ADVISORY COUNCIL ON THE ENVIRONMENT
ACE
Room 924, 9th floor, Murray Building, Garden Road, Central, Hong Kong
Tel: 2848 2606 Fax: 2530 5264
香港中環花園道美利大廈9樓924室 • 電話： 2848 2606 傳真機： 2530 5264

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for information

Greenhouse Gas Emissions In Hong Kong

Introduction

This paper inform Members of Hong Kong's greenhouse gas (GHG) emission levels and the measures taken to control them.

Background

2. The objectives of the United Nations Framework Convention on Climate Change[1] (the Convention) are to stabilise GHG concentrations in the atmosphere at a level that would prevent dangerous interference with the climate system by human activities and within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.

3. Human activities are releasing GHG into the atmosphere. The general consensus among researchers is that industrial, vehicular and agricultural emissions of carbon dioxide (CO_2), methane (CH_4) , nitrogen oxides (NO_x), chlorofluorocarbons (CFCs) and other GHG will change the global climate over the next 100 years.

4. GHG affect the flow of natural energy through the climate system by absorbing infrared radiation. They shift the balance of energy arriving from the sun and that escaping back into space, which in turn affects the global climate. The global temperature is predicted to rise by about 1 to 3.5 degree centigrade, and the sea level by 15 to 95 cm by the year 2100, if the current emission trends continue and no efforts are made to limit GHG emissions. Climatic zones (and thus ecosystems and agricultural zones) could shift towards the poles by 150-550 km in the mid-latitude regions.

5. Climate change, therefore, 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. Stabilizing atmospheric concentrations of GHGs will demand a major effort.

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1 The Convention on Climate Change deals with those greenhouse gases which are not covered by the Montreal Protocol on substances that deplete the ozone layer. Greenhouse gases means gaseous constituents of the atmosphere, both natural and man-made, that absorb and re-emit infrared radiation. They are mainly carbon dioxide, nitrous oxides, and methane.

6. The international community is tackling this challenge through the Convention. The Convention is one of five treaties[2] and non-binding agreements that arose out of the United Nations Conference on Environment and Development held in Rio de Janeiro in June 1992. Only States and regional economic integration organisations (e.g. the European Union) can be signatories to the Convention, which entered into force on 21 March 1994. About 160 states, including the United Kingdom (UK) and the People's Republic of China (China), have ratified the Convention.

Obligations Under The Convention

7. All parties to the Convention are required to, inter alia:

(a) develop, update and publish inventories on GHGs and sinks[3];
(b) formulate and implement measures to mitigate climate change and its possible impact;

and communicate these to the Conference of the Parties.

8. In addition, developed country parties (which do not include China) have committed themselves, inter alia, to:

(a) limit GHG emissions with the aim of returning by the year 2000 to their 1990 emission levels;
(b) review the progress made not later than 31 December 1998; and
(c) provide financial resources to meet the costs incurred under the Convention by developing country parties.

Global Greenhouse Gases Emissions 1990-1995

A 9. Annex A shows GHG emissions from a number of countries and entities.

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[2] The two conventions and three non-binding agreements passed at the Earth Summit held in Rio de Janeiro were: The **Convention on Climate Change** dealing with reduction of greenhouse gases, The **Biodiversity Convention** dealing with conservation of biological diversity, The **Rio Declaration** giving 27 broad principles to guide environmental policy, The **Statement on Forest Principle** dealing with protection of forests, and **Agenda 21** on action to protect the environment while encouraging development.

[3] "Sink" means any process, activity or mechanism which removes a greenhouse gas, an aerosol or a precursor of a greenhouse gas from the atmosphere.

Greenhouse Gas Emissions In Hong Kong

B and C

10. A GHG emission inventory for 1990 is at Annex B and a forecast up to the year 2010 is at Annex C. In 1990, about 98.9% by weight of local GHG emissions were carbon dioxide with the remainder comprising methane, nitrogen oxides[4], carbon monoxide, non-methane volatile organic compounds and nitrous oxide. Different GHGs have different Global Warming Potential[5] (GWP), with carbon dioxide predominant. Power stations are responsible for about two-thirds of CO_2 emissions. Vehicles, aircraft, vessels, stationary fuel users, and waste disposal processes account for the rest.

D

11. Annex D compares Hong Kong's per capita carbon dioxide emissions with a number of countries. Against a forecast annual population growth rate of 1.5%, we expect our CO_2 emission per capita by 2010 would be 28% higher than the 1990 level if no further active measures were taken to reduce emissions.

12. Hong Kong's CO_2 emissions fell by 4% from 1990 to 1996, and are expected to return to 1990 levels in 1999. Industrial emissions fell due to migration of industries. These reductions were partly offset by fuel consumption related to the new airport construction project. Coupled with growth of vehicular fuel usage, the CO_2 emission level from combustion of fossil fuel at stationary and mobile sources[6] remains roughly the same. Methane, the main constituent of landfill gas, is generated mainly during the decomposition of municipal waste at landfills.

