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Hong Kong Climate Resilience Roadmap for Business



FOREWORD

By BEC Chairman

Hong Kong has done well to date in managing the risks we currently face from natural hazards like strong winds and typhoons. Now the challenge for both business and the Government is to think ahead and prepare for the risks from a changing climate. Both government and business have a part to play in making sure this is done.

With these increasing risks in mind, BEC publishes the Hong Kong Climate Resilience Roadmap for Business, developed through the research of BEC Climate Change Business Forum Advisory Group. The Roadmap builds on BEC's earlier publication "the New Normal: A Hong Kong Primer on Climate Change Adaptation", as well as BEC's Climate Risk Tool.

The Roadmap includes recommendations for businesses to begin to embed an approach that ensures that critical business decisions related to buildings infrastructure, financial and insurance systems are made with due consideration of climate change risk.

It includes a broad set of actions that apply across different sectors, as well as a set of sector specific actions.

We also make recommendations for measures that the Government take in parallel, for an integrated approach across government, business and the wider community. These include the establishment of a better institutional framework to enable strategic decisions focused on long term risk as well as regular dialogue with business and other stakeholders.

By business and the Government acting in line with these recommendations, we believe that Hong Kong will have a better chance of protecting itself from high costs and large losses in the longer term. We will also benefit from better protection in relation to extreme natural disasters and higher temperatures that can occur at any time.

**– Professor John Chai, Chairman,
Business Environment Council Limited**

FOREWORD

By BEC Climate Change Business Forum Advisory Group Chairman

It is increasingly apparent that Hong Kong is experiencing climate change. We are seeing hotter days, more frequent intense rain, and rising sea levels, with the highest summer temperature on record in 2015.

A business-as-usual scenario in terms of carbon emissions worldwide means more extreme climatic events and rising temperatures, possibly by 3.1 - 5.5°C by the end of the century¹. Higher levels of heat stress, disease, and water scarcity are expected to follow. Flood risk will be heightened due to greater risks from storm surge and rising sea levels. Responding to climate change by increasing energy use may lead to a worsening spiral, an increasing heat island effect and a deteriorating global climate.

The severity of impact depends on whether the temperature rise is kept to 2°C or if we are closer to a 5.5°C rise, the higher end of the range for Hong Kong under the "business-as-usual scenario". The sooner the world starts cutting its emissions the easier it will be to keep carbon levels below the threshold of a 2°C rise.

If a sufficiently ambitious set of carbon reduction commitments at the 2015 climate change negotiations is not agreed in Paris or soon after², the business-as-usual scenario may

become reality. Regardless of what is achieved, we in Hong Kong will need to be resilient in the face of climate change.

Hong Kong has an excellent story to tell on many levels. Our Government has a clear desire to improve our environment and has climate change on its agenda. Our businesses recognize their role in this important topic and have taken the necessary steps to get involved. Together we are working to make Hong Kong less vulnerable. One good example is our world-class disaster preparedness system. This well tested system together with the robust infrastructure in place has helped us withstand the strongest typhoons.

We must however not be complacent as there is still more to be done to prepare for the full range of climate risks in the coming decades. The impact to our society both in lives affected and in financial costs could be catastrophic if we fail to act.

This Roadmap aims to help business understand the risks involved, and encourage action to adapt and embed the right practices and approaches to ensure resilience. It makes a number of recommendations that seek to ensure action by business supported by action by Government, building on the progress made to date.

**– Eric Chong, Chairman, Business Environment Council
Climate Change Business Forum Advisory Group**

¹ See Table 1 of Report for a full explanation.

² United Nations Framework Convention on Climate Change (UNFCCC), Conference of the Parties (COP) 21, Paris 30th November – 10th December 2015.

Messages from Hong Kong SAR Government Officials

“While climate change is a very major challenge, it also offers us a chance to pursue our liveability by embarking on a low carbon path.”

- KS Wong, Secretary for the Environment

“The government will continue to work on various aspects of adaptation. It is also very important for businesses to consider their own climate risks and implement their own corporate climate change plans for the whole city to be climate resilient.”

- Christine Loh, Under Secretary for the Environment

“We are now halfway to the dreaded 2°C increase in global mean temperature while atmospheric greenhouse gas concentration has just hit another record high in 2014. Strong mitigation efforts are required to keep the greenhouse gas concentration in check to avoid irreversible damage to the Earth. Determined adaptation efforts are also needed to plan ahead and to make our city ready to face the challenges brought by climate change, especially the increasingly frequent extreme weather and progressive sea level rise. This Climate Resilience Roadmap prepared by Business Environment Council is a timely guide for the business sector to take appropriate actions to minimise the potentially hefty mitigation and adaptation costs that will have to be borne by this and future generations.”

- CM Shun, Director, Hong Kong Observatory

Messages from Business Leaders

“AAHK has been working closely with the airport community to strengthen Hong Kong International Airport’s ability to prepare for and respond to potential disruption, particularly when there is an expected increase in extreme weather events.”

- Mike Kilburn, Senior Manager – Environment, Airport Authority of Hong Kong

“Providing a reliable and stable power supply is critical to Hong Kong’s economy and our most important commitment to our customers. With incidents of extreme weather increasing globally as a result of climate change, CLP has made it a priority to improve the resilience of our power supply system through network reinforcement, asset refurbishment, preventive maintenance and emergency preparedness. Hong Kong has one of the world’s most reliable electricity supply systems and we hope that these measures can reduce the impact of super-typhoons and floods on our power systems and keep disturbance to the public to a minimum.”

- Richard Lancaster, Chief Executive Officer, CLP Holdings Limited

“Resilience in Gammon means not only rethinking our methods but also protecting our workers from heat stress. A collaborative effort is needed from designers, engineers and our industry to optimise prefabrication, modularisation, mechanisation and automation as well as raise our levels of emergency preparedness.”

- Thomas Ho, Chief Executive, Gammon Construction Limited

“Green buildings present three significant advantages: they deliver stronger long-term economic performance, promote healthier lifestyles and support sustainable development. These form the foundation to build thriving and vibrant communities that are resilient to the impact of climate change.”

- George Hongchoy, Chief Executive Officer, Link Asset Management Limited

“Swire Pacific’s business depends on clean and reliable sources of water. Climate change poses a risk to our business through impacts to stable and quality water supply. We recognise that businesses and society need to modify their practices to reduce emissions whilst also adapting and strengthening our resilience, for example through replenishing our water sources and protecting them from pollution, and through enhancing water efficiency measures.”

- Mark Watson, Head of Sustainable Development, Swire Pacific Limited

“The Climate Resilience Roadmap is an important tool to increase the visibility of climate risk, particularly for Hong Kong companies. It will also encourage companies and financial institutions to measure and reduce their own carbon footprint. By working together we will build a climate-friendly future.”

- Malini Thadani, Head of Corporate Sustainability, Asia Pacific, The Hongkong and Shanghai Banking Corporation Limited

“As a major transport provider, KMB understands its responsibility of providing safe and efficient mobility to the community and takes all possible measures to mitigate the potential risks emanating from changes in climate. These measures range from deployment of new technologies to the development of manpower skills.”

- Roger Lee, Managing Director, The Kowloon Motor Bus Company (1933) Limited

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01 | INTRODUCTION

1.1 What the Roadmap offers

Why is resilience important?

A resilient Hong Kong will be better able to maintain or even increase its prosperity and quality of life, by adapting and ensuring that it is able to recover from emergencies that are likely to arise.

Forward thinking businesses are becoming increasingly aware of climate risk and are beginning to address it. However, the complex and long-term nature of climate change and the need for a collective response means that such risk is not taken on board equally or by all businesses.

The Hong Kong Climate Resilience Roadmap for Business (“the Roadmap”) seeks to present in a simple manner, the complexity of climate change impacts for Hong Kong and the risks that business will face. It considers the extent of vulnerability in the light of measures taken to date, the additional steps that need to be taken to adapt and ensure resilience, and who is best placed to take each of these steps.

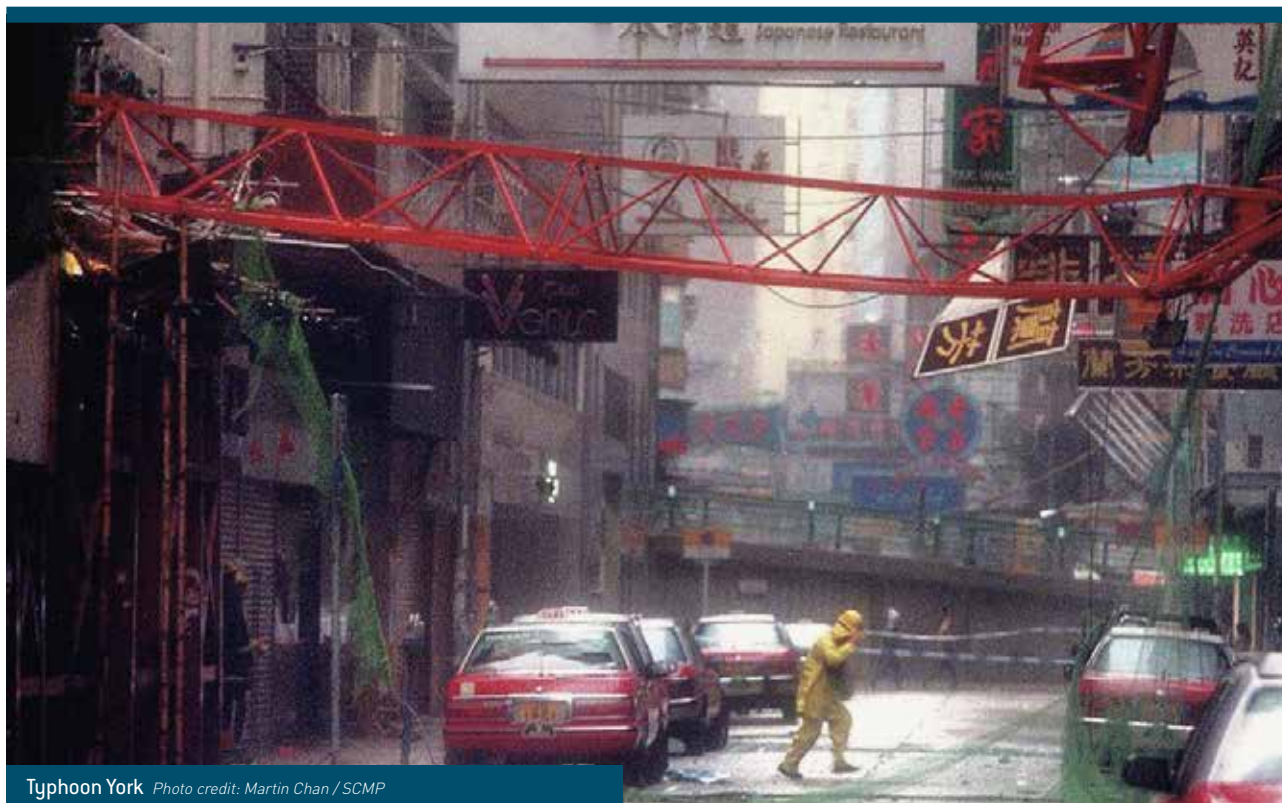
The Roadmap sets out key recommendations for business to address this risk, promoting a systematic

