However, in view of our expanding population and growing economic activities, it was projected that the GHG emissions would increase again from 2000 onward.

7. In 1997, the major source of GHG in Hong Kong is CO_2, accounting for over 83% of the total GHG emissions. 97% of the total

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[2] CO_2-equivalent is the equivalent concentration of CO_2 that would have the same direct effect on climate effect produced by a certain concentration of non-CO_2 GHG.

[3] Emission data for 1998-2000 are projected figures in the study commissioned in 1998.

[4] IPCC has developed guidelines to report GHG emissions. Inventories for hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride are only required by IPCC after 1995. Data prior to 1995 are therefore not available.

CO_2 emissions were estimated to have come from the energy sector[5], within which about 64% came from power generation and 24% from transport. The percentage of GHG emissions from power generation is generally similar to that of developed economies, such as the U.S. and Japan. The second major source of GHG was methane, which mainly came from landfills, and contributed about 14% of the total GHG emissions. The remaining 3% was shared by other GHG such as nitrous oxide and hydrofluorocarbons.

8. Hong Kong's per capita emission was about 6 Mg CO_2-eq in 1997, which is among the lowest in developed economies. Per capita emissions were 27, 11, 8 and 2 Mg CO_2-eq respectively for the U.S., Japan, Singapore and China.

9. Based on a forecast annual GDP growth rate of 3.5%, we expect our CO_2-eq emission by 2010 would be 34% higher than the 1990 level if no further active measures were taken to reduce emissions.

MEASURES TO CONTROL GREENHOUSE GAS EMISSIONS

10. We are now examining the report of the Study on GHG Emission Control that was completed in September 2000. The objective of the study was to establish the sources, volume and trends of Hong Kong's GHG emissions. Based on the data of the report, we plan to develop a package of measures to further reduce GHG emissions in Hong Kong. In the mean time, we have adopted the following measures to reduce GHG emissions:

(A) <u>Energy Efficiency and Conservation</u>

End-use efficiency improvements can reduce power demand and hence power generation output. It is therefore a cost-effective way to control GHG emissions. Measures taken by Government to further promote energy efficiency and conservation include the following:

- Implement Energy Efficiency Labelling Schemes for various

[5] Energy sector includes electricity generation, manufacturing and construction, transport and other fuel combustion industries.

electrical appliances (e.g. refrigerators, air conditioners). We intend to extend the scheme to cover vehicles later;

- Implement Building Energy Codes;

- Promote Energy Efficiency Registration Scheme for Buildings;

- Carry out energy audits for government buildings and implement energy management opportunities;

- Examine wider use of Water-cooled Air Conditioning System;

- Implement Demand Side Management Programme on power supply;

- Monitor Hong Kong's energy efficiency performance and identify opportunities for improvement using the historical energy end-use database.

(B) Renewable Energy

a) Architectural Services Department has already installed about 2 500 square metres of solar collection panels for water heating in 10 Government properties. We are planning to install additional photovoltaic panels[6] with total capacity of about 690 kW in another 11 projects in the coming three years. We are also working on two projects that will utilize fuel cells[7].

b) Housing Department and Civil Engineering Department are exploring the feasibility of using solar energy in housing developments and on slopes to generate electricity respectively.

c) The Government has provided about $29 million to

[6] A photovoltaic panel consists of photosensitive cells which capture and concentrate solar radiation, and convert thermal energy into electrical energy.
[7] Fuel cells are electrochemical systems which convert the energy of a fuel directly into electric power.

academic institutions and the industrial sector in support of 17 renewable energy research projects through the Innovation and Technology Fund, the Research Grant Council Fund, and the Environment and Conservation Fund. We will continue to support research in this area.

d) We are conducting a study on the potential application of renewable energy in Hong Kong, which will be completed by mid-2003.

(C) Cleaner fuels

a) All new power plants commissioned since 1996 have been using natural gas as fuel, which emits about 50% less CO_2 than coal.

b) EPD is working with the transport sector to conduct a pilot test on bio-diesel. This test is expected to be completed by the end of this year.

c) We are committed to replacing all diesel taxis by Liquefied Petroleum Gas (LPG) taxis by 2005. So far, nearly 50% of the taxi fleet are already using LPG.

(D) Others

a) Afforestation can reduce GHG as trees and plants take up CO_2 during photosynthesis. Agriculture, Fisheries and Conservation Department and Leisure and Cultural Services Department have annual programmes to plant trees and shrubs. The Environment and Food Bureau is also exploring ways to step up Government's greening efforts.

b) EPD will compile an annual GHG inventory for Hong Kong, which will be used for monitoring the emission levels.

c) We will enhance public awareness of the effect of GHG on global climate and human society, and educate them on ways to reduce GHG in daily lives.

d) In theory, early replacement of existing coal-fired power plants by natural gas-fired ones would be the most effective way to reduce GHG emissions as it is estimated that 60% of CO_2 emission in Hong Kong comes from power plants. However, wider use of natural gas for power generation may entail problems such as higher electricity tariffs, risks of over-reliance on a particular source of energy, as well as the availability of a long-term reliable supply of natural gas. We would need more time to study this option carefully.

WAY FORWARD

11. Despite the relatively small contribution of Hong Kong to global GHG emissions, we will continue our ongoing measures to join the international efforts in controlling GHG emissions. We will also continue to closely monitor the international developments in the control of GHG emissions.

12. We aim to report to the Panel the Administration's views on the recommendations of the report of the Study on GHG Emission Control, and consult the Panel on our proposed package to further reduce GHG emissions in Hong Kong as soon as possible.

Environment and Food Bureau
Environmental Protection Department
June 2001