13. In projecting the GHG emissions levels to 2010 in Annexes B and C, we have considered four scenarios -

(a) Scenario 1 assumes that we take no further active measures to reduce emissions. This scenario would result in 70% more CO_2 emissions over the 1990 level by 2010.

(b) Scenario 2 assumes we adopt electricity Demand Side Management (DSM) measures from 1998 onwards. This

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4 NO_x, CO and NMVOC are not important GHG in their own right but indirectly influence the concentration of some other GHG through atmospheric chemistry. The indirect effects for these gases are complex and depend on when and where they are emitted.

5 GWP is defined as the cumulative radioactive effect between the present and some chosen later time 'horizon' caused by a unit mass of gas emitted now, expressed relative to carbon dioxide. The GWP of methane, for example, is more than twenty times that of carbon dioxide.

6 Combustion at stationary and mobile source refers to the use of diesel, naphtha and fuel oil for industry and vehicle.

scenario is likely to materialise and would help to lower the CO_2 emissions to 60% above the 1990 level by 2010.

(c) Scenario 3 further assumes all future electricity generation units would use natural gas as fuel. This scenario is possible and would further improve the situation by reducing the CO_2 emissions to 42% above the 1990 level by 2010.

(d) Scenario 4 additionally assumes that all power plants (including existing ones) are fuelled by natural gas. This scenario is unlikely to eventuate in the short or medium term but is included to illustrate what would be necessary to maintain our CO_2 at around the 1990 level until 2010.

Measures To Control Greenhouse Gas Emissions

14. To reduce our GHG emissions we have focused on -

a) Energy Efficiency

The more efficient the energy conversion process, the less CO_2 will be emitted per unit of electricity produced. The power companies have adopted efficient electricity generation technology such as combined cycle gas turbines (CCGT).

b) Energy Conservation

(i) Improved building design and management. We implemented statutory control on the Overall Thermal Transfer Values (OTTV) of new commercial and hotel buildings in 1995.

(ii) Building Energy Codes. We are preparing energy efficiency Codes of Practice on lighting, air-conditioning, electrical installations, lifts and escalators, and centralised control and monitoring systems for commercial buildings.

(iii) Energy Efficiency Labelling Scheme (EELS). We have introduced EELS for household electrical appliances such as refrigerators and room-coolers. We plan to expand the scheme.

(iv) Water-cooled Air-conditioning. We are examining the wider use of water-cooled air-conditioning. We estimate that a water-cooled air conditioning system could save up to 30% of energy compared with an air-cooled system

(v) Establishment of an energy data centre. We have established an energy end-use database. The energy data centre will encourage the development of improved energy performances in the commercial and industrial sector.

c) Electricity Demand Side Management

The Scheme of Control Agreements require the power companies to develop and promote energy efficiency and conservation measures, which include DSM programmes. Consultants have identified suitable DSM programmes and technologies, and related tariff requirements and incentive arrangements. We are discussing the consultants' recommendations with the power companies with a view to early implementation. Savings of both generating capacity and energy will accumulate rapidly after implementation of the consultant's recommendation.

d) Clean fuel

Using natural gas for power generation produces 50% less CO_2, and only traces of sulphur dioxide (SO_2) and particulates compared with even the most advanced pulverised coal fired plants[7].

e) Renewable Energy

(i) We have installed solar collection areas of about 1700m^2 of solar thermal systems for water heating in nine government premises.

(ii) A pilot photovoltaic (PV) scheme for lighting was carried out in a park and a second pilot PV scheme to power equipment in a radar station will be implemented in 1998.

(iii) We have funded a research project at the University of Hong Kong to investigate the application of a combined PV and building fabric system.

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[7] Figures are based on comparing gas-fired CCGT using natural gas of 70% carbon in fuel with advance pulverised coal-fired CCGT units using coal with 1% sulphur, 65% carbon and 11% ash under the same load factor.

(iv) Landfill Gas. We are implementing controls over methane emissions from landfills. The collected gas is flared or used to generate electricity for the site facilities. We are examining other options to use the gas.

f) Waste to Energy Incineration

We have employed consultants to undertake a feasibility study which will include an examination of feeding the electricity produced from waste-to-energy incineration into the electricity grid.

Hong Kong's Position

15. Hong Kong cannot become a party to the convention. Nonetheless, Hong Kong recognises the objectives of the Convention. Although we have not announced the Convention's objectives as our policy aims, we have used them as a basis for our actions.

16. A Conference of the Parties will be held in Kyoto, Japan in December 1997, to adopt a protocol to define new obligations beyond the year 2000. We will monitor the conference and will re-assess Hong Kong's position thereafter.

Planning, Environment and Lands Bureau
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