For information
on 28 February 2011

LEGISLATIVE COUNCIL
PANEL ON ENVIRONMENTAL AFFAIRS

Consultancy Report
A Study on Climate Change in Hong Kong

INTRODUCTION

The consultancy study on climate change in Hong Kong ("the Study") was completed in early December 2010. The full study report and an executive summary were circulated to members of this Panel on 10 December 2010. At Members' request, this paper seeks to brief Members on the major findings of the Study, which have been reflected as appropriate in the public consultation document on "Hong Kong's Climate Change Strategy and Action Agenda" issued in September 2010.

BACKGROUND

2. EPD commissioned the Study in March 2008 to provide the basis for implementing additional strategies and measures for addressing climate change in Hong Kong, as well as making available data and information for contributing to the national level communications under the United Nations Framework Convention on Climate Change (UNFCCC). The Study was steered by the Inter-departmental Working Group on Climate Change (IWGCC)[1].

3. The objectives of the Study are summarized as follows -

[1] The IWGCC is led by the Environment Bureau and composed of representatives from 5 bureaux and 16 departments. It is established to co-ordinate, formulate and promote actions to reduce GHG emissions and to adapt to climate change.

(a) review and update the inventories of greenhouse gas (GHG) emissions and removals and project future trends;

(b) evaluate existing and recommend additional policies and measures to reduce GHG emissions or increase sinks of GHG, and assess the cost-effectiveness, economic, social and environmental implications of such mitigation measures;

(c) characterise the impacts of climate change in Hong Kong, and evaluate existing and recommend additional strategies and measures to facilitate adequate adaptation to climate change; and

(d) evaluate existing and recommend further strategies and measures to promote the development and application of environmentally sound technologies and scientific research pertinent to, and public awareness of, climate change.

4. In the course of the Study, the Consultants have taken into account views of major stakeholders expressed at technical workshops. These include a public workshop in July 2008, two technical workshops on mitigation assessment in September 2008 and September 2010, and two technical workshops on vulnerability and adaptation assessment in December 2008 and February 2010. Participants included professional organizations, green groups and non-governmental organizations, academia, energy companies, transport companies, waste management service providers and trade associations, etc.

5. In the light of the announcement in November 2009 of the voluntary national target to reduce carbon intensity by 40% to 45% by 2020 as compared with the 2005 level, the Consultants were invited to carry out additional modelling work and analyses to evaluate the options for reducing carbon intensity in Hong Kong by 2020. The Study was

completed in early December 2010, and the full Report was uploaded to EPD's website for public information.

STUDY METHODOLOGIES AND FINDINGS

6. In carrying out the Study, the Consultants have made reference to the findings of major local and international studies on climate change, in particular those published recently by the UNFCCC and the United Nations' Intergovernmental Panel on Climate Change (IPCC). Reference to the climate data recorded by the Hong Kong Observatory (HKO) was made for assessing the impact of climate change on Hong Kong. Desktop research was also conducted for comprehensive review of the latest local and international guidelines and practices, including policies and measures that help reduce GHG emissions.

Climatic Changes in Hong Kong

7. HKO has been making observations of climatic variables in Hong Kong for more than 120 years. There are observable changes in many weather patterns which correspond to the changes experienced by many global climatic systems observed over the same period, such as increasing annual mean temperature and annual rainfall, more hot nights and thunderstorm days, less cold days, and rising sea level.

8. The rising trend in temperature in Hong Kong is likely to continue in the future. The number of very hot days is projected to increase for the rest of the 21st century, and conversely the number of cold days is expected to fall dramatically.

Review and Update of the GHG Inventories

9. The Consultants have reviewed and updated the GHG inventories of Hong Kong based on latest methodologies adopted internationally. Accordingly, the emissions of GHG had risen from 35.3

million tonnes in 1990 to 42.3 million tonnes in 2006[2]. Major emission sources were electricity generation (accounting for about 57 to 67% of the total), transport (about 16 to 23%) and waste management (about 5%).

Mitigation of GHG Emissions

10. As recommended in the United Nations' guideline[3] for mitigation assessment, the Consultants have used an integrated energy-economic-environmental optimization modelling framework, the Hong Kong MARKAL-MACRO (market allocation macro-economic) model, as the primary tool for assessment and analysis of the mitigation measures and projecting future performance[4] up to 2020 and 2030. In making the projections, the Consultants have taken into account factors such as the future growth of local population and the economy as well as past situation and trends. More than 60 countries (including China) use their country-specific MARKAL-MACRO models for GHG mitigation analysis.

11. Since over 90% of Hong Kong's GHG emissions come from the energy supply, use of energy in buildings and transport sectors, and waste treatment, the greatest potential for Hong Kong to further mitigate its GHG emissions lies within these sectors. Based on local and international policy reviews, the Consultants shortlisted measures considered potentially suitable for further consideration of their feasibility for implementation before 2020 and beyond, with regard to their technical feasibility, cost benefits, etc.

12. A Base Case or "business as usual" scenario assuming that no additional measures were to be introduced after 2005 and three

---

[2] The GHG emissions of Hong Kong in 2008 were about 42 million tonnes, which accounted for about 0.1% of the global emissions, and per capita GHG emission in Hong Kong was around 6 tonnes and is lower than most developed economies.