sequence of actions. The sequence begins with assessing risk, then developing and implementing an adaptation/resilience plan, and finally benchmarking and reporting on performance. It is recommended that this is combined with continued efforts to build up knowledge, be innovative, and work collaboratively with other businesses, as is required to address a challenge such as this.

What do we mean by resilience?

A resilient city or territory is one where action has been taken to reduce vulnerability to climate risk, with infrastructure adapted to reduce impacts on people and assets, and systems put in place to ensure limited loss and damage and a prompt recovery after a climatic incident.

Our aim is for the Roadmap to prompt business to think ahead and begin a process of long-term adaptation as well as broader contingency planning, both of which are essential for resilience. It sets out recommendations for the Hong Kong SAR Government (“the Government”) which will complement and support action by business. Acting together, it is possible to enhance our level of resilience.



Typhoon York Photo credit: Martin Chan / SCMP

1.2 Preparing the Roadmap

Business Environment Council Climate Change Business Forum Advisory Group (“BEC Climate Change Business Forum AG”) commissioned the Roadmap to build on its earlier outputs. These are:

- *The New Normal: A Hong Kong Business Primer on Climate Change Adaptation*³ (“the New Normal report”), which gives business guidance on climate resilience.
- *The Climate Risk Tool*⁴ (“the CRT”), which provides a risk management tool for business to develop their climate resilience.

The Roadmap has been developed through:

- Desk research to explore the vulnerability of Hong Kong under various scenarios with particular reference to the Intergovernmental Panel on Climate Change’s 5th Assessment Report (AR5) combined with input of the Hong Kong Observatory to understand how Hong Kong will be affected, and the “Study of Climate Change in Hong Kong – Feasibility Study”⁵.
- Dialogue with business, focusing on Hong Kong’s six

key sectors through a multi-sectoral workshop, to understand actions taken to date to address risk.

- Dialogue with the Government to understand actions taken to adapt and ensure resilience and consideration of the Government’s Hong Kong Climate Change Report 2015.
- Consideration of approaches to adaptation and resilience in other parts of the world, looking at a range reports and attending events to build capacity.

1.3 Scope and Outline

The Roadmap is about resilience, including adaptation, with a limited focus on emission reduction. However, some adaptation measures have emission reduction benefits. Increasing our energy efficiency and planting trees and mangroves for example, can help reduce carbon emissions whilst also increasing our ability to withstand climate change.

Chapter 2 of the Roadmap explains the risks that will be faced by Hong Kong, with reference to the different IPCC scenarios. Chapter 3 sets out key actions that have been taken to develop resilience and areas for improvement. Chapter 4 sets out recommendations for the Government and business, and is followed by Sectoral Annexes explaining action to date by the six key business sectors, with recommendations for further action by business and the Government.

³ Available for download here: http://www.climatechangebusinessforum.com/en-us/research_04292013

⁴ Please email ccbfbec.org.hk

⁵ Environmental Resources Management. 2010. A Study of Climate Change in Hong Kong – Feasibility Study.

02 | CLIMATE CHANGE IMPLICATIONS FOR HONG KONG

2.1 Projected Climatic Changes

Like many of Asia’s coastal cities, Hong Kong is at risk from climate change. Many of the city’s valuable assets which range from the airport to large-scale commercial and residential real estate are only just above sea level, making them susceptible to storm surge exacerbated by sea level rise. A report by Bloomberg in 2012⁶, estimated that in Hong Kong, US\$35.9bn worth of assets were at risk from flooding, with this total rising to US\$1.2tr by 2070.

We are now halfway to the 2°C increase in global mean temperature while the atmospheric greenhouse gas (“GHG”) concentration has just hit another record high in 2014. In Hong Kong, 2015 had the highest summer temperatures on record, with four of the six hottest summers occurring within the past seven years.

Projecting forward, Table 1 shows the key changes in Hong Kong under two potential scenarios used by the Intergovernmental Panel on Climate Change (“IPCC”)⁷. These scenarios known as Representative Concentration Pathways - RCP 2.6 (“the low GHG concentration scenario”) and RCP 8.5 (“the high GHG concentration scenario”) show the impact in terms of temperature, rainfall and sea level rise in the decades 2041-2050 and 2091-2100. It is evident that the RCP 8.5 scenario is considerably worse, for example with temperatures projected to rise by 3.1°C- 5.5°C by 2100 rather than 0.7°C- 2.2°C. Table 1 - Projections of Key Climate Variables.

Table 1 - Projections of Key Climate Variables

RCP2.6			RCP8.5	
Projected annual temperature (°C) Hong Kong (relative to the average of 1986-2005)				
Decade	Mean	Likely Range	Mean	Likely Range
2041-2050	1.2	0.7 - 1.9	1.7	1.1 - 2.4
2091-2100	1.3	0.7 - 2.2	4.2	3.1 - 5.5
Projected annual rainfall anomaly (mm) of Hong Kong (relative to the average of 1986-2005)				
Decade	Mean	Likely Range	Mean	Likely Range
2041-2050	-60	-373 - 291	-50	-343-319
2091-2100	-145	-381 - 63	177	-263 - 806
Projected changes in the mean sea level (m) in Hong Kong and its adjacent waters relative to the average of 1986-2005				
Decade	Median	Likely range	Median	Likely Range
2041-2050	0.30	0.23 - 0.38	0.33	0.25 - 0.41
2091-2100	0.62	0.46 - 0.81	0.91	0.67 - 1.16

Hong Kong has already taken a range of steps to address this risk, as documented in the Hong Kong Climate Change Report 2015, however, more remains to be done. Some of the actions that can be undertaken to ensure resilience will also help reduce carbon emissions. These synergies can be made use of to reduce emissions while simultaneously adding to Hong Kong’s resilience.

⁶ Bloomberg Business. 2012. Top 20 Cities with Billions at Risk from Climate Change.
⁷ These figures have been provided by the Hong Kong Observatory (HKO) and a more detailed note on the projection data can be found at Annex B.

2.2 Potential Impacts on Business

Hong Kong's growth and prosperity is reliant primarily upon six key business sectors ("the Sectors"): property holding and management, construction, transport, finance, manufacturing and the retail supply chain, energy transmission and generation. Understanding the resilience of the Sectors to the physical impacts of climate change is an important issue for business continuity, competitiveness and the long-term prosperity of Hong Kong.

The extent of the climate impact in Hong Kong depends on which scenario materialises: RCP 2.6 with a low temperature rise of 0.7°C – 2.2°C or RCP 8.5 the high GHG concentration scenario with a temperature rise of 3.1°C – 5.5°C by 2100. At the moment the world is on track to realise the high greenhouse gas concentration scenario, RCP 8.5, with projections of a temperature rise as high as 5.5°C for Hong Kong. Neither business nor government can afford to assume that we will manage to avoid the worst situation, nor that the conservative calculations of the IPCC will be what is experienced. It is possible that the situation could deteriorate more rapidly with temperatures rising to this level before the end of the century. So working on resilience needs to be combined with reducing carbon emissions to ensure a stable situation in the longer term.

As Table 1 shows, adjusting and ensuring resilience is not a long-term issue to be left to the next generation. Even as early as 2050, significant change is expected with a sea level rise of close to 0.4 metres and an average temperature increase possibly over 2°C. Change does not take place on a linear basis and we may see significantly higher temperatures and extreme weather much earlier on. Many decisions, from infrastructure planning to investment in new buildings and businesses will need to take this into account.

2.3 The Key Climate Risks to Business

It is not just the risks that flow directly from these factors that need to be addressed. We also need to address the indirect impacts from climate change⁸, such as disease epidemics and risk to the supply chain. The five main impacts for Hong Kong business, direct and indirect impacts, which we have identified, are explained below⁹:

1. Flooding and Landslides: Strong Winds, Storm Surge, Sea Level Rise and Heavy Rainfall
2. Heat Stress
3. Water Scarcity
4. Health – Heatstroke and Disease
5. A Compromised Supply Chain

1 – Flooding and Landslides: Strong Winds, Storm Surge, Sea Level Rise and Heavy Rainfall

Hong Kong is fortunate in having a large part of its land-mass significantly above sea level. However, a considerable proportion of the territory is at a low level with 15% below mean sea level¹⁰. Many low-lying areas are densely populated and hold a large share of Hong Kong's assets. The severity of flood risk is related to sea level rise and coastal erosion as well as storm surge and surface water run-off from heavy rainfall. Hong Kong's gradually falling landmass also increases this risk¹¹.