[3] *Reporting on Climate Change: User Manual for the Guidelines on National Communications from non-Annex I Parties, UNFCCC, 2003.*

[4] The modelling was done based on available past data and information, including energy supply, energy consumption for various applications, size of the economy, population, number of vehicles and building space, etc. up to the base year of 2005.

technically feasible scenarios were developed in the Study for analysis by the Hong Kong MARKAL-MACRO model. The key features of the scenarios for 2020 are summarized below -

(a) Scenario 1 (the "AQO Scenario")

Scenario 1 included relevant mitigation measures proposed in the Air Quality Objectives (AQO) Review, including increased use of natural gas and renewable energy sources for electricity generation, wider use of road vehicles using clean fuels, and enhanced energy efficiency in the building and appliance sectors;

(b) Scenario 2 (the "Accelerated Scenario")

Scenario 2 built upon Scenario 1 and included additional proposed measures to increase energy efficiency and reduce energy demand, particularly in the building and transport sectors. It also assumed local sources of renewable energy such as energy from waste treatment by 2020, and electricity imported from Mainland China being maintained at the 2005 level; and

(c) Scenario 3 (the "Aggressive Scenario")

Scenario 3 built upon Scenario 2 and further assumed making full use of natural gas supply guaranteed by the Mainland under the Memorandum of Understanding on Energy Co-operation for electricity generation, and that nuclear electricity imported from the Mainland in 2020 would be able to meet about 50% of local demand for electricity.

13. The findings of the modelling work in the mitigation assessment, in respect of changes to carbon intensity, GHG emissions and economic performance, under the Base Case and the other three scenarios are summarised below –

Scenarios	Projections (2005-2020)		
	Reduction in carbon intensity	Change in total GHG emissions	GDP growth
Base Case "Business as usual Scenario"	-33%	+10%	+63.3%
Scenario 1 "AQO Scenario"	-37%	+2%	+63.6%
Scenario 2 "Accelerated Scenario"	-39%	0%	+63.7%
Scenario 3 "Aggressive Scenario"	-57%	-30%	+64.1%

14. The above findings indicated that by 2020, the measures proposed in the first two scenarios, i.e. Scenario 1 and Scenario 2, would not be able to reduce GHG emissions in real terms. In order to achieve a substantial reduction in Hong Kong's GHG emissions, the Consultants recommended the adoption of measures suggested under Scenario 3. If implemented, these measures are expected to reduce absolute GHG emissions by about 30% or carbon intensity of about 57% by 2020 as compared with 2005 level.

Vulnerability and Adaptation to Climate Change

15. The climate change vulnerability assessment was conducted using scenarios based upon the scientific data and information in relevant IPCC reports and locally published data and information from HKO. The vulnerability assessment identified the background climate conditions and their changes that could impact on different sectors, and the potential consequences of the exposure, and evaluated the vulnerability of each sector to such consequences.

16. On the uncertainties and limitations of the assessment, the Consultants advised that this was the first comprehensive assessment of vulnerability to climate change in Hong Kong. It had been carried out based upon the current state of knowledge and the information available in relevant IPCC reports as well as Consultants' and expert's judgment so as to make the best possible assessment of potential areas of greatest risk.

17. The vulnerability assessment conducted indicates that there are eight key sectors of vulnerability in Hong Kong -

(a) biodiversity and nature conservation – including terrestrial, aquatic and marine biodiversity, and nature conservation;

(b) built environment and infrastructure – including construction and maintenance, building stock, transport infrastructure, communications infrastructure, drainage and sewage infrastructure;

(c) business and industry – including trading and logistics, manufacturing, professional services and producer services;

(d) energy supply – including electricity generation, electricity distribution and transmission, primary fuel imports and supply;

(e) financial services – including banking, financial trading, brokerage and speculation, asset management, insurance, reinsurance and other financial services;

(f) food resources – including agriculture, aquaculture and fisheries in Hong Kong, overseas food imports and food wholesale and retail trade;

(g) human health – including healthcare infrastructure, and changes to mortality and morbidity due to climate change; and

(h) water resources – including local yield and treatment, and Dongjiang imports.

18. With the rapid evolution in the climate change science, the Consultants recommended that the vulnerability assessment should be considered as a dynamic process and the findings of the risk-based

assessment should be regularly reviewed and updated.

19. The Study also took stock of Hong Kong's current significant adaptive capacity to deal with climate change impacts and the many policies, measures and systems in place to respond to the physical impacts of climate change. The Consultants recommended follow-up action for the identified sectors in the following major aspects -

(a) monitoring – creation of monitoring infrastructure which enhances knowledge pertaining to the status of key sectors, as well as enhancement of current efforts for the purpose of reviewing and revising current programmes;

(b) institutional strengthening and capacity building – enhancing the ability of institutions to respond and adapt to adverse impacts brought about by climate changes;

(c) disaster management and emergency planning – improvement of the planning and systems which are responsible for responding to emergencies;

(d) research and investigation – expanding current knowledge regarding vulnerable sectors such as establishing priorities for improvement measures and identifying local high risk areas; and

(e) education and public awareness – increasing the level of public awareness amongst the population such that they can take appropriate actions to combat climate change impacts.

PUBLIC CONSULTATION ON CLIMATE CHANGE

20. Major findings of the Study have been reflected as appropriate in the public consultation document on Hong Kong's Climate Change Strategy and Action Agenda. The consultation period ended on 31 December 2010. We are now analysing the feedbacks received with a view to compiling a consultation report in the next couple of months.

ADVICE SOUGHT

21. Members are invited to note the findings of the Study.

Environment Bureau
21 February 2011