Map 1 shows the areas that would be flooded when the sea level reaches 4.76mCD (metres above chart datum, which in Hong Kong is 1.45m below the mean sea level). This would arise with a 1m storm surge occurring along with a high astronomical tide level (around full moon) and a 1m mean sea level rise.

The IPCC 5th Assessment Report (2013)¹² sets out the most widely accepted figures for sea level rise. Under the high GHG concentration scenario, RCP 8.5, Hong Kong may expect a sea level rise of about 1 metre by 2100 and 0.4 metres by 2050¹³. However, the IPCC's projection is regarded by some scientists¹⁴ as "cautious", as it does not take into account the risk of accelerated melting of the Greenland and Antarctic Ice Sheets. These scientists take the view that the rise could be much higher, around 2 or even 3 metres, and even higher in regions closer to the Equator. Supporting this view is a recent finding that some glaciers in West Antarctica have hit the point of no return, which means an inevitable 1.2 metre sea level rise, though the time span remains unknown. Sea level rise in Hong Kong is therefore likely to be on the high side of the IPCC projections and may even be significantly higher. It is also expected to continue to rise.

⁸ For more details of an equivalent analysis of risk, see the USA study, *Risky Business*, 2015.

⁹ See Hong Kong Observatory website, BEC Climate Change Business Forum Advisory Group's New Normal for more information regarding Hong Kong. We have also drawn heavily on the IPCC's Fifth Assessment Report, 2014.

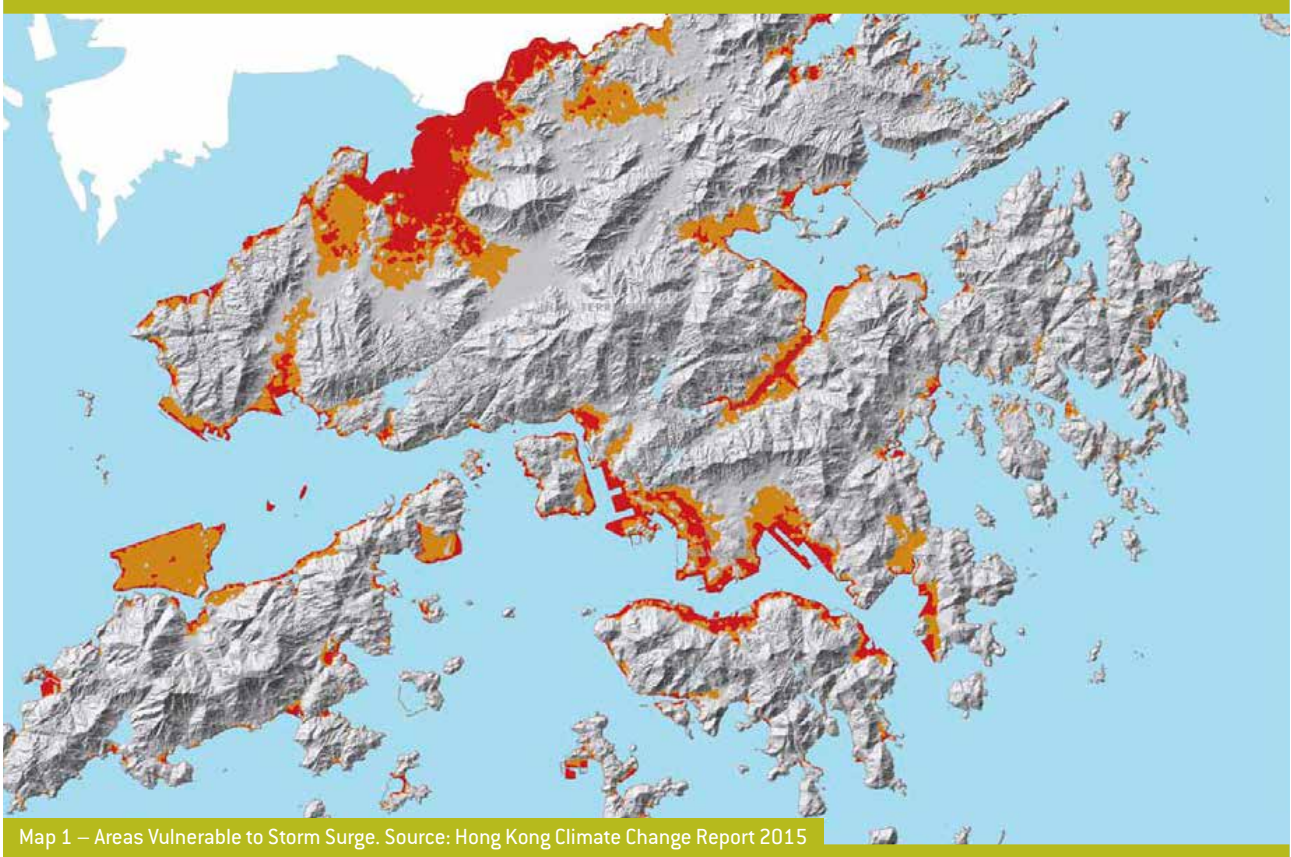
¹⁰ Hong Kong Climate Change Report 2015, p.68.

¹¹ According to Hong Kong Observatory's research, Hong Kong's landmass is sinking for reasons unconnected with climate change which exacerbates its impact.

¹² Intergovernmental Panel on Climate Change, Working Group 1 (Summary for Policymakers), 2013.

¹³ Hong Kong Observatory, 2015.

¹⁴ PLOS One, 2015.



Although the number of rainy days is expected to fall, the number of extreme rainfall days is projected to rise. Similarly tropical cyclones, though not projected to increase in frequency globally, their average intensity is likely to increase in certain regions such as in the western North Pacific. If existing drainage systems are unable to cope, possibly affected by a backwash from the sea, the risk and severity of flooding may also increase. Asian cities from Singapore to Taipei have seen such flooding of main thoroughfares and public transport systems in recent years.

Sea level rise combined with more intense tropical cyclones will increase the loss and damage from storm surge. These impacts will be increased where the storm surge coincides with high tide and high intensity rainfall. This was the case with New York City's Hurricane Sandy.

Under the high GHG concentration scenario (RCP 8.5), a substantial proportion of the built up area – both sides of Victoria Harbour and low lying areas of the north western New Territories - would be flooded more frequently. A sea level of 3.5 m that can cause serious flooding in

low-lying areas in Hong Kong, such as the one brought by Typhoon Hagupit in 2008 may become a recurrent event every year by the end of this century. The situation could be even worse as the global mean tropical cyclone intensity is likely to increase¹⁵. Floods would affect homes, shops and access to services because roads would be flooded. Critical infrastructure may also be at risk. The risk of sea level rise combined with tropical cyclones and heavy rainfall is the key reason Hong Kong is high on the risk of vulnerable cities.

Though much of Hong Kong's heavily built up area has been protected from landslides, some areas will continue to be at risk from the increased intensity of rainfall, as shown by the 2008 landslide in Lantau¹⁶. Under extreme scenarios possible in current conditions, like if the June 2008 rainstorm were to hit Hong Kong Island, the Government recognises that this may overwhelm the capacity of the existing system¹⁷.

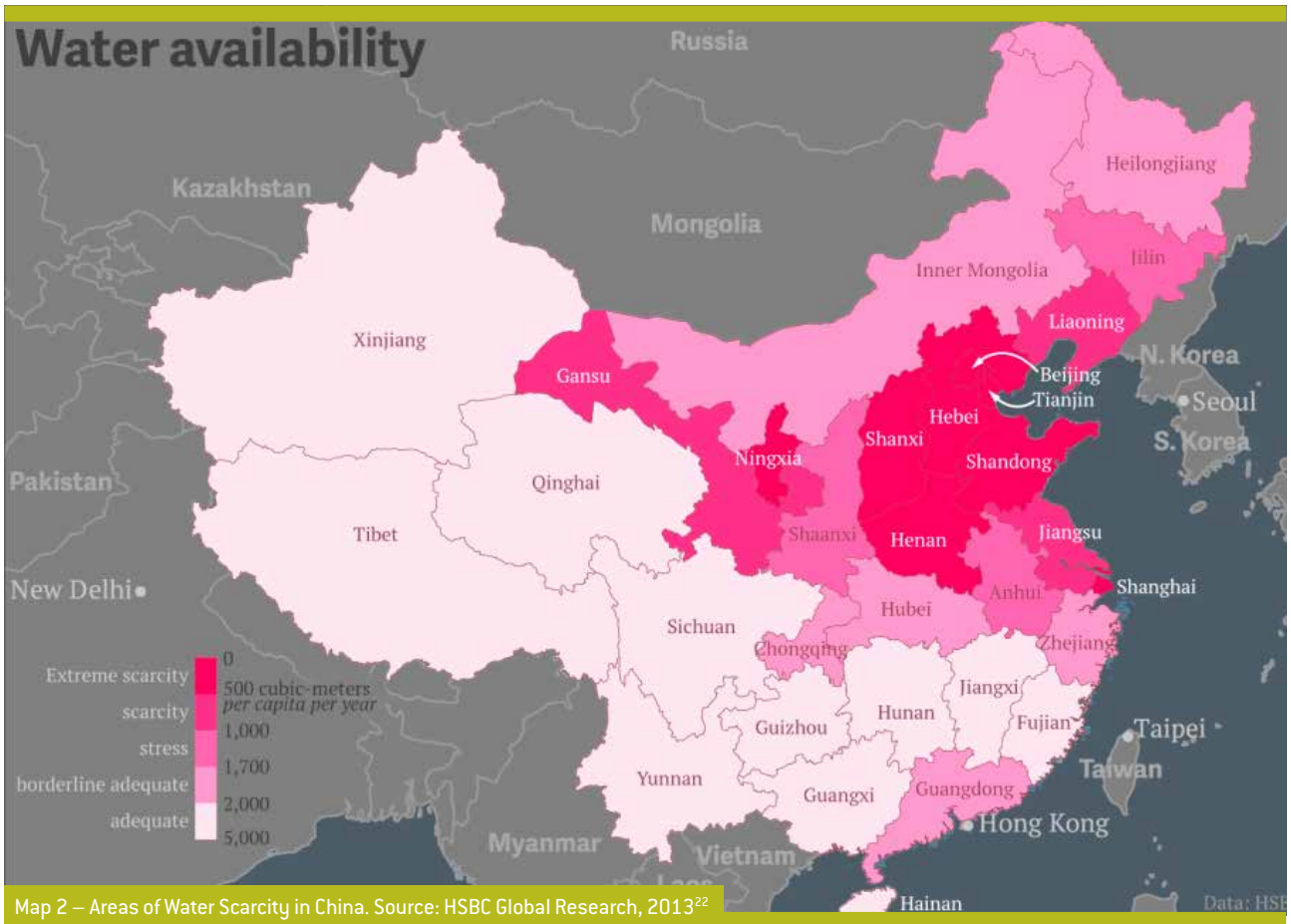
2 – Heat Stress

Under the low GHG concentration scenario RCP 2.6, (see Table 1), Hong Kong can expect an increase in average temperature of 0.7°C-1.9°C by 2050 and 0.7°C-2.2°C by 2100. If the high GHG concentration scenario materialises, we can expect a rise of 1.1°C – 2.4°C by 2050 and 3.1°C – 5.5°C by

¹⁵ Hong Kong Climate Change Report 2015, p.59. Changes by 2040 are irrespective of GHG concentration scenario.

¹⁶ AECOM Asia Company Limited, 2008.

¹⁷ Hong Kong Climate Change Report 2015, p.64.



2100. This would be combined with a substantial increase in extremely hot days and fewer cold days. The heat island effect, with tall buildings limiting wind movement and concrete surfaces absorbing heat, exacerbates the local change in temperature resulting from climate change. Studies suggest that cities have the most to worry about from the direct effects of higher temperatures¹⁸.

Without a change in levels of mechanical cooling of buildings, a temperature increase will raise operational costs. Increased energy generation and air conditioning usage will add to the local heat island effect. This will also create a carbon feedback loop, as a dramatic temperature rise requires a substantial increase in air conditioning. As about 34% of Hong Kong’s electricity use is for cooling, electricity generation will need to increase significantly. Power outages may occur at times of high demand and lead to the temporary closure of businesses¹⁹.

Heat stress will affect productivity especially of blue-collar workers and those who work outdoors. This is an issue particularly relevant to the construction workforce which

will be more vulnerable to heatstroke than at present, especially those who do “hot work” like welding, made worse by the high number of older workers characteristic of the industry.

Hot weather and drought may also lead to loss of tree cover, loss of topsoil, and fire. Infrastructure from roads to railway may also be affected by heat.

3 – Water Risk

Whilst annual rainfall in Hong Kong is projected to increase under the high GHG concentration scenario, year to year variability will also increase²⁰. The map of water availability (see *Diagram 1*) shows that Guangdong Province is only borderline in terms of water adequacy. This is where Hong Kong sources 70-80% of its freshwater²¹. A drought year combined with higher demand for water from Guangdong Province and Hong Kong – likely as a result

18 Phys.org, 2015.

19 Intergovernmental Panel on Climate Change, 2014. 5th Assessment Report, Chapter 8 p.569.

20 Hong Kong Observatory, 2015.

21 Water Supplies Department, 2015.

22 HSBC Global Research, 2013, Accessed via Quartz, 2014.

of higher temperatures and population pressures - creates a risk of water scarcity. Feedback, at BEC's sectoral workshop, from Hong Kong's manufacturing sector, which largely sources products from the wider region noted this as an important issue, for example affecting the production of textiles.

4 – Health Risks

Even with a 2°C rise, health impacts are likely to include an increase in existing health problems such as heatstroke and diseases in hot weather²³. The impacts should not be under-estimated. In 2003, a heat wave in Europe killed between 25,000 and 65,000 people. The demographics are not in our favour. With an ageing population, vulnerability is higher. By 2100, under the high GHG concentration scenario, the IPCC says “that the combination of high temperature and humidity in some areas for part of the year is expected to compromise common human activities, including growing food and working outdoors”.

Beyond the direct impacts of heat in Hong Kong, higher temperatures may magnify the impact of air pollutants like ozone²⁴. We can also expect a higher incidence of vector and waterborne diseases, transmitted by parasites and pathogens, for example dengue fever, malaria and diarrhoea²⁵.

5 – A Compromised Supply Chain

Climate change will affect the price and availability of many products that we rely upon in Hong Kong, which we import from elsewhere. The transportation of imports is also likely to be disrupted periodically by extreme weather.

Food supplies are a particular cause for concern. Extrapolation from climate models suggests that the global risk to food security becomes very severe under an increase of 4°C - 6°C²⁶. Extreme weather in the form of drought and flooding will affect production. Crop failure in more than one of the bread basket regions of the world in a year could have severe impacts, particularly when combined with a population rise and changing dietary preferences. Research by Chatham House suggests that in comparison to the second half of the last century, the risk of a 1-in-100-year multiple crop failure is likely to increase to 1-in-30 years by 2040, and perhaps even to

²³ Intergovernmental Panel on Climate Change, 2014. 5th Assessment Report, Chapter 11.

²⁴ As above. Chapter 11, p.729.

²⁵ As above Chapter 11.5.

²⁶ Intergovernmental Panel on Climate Change, 2014. 5th Assessment Report Chapter 11 p.737.



Reliable power supply technologies for Hong Kong *Photo credit: Siemens*

1-in-15 years in the decades after 2050. In the event of a multiple crop failure, food prices in Hong Kong are likely to increase as well as tensions in relation to the availability of food.²⁷

In other sectors such as apparel, costs could increase significantly, for example because the production of fabrics such as cotton is highly water intensive. Construction and the food and beverage sector have also noted concerns related to, for example, impacts on tea plantations, water supplies for bottled drinks factories, and supply of construction materials.

²⁷ Chatham House, 2015.

03 | PROGRESS TO DATE

3.1 Understanding Resilience

The understanding of climate change on the part of Hong Kong business has increased in recent years.

- The HKSAR Government (“the Government”) recently outlined the climate mitigation, adaptation and resilience initiatives in its Hong Kong Climate Change Report (2015). This sets out in detail the vulnerability of Hong Kong to climate change²⁸.
- The Hong Kong Observatory carries out climate change research, promotes public awareness through various channels including school and public talks, blogs, TV (and educational TV) programmes, and YouTube videos.
- In 2013, BEC’s Climate Change Business Forum published the report *The New Normal: A Hong Kong Business Primer on Climate Change Adaptation*²⁹ (“the New Normal Report”) which outlines sector-specific impacts of climate change on business in the Pearl River Delta.
- In parallel, BEC published the accompanying Climate Risk Tool (CRT), which provides a risk management tool to help businesses develop their climate resilience.
- At the ICCC 2014 conference³⁰, the Government focused on climate science, as well as action on landslides, coastal structures, flood prevention, building design specifications, emergency response systems, health impacts and water security. Some of the measures explained are set out in our sectoral analysis below.

²⁸ Environmental Bureau Website, 2015.

²⁹ Available for download here:
http://www.climatechangebusinessforum.com/en-us/research_04292013

³⁰ Available for download here:
<http://iccc.hk/wp-content/uploads/2014/12/HKSAR-Government-Adaptation-Resilience-Forum.pdf>

However, considerable uncertainty remains as to precise long-term climate impacts in part because of the complexity of the science and the uncertainty in relation to aspects of change like sea level rise.

To help address this Annex A outlines, on a sectoral level, the risks and adaptation measures required, taking on board activity by business and government over the past few years. It is intended that they form the basis of continuing discussion by business within these sectors and across these sectors.

3.2 Developing Resilience

3.2.1 Business Action

Businesses in Hong Kong have over the years invested considerable resources and made concerted efforts to lessen our vulnerability to adverse weather. In recent years, this has accelerated with the inclusion of systematic risk analysis to take into account climate change effects. Certain sectors stand out in their efforts. The transport sector has put considerable effort into planning alternative routes, putting in place emergency systems as well as reducing cooling needs and using materials which are resilient to heat stress. The energy sector has put in place robust infrastructure that ensures our energy supply is maintained at its highest reliability even in times of extreme weather conditions. Key facilities like generation units in the power stations, transmission lines and distribution sub-stations are fortified against strong winds, floods and storm surges. The property /construction sector has modified building design to adapt to higher wind speeds, while living accommodation in new buildings is generally raised considerably above sea level. To reduce the exposure of workers to heat stress on site, the construction sector is increasing the use of automation and pre-fabrication methods. Some examples of these efforts are set out below.

TRANSPORT AND LOGISTICS MTR Corporation Limited

The MTR Corporation Limited ("the MTR") implemented a risk-based climate change policy in 2006. The likelihood and consequences of potential risk and actions to address this risk are updated and reported on annually by the operating division of the company. An internal procedure has been introduced to improve recovery efforts across Hong Kong in the event of adverse weather. The company also provides "Typhoon Travelling Tips" for the

public. It has implemented energy reduction initiatives in accordance with its climate change policy: (a) measuring and public reporting of the company's carbon footprint; (b) taking into account lifecycle carbon emissions and energy efficiency in the design standard for new railway projects; (c) included energy efficiency specifications for all major electrical and mechanical contracts including rolling stock. (d) It has established Hong Kong BEAM Gold as the standard for all MTR property developments.

Airport Authority Hong Kong

The Airport Authority Hong Kong ("AAHK") and its business partners have put in place systems and processes to manage and minimize the negative impact of adverse weather, in particular typhoons, which occur regularly in Hong Kong. The Business Continuity Manual for typhoons sets out the responsibilities of different parties to enable a timely response. Drills and exercises are conducted on a regular basis to train staff and test contingency plans. A well-established coordination network is in place across the entire airport community for weather incident handling. AAHK has also made investments to strengthen its ability to cope with extreme weather events using technology. For instance, AAHK has adopted an information system to provide staff with real-time baggage handling conditions to minimize delays during bad weather.

AAHK has also identified the longer-term impact of climate change on sea level rise and associated storm surge as a threat to business continuity for AAHK. In planning for the third runway, AAHK has considered international research findings and made allowance for a sea level rise of about 0.5m in the design of the seawall crest.

PROPERTY HOLDING AND MANAGEMENT SECTOR Swire Properties Limited

Swire Properties Limited ("Swire Properties") has adopted a sustainable development policy, reflected in its new building projects and operation of existing buildings. A fundamental part of this approach is a knowledge-based energy management strategy for existing portfolios, which helps address higher temperatures arising from climate change. This approach was adopted in 2003 and involves: setting realistic green targets; putting in place robust management systems; and setting up comprehensive

energy and EHS (environmental, health and safety) database systems.

Swire Properties funded and collaborated intensively with Tsinghua/Hunan University on in-depth research studies which involve their buildings being used as living laboratories to test pilot initiatives in energy efficiency improvement. They make use of performance data relating to existing buildings to set targets for new development projects. They provide a wide range of environmental training to their staff, and their experts participate in the industry and government committees in establishing sustainable building benchmarks for new buildings. In order to encourage tenants to work towards the same goals, they provide free energy audits.

Steps have been taken to reduce the water demands of Swire Properties' buildings through using sea water rather than freshwater for cooler chiller equipment and collecting rainwater and condensate in some of their buildings.

CONSTRUCTION Gammon Construction Limited

In terms of its resilience preparations, Gammon Construction Limited ("Gammon"), for flood risk carefully sizes its temporary drainage systems to cope with peak rainfall events using design criteria provided by the Drainage Services Department updated according to the latest climate change predictions. It also has emergency procedures in place. For risks from typhoons and high wind speed, Gammon has measures and operating procedures in place to reduce the risk of injury and environmental impact.

To reduce the risk of heat exposure for the work force, a range of measures are in place including: multiple rest areas around sites including shading, fans, and water sta-



tions; provision of multiple breaks, herbal tea and electrolyte drinks on 'very hot' days; the use of 'humidex' and a standardised air conditioned rest area that will be rolled out to more sites. Gammon also optimises designs to maximise system form-work use, standardisation, modularisation and prefabrication – enabling fabrication in a more sheltered and controlled environment, faster installation on site (reducing exposure times), and reduced hot work (welding); and are studying and investing in automation methods, reducing high-stress, physical work e.g. they will bring the first robot to Hong Kong for curtain wall installation in 2015.

Gammon's risk management process includes comprehensive Business Continuity Planning. This includes risks within the supply chain. They continue to regularly engage with the supply chain and will study further any particular manufacturing areas and key transport routes at a high risk of flooding. The Gammon Technology Park is on a coastal site in Tseung Kwan O, and they plan to further study the resilience of this site to flood risk.

ENERGY SUPPLY AND TRANSMISSION CLP Power Hong Kong Limited

CLP Power Hong Kong Limited ("CLP") recognises that electricity is essential to the community and the economy and that disruptions to the supply can affect a wide range of critical services and infrastructure. More than 40% of CLP's network is carried through overhead lines while more than 700 400kV transmission towers form the backbone of its supply system. If a pylon is destroyed by strong winds or collapses because of a landslide, it can take several months for it to be restored to working order.

CLP conducts regular emergency typhoon drills, particularly ahead of Hong Kong's typhoon season to help reduce the vulnerability of the power system and minimise the time required for recovery from extreme weather events. A super-typhoon drill in June 2013 simulated the collapse of a transmission tower during a typhoon and the construction of a temporary pylon, which would restore electricity 10 times faster than by repairing the damaged pylon. CLP has introduced an emergency restoration system for the rapid construction of temporary pylons and has identified 151 high-risk pylons and 74 slopes needing reinforcement. CLP has also implemented a number of other measures to counter the potential impact of super-typhoons. These include installing smart switchgear on 11kV and low-voltage overhead lines that supply electric-

ity directly to 160,000 customers, installing flood alert systems in substations, and creating a typhoon response protocol and coordinating system.

The Hongkong Electric Company, Limited

The Hongkong Electric Company, Limited (“HK Electric”) seeks to maintain its operations in the face of extreme weather phenomena that could be triggered by climate change. Its approach is to conduct thorough risk assessments, adopt resilient designs and enhance emergency preparedness to make its operations stronger and less susceptible to challenges such as flooding and typhoons.

The transmission and distribution system of HK Electric consists mainly of cable tunnels and underground power cables which are unaffected by thunderstorms and typhoons. HK Electric has also implemented a number of measures to safeguard the power system against potential threats of flooding. These include reviews to assess the flood risk to significant distribution substations located in low-lying areas, and installation of flooding alarms, water pumps and waterproofing shutters in substations where necessary. By adopting diverse procurement methods and avoiding reliance on a single fuel source or limited fuel sources, the overall fuel supply for HK Electric’s power station is less affected by adverse weather conditions at individual source areas.

HK Electric is also mindful of the effect of hot ambient conditions on the critical parts and components of its generating plant, and has been focusing on improving plant performance under these conditions. As hot weather can prompt more severe heating of cables, reductions in current carrying capacities and a higher chance of failure, HK Electric constantly monitors the temperatures of the key cable sections and has installed 22kV cables with higher power carrying ratings to boost operational reliability.

The Hong Kong and China Gas Company Limited

As a major energy supplier, the Hong Kong and China Gas Company Limited (“Towngas”) emphasizes that it strives to safely and reliably supply gas to customers while working to preserve, protect and improve the environment. It has taken steps to increase the amount of fuel they can source locally, reducing dependence on imports and thereby increasing resilience, through commencing the harnessing of landfill gas with utilisation

projects at Tsuen Wan. On the customer side, it launched the “Low Carbon Action” program and published the “Green Cooking Tips” to promote energy efficiency and reduce daily carbon emissions.

To cope with the possible threats from climate change, Towngas recently conducted a comprehensive climate change risk assessment to systematically review its operations against possible climate change impacts such as super-typhoons, serious flooding and storm surge. Appropriate preventative measures and enhancements were taken. Training and workshops on climate change are organized for relevant staff to enhance their awareness on these issues. Proper emergency procedures and drills are in place to cope with any unusual occurrences from adverse weather such as damage to plants or gas transmission and distribution systems.

3.2.2 Government Action

The Government has taken many actions and introduced a range of measures that will increase Hong Kong’s resilience to climate change. Many of these measures were put in place to address current risk. Key steps taken are set out below, in relation to the following themes. This is not a comprehensive list of action taken, and more detail can be found in the Government’s Climate Change Report.³¹

- Flood Risk: Rainfall and Coastal Flooding
- Landslides
- Heat
- Water
- Information

Flood Risk: Rainfall and Coastal Flooding

To address flood risk from storm water, the Drainage Services Department has put in place Drainage Master Plan review studies and taken action to address flood risk in the territory³². It reviews drainage periodically for different catchment areas, taking into account the latest available climate data, which for the latest studies includes IPCC AR5. It has put in place 3 large storm water storage chambers in Kowloon and Hong Kong Island. It is also developing “blue-green” infrastructure which makes greater use of natural processes including revitalising water bodies and creating green roofs and porous pavements. A 24-hour flooding hotline is in place: 2300 1110³³.

³¹ From Hong Kong Climate Change Report 2015, and information from Government Bureaux / departments.

³² Drainage Services Department, 2014.

³³ Drainage Services Department Website – How to Reduce Flood Damage

Government has developed an understanding of impacts of sea level rise and extreme weather, as well as design principles for coastal structures. Further work is required, some of which is already being undertaken, to understand and address the impact of sea level rise.

Landslides

In the light of Hong Kong's terrain and the related risks, landslide protection is well-advanced in Hong Kong. The Civil Engineering and Defence Department, through its Geotechnical Engineering Office, has carried out a detailed risk assessment and has already taken action on 11,000 slopes. It is planning action on another 17,000 slopes. This makes Hong Kong a world leader in this field. However, if Hong Kong were to be hit by an extreme rainstorm similar to the 2009 Typhoon Morakot in Taiwan, which is consistent with climate change projections, the number of landslides despite all this work could overwhelm the system.

Heat

Through the Planning Department, Buildings Department and Electrical and Mechanical Services Department a number of actions have been taken. These include the formulation of an Urban Climatic Planning Recommendation Map to assess urban climatic and air ventilation impacts of major developments. The Sustainable Building Design Guidelines aim to improve air ventilation in an area. Both help mitigate the heat island effect and enhance environmental quality. Greening Master Plans, which define the "greening needs" of an area including appropriate planting locations and species, have been developed.

Mandatory energy efficiency standards for commercial buildings and guidance as to the thermal transfer levels of residential buildings supported by a Gross Floor Area incentive have been introduced. For the New Development Areas ("NDAs"), there is an emphasis on good urban design and the adoption of environmentally friendly and energy saving measures, with high green design standards in Kwun Tung North and Fanling North New Development Areas (NDAs).

Water

The Water Supplies Department has undertaken studies to assess the impacts of climate change on water resources and water security. It launched the Total Water Management (TWM) strategy in 2008, which aims to con-

tain the growth of water demand and develop new water resources not susceptible to climate change. This includes educational and promotional programmes on water conservation, as well as implementation of voluntary water efficiency labelling schemes (WELS). It has also been looking into new sources of water and the detailed design of a desalination plant in Tseung Kwan O started in November 2015. Infrastructure design and a study on the financial and legal issues are underway for the supply of reclaimed water utilising the treated sewage effluent of the Shek Wu Hui Sewage Treatment Works for flushing and other non-potable uses. The aim is to commence supplying reclaimed water from 2022. This builds on the use of sea water for flushing, which puts Hong Kong in a better position than some other coastal cities.

Information

A resilient system is not only about adaptive measures. It is also about the information that enables a quick response. Hong Kong Observatory plays a key role in this respect. It also operates a rainstorm and tropical cyclone warning system, provides aviation weather services, gives marine weather forecasts and warnings, and carries out tidal monitoring amongst its other operations.

3.3 Areas for Improvement

Areas for improvement have been identified on a sectoral level through a risk assessment of each sector with reference to BEC's Climate Risk Tool, wider desk research and dialogue with business. There are some areas of government and business activity that apply across the sectors and these are highlighted below. To some extent, they reflect the perceptions of business at the time of the dialogue. The release of the Climate Change Report 2015 by Government partly addresses some of these issues, especially in terms of raising awareness and visibility.

3.3.1 Business activity

In terms of business activity, the areas for improvement identified are:

- **Limited assessment of risk:** Though some businesses have carried out risk assessments, it appears that many have not done so with reference to climate change, or have done so looking at an optimistic scenario, reflecting a low GHG concentration scenario (RCP 2.6).
- **Adaptation/resilience plans:** Though some businesses have contingency/emergency plans and a few

have longer term adaptation plans, this is not yet the norm in the business sector.

- **Sectoral co-operation:** To develop coordinated emergency plans, as may be necessary. For example MTR to compensate for loss of service by buses or vice versa in order ensure access and mobility across Hong Kong. Systems that provide for swift action will help ensure that passengers are not left stranded away from home and minimise lost working hours.
- **Inter-sectoral co-operation:** In some fields, co-operation may be needed between business sectors. For example in developing standards that apply across the board like flood resilience and emergency planning.
- **Standards and benchmarks:** There is room for improvement in terms of common standards and ways of benchmarking performance, from building standards to investment and lending criteria, including increasing the level of application.
 - **Energy efficiency:** This is of importance across the economy and has climate mitigation benefits too. The Government's Energy Saving Plan is an important step towards encouraging such action and Hong Kong has various guides, codes and some mandatory measures relating to installation and audits in place. However, Hong Kong does not as yet have a comprehensive set of goals and measures to support energy efficiency across all sectors.
 - **Flood resilient buildings:** There is room to develop clear standards for flood resilient buildings and infrastructure, from guidance on suitable locations for back-up generators to actions required in relation to existing buildings.

3.3.2 Government activity

It appears that more can be done in relation to the following:

- **Clear goals and co-ordination of activity:** Hong Kong now has a Climate Change Report setting out Government activity, partly addressing the business perception of Government action being limited and fragmented. However, there is as yet no statement of goals beyond 2020, and current goals do not take on board developments in commitments at an international level. It is expected that longer term goals will follow the Paris COP 21 negotiations. Though there
- is an inter-bureaux/departmental working group at an official level, there is a need for enhancement to enable strategic decisions to be made and improved co-ordination across government.
- **Interface between government and business:** This could be improved through forums or platforms to enable regular communication. Such forums would help with: clarity of residual climate risk on the part of business, after action by government; sharing of responsibility for adaptation and resilience; and the development of targets and goals as well as practical policy measures that deliver more effectively on shared objectives.
- **Information and data:** Businesses are interested in data at a more granular level in order to ascertain how their assets and supply chain may be impacted. This needs to show localised flood risk areas as well as projections over different time periods. There is currently limited information on local impacts of flooding and sea level rise.
- **Infrastructure enhancement:** Though considerable progress has been made, there are still areas where the infrastructure has not been fully adapted to take on board climate risks for example coastal storm surge defences. There are issues as to whether the improved infrastructure is sufficient for the expected severity of extreme weather effects.
- **Regulations, standards and benchmarks:** Mandatory building standards currently cover minimum energy efficiency standards for installations, and thermal transfer values. The BEAM Plus assessment, a voluntary approach incentivised by a Gross Floor Area concession, brings some other energy issues into consideration. These standards and the assessment process do not fully ensure adaptation and resilience of buildings: firstly, they do not apply to existing buildings unless a substantial retrofit is undertaken; secondly, energy efficiency standards could be raised; and thirdly, they do not appear to cover all resilience issues of new buildings, in particular storm surge combined with surface water flooding and a higher sea level. There are also opportunities to set clear standards and targets for the "smart cities" and New Development Areas.
- **Provision for sectoral co-operation:** There appears to be space for further action to put in place systems or processes for business to liaise and co-ordinate the provision of services in the event that they are disrupted by climate-related events.

04 | RECOMMENDATIONS

BEC's sectoral and overarching analysis shows that many steps have been taken in Hong Kong by the Government and business towards adaptation and making the city more resilient. The extreme weather of Hong Kong with its tropical cyclones, rainstorms and high temperatures means that Hong Kong leads the field in resilience in some key respects. Other global cities can learn from this experience.

However, further action is needed by both Government and business to ensure the city is resilient to future change, taking into account climate projections. BEC has made a series of recommendations below, emphasizing the need for more far-reaching action considering that at present it looks most likely that the temperature rise will not remain below 2°C.

It is important that business begins without delay, as climate change is already underway and because retrofitting a building or infrastructure which is not resilient can be much more expensive than getting it right at the outset.

4.1 Summary of Progress

We in Hong Kong can be proud of actions by both Government and business. Here are some highlights:

- Progress has been made in terms of understanding impacts and collecting data.
- Systematic action has been taken to address landslide risk across Hong Kong and construct new

buildings to withstand higher wind speeds.

- Surface water flood risk has been addressed through a Drainage Masterplan, leading to capacity for addressing storm water run-off being expanded, through large storm water storage areas and introduction of a new blue-green approach to drainage. The latter increases water permeation reducing the pressure on artificial drainage systems.
- Contingency measures such as early warning systems are reasonably strong in Hong Kong with a well-used system of on-line alerts for extreme weather events.
- Shelter from the sun and rain for pedestrians in key areas provided through walkways and tree lined streets in many parts of the city.
- The Sustainable Building Design guidelines incorporate pioneering work on air ventilation assessments and greenery to help address heat island impacts.
- The experience of the SARS epidemic strengthened systems for responding to epidemics.

Areas for improvement on the part of business and Government have been identified and set out in chapter 3 of the report. Recommendations have been developed on that basis.

4.2 Actions for Business – Our Recommendations

To ensure a secure future for Hong Kong, here are vital actions that we encourage business to take:

Recommendation 1: Assess Risk

Consider and assess risks across the length of operations, from the supply chain to investment decisions, and monitor risk exposure at regular intervals.

Relevant Actions

- Carry out a broad and systematic risk assessment to identify major risks to the business from climate change. BEC's Climate Risk Tool can help businesses do this.
- Build climate risk assessment into standard enterprise risk procedures, making sure the possibility of the more extreme IPCC temperature scenarios are taken on board.
- Clearly allocate responsibility within the organisation, and monitor risk exposure at regular intervals.

Recommendation 2: Develop and Implement Plans

Establish and implement plans to adapt to climate change as well as contingency plans for severe weather and disaster situations.

Relevant Actions

- Put in place recovery plans and train staff for their implementation, in the near future.
- Put in place a medium to long-term adaptation plan, reviewing progress routinely. Draw on available new technologies and practices in developing this plan.
- Address heat stress through measures like urban greening, appropriate provisions for the workforce especially those working outdoors, and work towards increasing the energy efficiency of new and existing buildings.
- Take steps to ensure that new and existing buildings are highly resilient to extreme weather taking on board risks in their location from flooding, sea level rise, landslides and high winds.
- Improve supply chain management, drawing on the best practice already in place within the sector. Share experience and seek specialist support if necessary.

Recommendation 3: Co-operate on a Sectoral Level and Cross-sectoral Level

Co-operate on a sectoral and cross-sectoral level to ensure risks are understood and kept under review, that research is carried out and sound industry practice is developed, and opportunities for mutual support and co-operation are implemented.

Relevant Actions

- Share best practice, experience, expertise and information through forums, including BEC Climate Change Business Forum Advisory Group, trade associations and professional bodies, on climate change risks and responses.
- Put in place sectoral groups where appropriate to ensure joined-up emergency response systems, for example between transport operators and / or utility companies.
- Engage across sectors to develop shared views on: actions to ensure resilience, research needs, and Government policy measures needed to support action.

**Recommendation 4:
Benchmark Performance**

Work across the sector and with other sectors to develop standards and benchmarks, assess performance against these benchmarks, and publicise achievements.

Relevant actions

- Develop and implement appropriate standards and benchmarks, such as on assessing climate risk in the financial services and insurance sector, and on resilience of buildings to flooding and storm surge, working through trade associations and professional bodies where necessary.
- Review practice and performance against these benchmarks at regular intervals.
- Report on risk management approach and performance e.g. in ESG Reports.

**Recommendation 5:
Develop Knowledge and Innovate**

Develop knowledge of best practice and seek to improve and innovate, making the best use of new technologies and approaches.

Relevant Actions

- Identify areas for research, and seek to ensure this is carried out by business or collaboratively with government or research institutes.
- Adopt a culture of innovation, which encourages and supports businesses to work collaboratively, making use of expertise from universities and research institutes, and trial new technologies.
- Draw on the “smart city” approach, which brings out the opportunities from developing the technological interface between people and infrastructure, for example through smart grids and smart meters.

Overall, the proposed approach involves a cycle of assessing risk, making and implementing adaptation and contingency plans, monitoring progress, reporting and then enhancing plans. It also involves working collaboratively within and across sectors and building knowledge and expertise to drive continuous improvement.

**4.3 Government Measures
– Our Recommendations**

Government has a vital role to play in supporting and facilitating adaptation and resilience by business for the benefit of society as a whole. Government is encouraged to do the following:

**Recommendation 1:
Enhance Institutional Arrangements
and Maintain Dialogue**

Establish a ministerial level body to enhance internal government deliberation on climate related issues to help Hong Kong optimise its efforts, and put in place mechanisms to enable on-going dialogue with critical business sectors on goals, plans and implementation.

Relevant Measures

- Establish a ministerial level climate change committee to enable the Government to develop policies, set targets and goals and monitor implementation and report on progress.
- Set up a forum for the Government and critical sectors (such as power, transport, construction, and property development and management) to regularly share views and coordinate efforts in order to improve Hong Kong’s overall resilience.
- Create a broader forum for Government, business and the community to discuss climate preparedness from time to time.

While the Government already has an Inter-departmental Working Group on Climate Change, which consists of representatives from across many departments, decision-making needs to be carried out at the ministerial level where there is the authority required to make and commit to new policy and strategic decisions.

**Recommendation 2:
Commit to Reduce Hong Kong’s GHG
Emissions, Adapt and Be Resilient**

Articulate new goals and put in place a plan post the Conference of the Parties negotiations in Paris (COP 21) for Hong Kong to reduce its GHG emissions, adapt and be more resilient.

Relevant Measures

- Set a new GHG reduction target to be achieved by 2030, and longer term targets where possible, working to achieve this in particular through reducing carbon emissions from energy generation and transportation, and by enhancing energy efficiency.

- Strengthen Hong Kong's capability to become more energy efficient and consider if the energy saving target of 40% energy intensity reduction by 2025 may be improved.
- When conducting periodic reviews of laws relating to energy savings, including as to electrical installations, electrical appliances and the building envelope, adopt high standards with reference to international best practice benchmarks.
- Adopt a national adaptation and resilience plan, which ensures all bureaux/departments and critical sectors take climate adaptation and resilience into account in the development and implementation of their policies and plans.

Progressively raising existing mandatory standards such as on energy efficiency is important. Voluntary standards and benchmarks combined with incentives can be a good starting point to embedding standards, including through legislation, which Government should consider as a way of providing a level playing field for businesses. Areas of Urban Regeneration (e.g. East Kowloon) and New Development Areas are useful testbeds for setting higher standards and leading by example.

Recommendation 3: Fund and Encourage Research and Provision of Information

Support the collection and dissemination of relevant data, and provide funding for and encourage research relevant to climate risk, adaptation and resilience in Hong Kong.

Relevant Measures

- Allocate funding through the Research Grants Council and other bodies for research into key issues including critical infrastructure, good labour practices in conditions of heat stress, disease and food supplies.
- Support the collection and dissemination of relevant data, such as on levels of flood risk and storm surge in different localities, as well as impacts of energy efficiency measures.

Business recognises the impact of climate change but takes the view that there is a need for provision of more information on potential climate change impacts in particular from sea level rise and flood risk, to draw out the likely impacts on business and existing buildings. This needs to be at a sufficiently local level. Research is needed on key issues including: resilience of existing buildings, mobile transmission systems, food importation and distribution, and insurance. The platform or forum mentioned in Recommendation 1, could help Government prioritise research needs.



Typhoon Hope Photo credit: Chan Kiu / SCMP

Recommendation 4: Raise Awareness, Educate and Exemplify

Continue to spread awareness of the impacts of climate change amongst the public, inform business of action that needs to be taken, and exemplify good practice.

Relevant Measures

- Continue to communicate the impacts of climate change to the public.
- Encourage action by smaller businesses and particularly vulnerable sectors such as the food retail sector.
- Influence behaviour through leading by example, showing what can and should be done, for example on energy efficient buildings, working conditions, and the supply chain.



ANNEX A

The Sectoral Picture – Progress and Areas for Improvement

- 1 These sectoral annexes are aimed at developing a better understanding on the part of business and government of the climate risks involved and adaptation and resilience measures required by both business and government, taking on board activity to date.
- 2 It is intended that they form the basis of a continuing discussion by business within these sectors and across these sectors.
- 3 They were developed through: a multi-sectoral workshop; discussions with businesses; discussions and information from Government departments; and desk research by BEC using the New Normal and other reports, as well as the application of BEC's Climate Risk Tool. This risk assessment tool can be obtained without charge by emailing BEC at cbff@bec.org.hk
- 4 The sectors we have considered are:
 - a. Construction
 - b. Energy
 - c. Financial Services
 - d. Manufacturing and Retail Supply Chain
 - e. Property Holding and Management
 - f. Transport and Logistics

CONSTRUCTION SECTOR



Risks

Under RCP 8.5, by 2050 likely to see:

Assets: Damage to construction sites and equipment.

Operations: Delay in construction of buildings and infrastructure caused by bad weather in Hong Kong, as well as bad weather impacts on inputs and material flows.

People: Health and safety of construction workers operating in high temperatures, exacerbated by an ageing population.

Costs: Caused by delay as well as dealing with impacts of flooded sites and landslip.

Market: Reputational impacts if buildings are not resilient to climate change.

Adaptation Measures Needed

1. Develop strategies for all aspects of resilient construction practices, e.g. managing landslip and flooding.
2. Put in place infrastructure to protect equipment.
3. Codes of Practice covering construction practice as well as siting, design, materials.
4. Understanding of means of safeguarding health of construction workers, and developing alternative construction methods, e.g. prefabrication.
5. Guidelines/regulations on working conditions in hot weather, for a level playing field and a common understanding.

Business Actions to Date

- a.** Provision of a better working environment (e.g. shaded rest areas, drinking water) for construction workers by contractors.
- b.** Incorporation of climate change concerns (e.g. stronger tile bonding, or eliminating tiles) into the building construction and design.
- c.** Increase use of pre-fabrication and automation to improve health and safety of workers on-site.

Government Actions to Date

- a.** Housing Authority: Comprehensive design and planning against heavy rainstorm in public housing estate.
- b.** Buildings Department: Code of Practice on Wind Effects in Hong Kong 2004.
- c.** Electrical and Mechanical Services Department: Hong Kong Energy Efficiency Registration Scheme for Buildings and Building Energy Efficiency Ordinance. (See Sectoral Annex on Property Holding and Management).

Business is encouraged to:

- a. Explore the potential for more flexible working hours, for example in the evening, though this will be subject to noise constraints.
- b. Improve sheltering provisions for workers while also ensuring their security during inclement weather.
- c. Optimise drainage design arrangements according to site specific constraints to minimise risks to Develop a better understanding of fundamental principles of material behaviour under different climatic conditions in order to ensure resilience of building materials being used.
- d. Expand supply chain knowledge and testing of materials under extreme conditions.
- e. Maximise off-site fabrication of elements which can be undertaken in more easily controlled environments, e.g. use of prefabricated prefinished volumetric construction, off site cut and bend yards.
- f. Standardisation and modularisation to speed up construction processes and minimise hot works (e.g. welding, bar bending).
- g. Develop contingency plans for materials supply chain disruption in the event of extreme events.

Government is encouraged to:

- a. Ensure buildings codes and standards properly address impacts of hot weather, considering whether standards are sufficiently high in terms of insulation, shading, installations and appliances.
- b. Develop guidelines/regulations on working conditions during hot weather in this sector including exploring the potential for more flexible working hours, for example in the evening, to have a level playing field and a common understanding.
- c. Mandate and facilitate construction methods which maximise prefabrication, standardisation and modularisation (as currently mandated in Singapore, by the Housing and Development Board, for public housing projects).
- d. Support and incentivise automation in the construction sector e.g. robotics, to reduce reliance and stresses on work-force.
- e. Consider 'stop work' requirements at extreme temperatures on site.
- f. Continue and expand support for waste recycling in Hong Kong e.g. timber waste, to avoid greenhouse gas emissions from landfill.

ENERGY SECTOR



Risks

Under RCP 8.5, by 2050 likely to see:

Assets: Increased flood risk and storm surge affecting energy infrastructure.

Operations: Potential for power outages as a result of flooding and super typhoons, with rising temperatures making peak demand for electricity more difficult to meet. Increased supply chain disruption as a result of severe weather affecting transportation and fuel source e.g. open-cast coal mine supplies.

People: Potential difficulties getting to work at remote locations e.g. Power Station at Lamma Island, heat stress and climate-related disease risk.

Cost: Unpredictability in the availability of natural resources, which may increase commodity prices and hence operational costs.

Markets: Reputational impacts related to the costs associated with resilience, and from severe weather impacting response time commitments.

Adaptation Measures Needed

1. Supportive regulatory regime to underpin long term investment in climate change resilience and sufficient generation capacity.
2. Protection of generation infrastructure and electricity transmission and distribution systems.
3. Monitoring / detection systems to address causes of potential failures, and provide back-up.
4. Addressing issue of high peak electricity demand through supply-side and demand-side measures.
5. Extending diversity of sources of energy including new low carbon energy supplies and demand-side diversity in the sourcing of fuel through multiple channels, including local supplies of renewable energy and landfill gas where practicable.
6. Clean distributed generation, at least on a back-up basis³⁵ where appropriate.

Business Actions to Date

- a. Adoption and application of sophisticated risk assessment and management techniques and planning criteria to enhance climate change resilience. For example, the impacts of flooding and storm surges have been considered and measures have been put in place such as remote alarms, typhoon planning and a flood calculator.
- b. Preparation, approval and implementation of investment plans necessary to achieve the above.
- c. A strong focus on continued operational excellence to deliver world-class reliability.
- d. Asset protection and defence measures, such as action to protect coastal power plants from storm surges and electricity substations from flooding.

Government Actions to Date

- a. A number of initiatives exist that directly or indirectly address each adaptation action:
 - Scheme of Control Agreements (SCA): The terms in the 2008 reflect agreement by the two electricity companies to promote energy efficiency through various programmes in co-ordination with the Government, as well as enhanced service quality and operational performance, and a reliable & secure electricity supply,
 - Development Plans. Every 5 years the power companies put forward investment plans for government approval, including specific measures to increase climate change resilience (such as the super-typhoon programme for slopes and pylons),
 - Electricity Ordinance: Ensures the secure provision of electricity while specifying guidelines for emergency disconnection and safety.

Business Actions to Date (continued...)

- e.** The use of ring circuits and multiple gas/electricity transmission lines to enhance resilience to ensure the continued supply of energy, even if an individual component were to fail.
- f.** In so far as practicable and environmental legislation allows, diversification of energy sources and the fuel supply chain.
- g.** Management of supply chain risk through on-site storage of fuel supplies, where practicable.
- h.** Supported demand-side management, both internally and through customer education and action programmes, including audit services, provision of information and use of energy efficiency funds to support energy efficiency improvement works in residential blocks.

Government Actions to Date (continued...)

- b.** Security Bureau Emergency Response System: government in close liaison with utilities companies to ensure that repair works carried out as quickly as possible to resume supply.
- c.** 2008 Memorandum of Understanding on energy cooperation with the Mainland: provides guarantee of supply of energy from 3 sources.
- d.** Towngas Information and Consultation Agreement: Towngas provides information on available raw materials to government.
- e.** The Security Bureau and Electrical and Mechanical Services Department ask for climate plans from companies in the energy sector.

Business is encouraged to:

- a.** Continue to comprehensively model and plan for the investments necessary to ensure climate change resilience
- b.** Ensure robust planning standards and risk mitigation processes and systems are in place and continued operation excellence to maintain service delivery
- c.** Work to manage risks in the energy and fuel supply chain, through diversity of supply, the introduction of new technology and by exploring the opportunity for new supplies of low carbon energy
- d.** Support the development of climate change resilience along the chain of relevant bodies, with outreach programmes to customers and business partners, as approved by government
- e.** Demand Side Management: there are currently limited incentives for the power companies to promote demand side management. To develop policy recommendations for government that will make effective demand-side management also in the interests of power companies and introduce new technology such as smart metering to facilitate this
- f.** Ensure continued close collaboration across the energy sector including the provision of mutual emergency support
- g.** Develop a sectoral blueprint to facilitate and benchmark long term adaptation and contingency planning.

Government is encouraged to:

- a.** Develop strategic policy measures to encourage power companies to invest in climate change resilience and incentivise their support for energy efficiency.
- b.** Approve the necessary investment, together with satisfactory renewal of a supportive regulatory regime and planning standards beyond 2018 to ensure continued long-term investment in reliable electricity infrastructure.
- c.** Support improved access to a more diverse range of sources for key fuels, such as the provision of a local Liquefied Natural Gas (LNG) terminal in Hong Kong which can be used by all three local energy utility companies to access natural gas from global markets or the use of Landfill Gas by energy companies to reduce GHG emissions, and support for the development of local RE generation, where practicable.
- d.** Develop incentives to help customers use energy more efficiently, whether through utilities or by businesses at the individual building level.
- e.** Support the energy companies to introduce new technology to empower customers to better manage their energy usage, for example through smart metering demand-side management initiatives.
- f.** Encourage continued collaboration between the local energy companies on climate change resilience and disaster preparedness and encourage the development of procedures, protocols, drills and appropriate infrastructure to provide mutual support.
- g.** Consider developing a blueprint on climate resilience in collaboration with the sector, with regard to international best practice benchmarks, which has a clear timeline.
- h.** Raise awareness through Government communications in respect of the long-term costs for climate change resilience of the energy infrastructure having to be borne by the community

FINANCIAL SERVICES SECTOR



Risks	Under RCP 8.5, by 2050 likely to see:	
<p>Assets: Risks to existing built assets – though may not be substantial for this sector. Impact on data security may pose more of a threat.</p> <p>Operations: Exposure to risk through investments, which are not climate proofed. Substantial risks to the insurance sector, and failure here would affect other businesses. Running of banks and stock exchange affected by flooding and possible power outages.</p> <p>People: May be affected by delays to work, injury, disease and migration, aggravating existing concern about pollution</p> <p>Costs: Financial loss from damage to existing assets or disruption to key markets as a result of insufficient consideration of Climate Change risk.</p> <p>Markets: Loss of trust in Hong Kong Financial Services sector in Hong Kong as a result of the sector not taking on board climate change related risk.</p>		
Adaptation Measures Needed		
<ol style="list-style-type: none"> 1. Building climate risk into investment decisions. 2. Understanding risk to assets including intangible assets like data. 3. Continuity plans for disruption occasioned by power outages and adverse weather. 		
Business Actions to Date	Government Actions to Date	
<ul style="list-style-type: none"> a. Businesses have data protection and backup systems in place, but indicate that these can be improved. b. International Principles such as the United Nations Principles on Responsible Investment (UNPRI) exist to guide greater consideration of responsible investment decisions. c. Improved awareness of climate risk within the sector. 	<ul style="list-style-type: none"> a. The Hong Kong Monetary Authority’s emergency response plan: encourages the development of continuity plans including arrangements for backup services and methodology for service reactivation and has strong contingency plans on the prevention and management of pandemics. b. Office of the Communication Authority responsible for relaying the possible Telecommunication Network Congestion Warning to the telecommunication network operators upon receipt of notification of a disaster or major emergency. c. Section 101 of the Banking Ordinance requires a minimum capital adequacy ratio of 8% to be maintained in respect to risk exposure in general. 	

Business is encouraged to:

- a.** Establish Hong Kong as a centre of green finance, with improved awareness of climate risk and opportunities.
- b.** Put in place plans and processes to take into account longer term climate risk.
- c.** In conjunction with regulators and industry bodies, conduct a comprehensive review of climate risks facing the insurance and financial services sector.
- d.** Incorporate Environmental, Social and Governance considerations into investment fund decision-making processes, with consideration in particular for Mandatory Provident Fund ("MPF") funds in Hong Kong.

Government is encouraged to:

- a.** Work with Hong Kong Stock Exchange and businesses in the financial sector to form a strategic partnership to bring together activity on climate resilience, to secure the resilience of the sector in Hong Kong.
- b.** Encourage companies to adopt a risk-based ESG approach and sign up to standards such as the UNPRI, possibly with regulatory measures on the part of the Hong Kong Exchange.
- c.** Encourage the development of business contingency plans by companies across Hong Kong, with regulatory requirements considered for critical sectors.
- d.** In conjunction with the financial services sector, conduct a comprehensive review of climate risks facing the insurance and financial services sector.
- e.** Government should start considering climate risks and related risk management in their investment, spearheading such sectoral responses to climate change.
- f.** Consider the role that Hong Kong could play in climate finance, including mainland China's carbon trading scheme, which may enable Hong Kong to play a role facilitating overall climate resilience.

MANUFACTURING AND RETAIL SUPPLY CHAIN SECTOR



Risks	Under RCP 8.5, by 2050 likely to see:	
<p>Assets: Asset damage to manufacturing facilities, machinery and depots.</p> <p>Operations:</p> <ul style="list-style-type: none"> • Reduced availability of water and raw materials, as well as energy, which impact on operating cost and profit. Water pollution exacerbates this risk. • High risk of flooding in South Asia, and other climatic change, which would disrupt the supply chain. Disruption to transportation poses a risk to availability of raw materials and product delivery. • Significant impact on agricultural businesses, which will have a bearing on food manufacturing and textile industries. <p>People: Higher temperatures may increase the frequency of disease among employees resulting in operational disruptions while also increasing demands on cooling. Risk of pandemics within the supply chain.</p> <p>Markets: Unstable weather may impact purchase of products in the case of beverages; consumption is higher on warm days and lower on rainy or cold days.</p>		
Adaptation Measures Needed		
<ol style="list-style-type: none"> 1. Understanding supply chain issues and developing resilience. 2. Pandemic disease management. 3. Securing power supply in the event of an emergency, including back-up generation. 		
Business Actions to Date	Government Actions to Date	
<p>a. Business action varies depending on the location of operational facilities. Businesses present at the sector group discussion noted that they filtered waste water before discharge.</p> <p>b. On-going consideration of resource and energy consumption in this sector.</p> <p>c. Health and safety policies often in place to ensure the wellbeing of employees.</p> <p>d. Some monitoring consumer attitudes and engaging consumers to promote awareness and behavioural change as to what is bought and consumed.</p> <p>e. Some businesses are working on the resilience of their supply chain, including better management of water and development of less water hungry raw materials, but this is not widespread practice.</p>	<p>a. Civil Engineering and Development Department: Public Works Laboratories relevant to all infrastructure and publically utilised materials.</p> <p>b. Drainage Services Department and Water Supplies Department: The proposed Inter-Reservoirs Transfer Scheme (“IRTS”) will reduce the risk of overflow from Kowloon Group Reservoirs and conserve more water locally.</p> <p>c. Water Supplies Department: Includes education and promotion of water conservation, implementation of voluntary WELS (Water Efficiency Labelling Scheme) and development of new water resources such as desalination, reclaimed water. (See Chapter 3 for further details).</p> <p>d. For built manufacturing facilities located in Hong Kong, government initiatives to safeguard property as outlined within the “property and construction” section apply.</p>	

Business is encouraged to:

- a.** Develop approaches to ensure supply chain resilience not only in Hong Kong but along the supply chain, including in manufacturing countries and sources of raw materials.
- b.** Identify possible improvements in relation to transport and logistics, to minimise the risks of supply chain disruption, and put suggestions to the transportation sector and to government.

Government is encouraged to:

- a.** Develop incentives to save energy.
- b.** Explore potential to support renewables and distributed energy eg subsidies for solar panel installation.
- c.** Consider standards and regulations to encourage demand management including peak demand management, by industry.
- d.** Enhance measures to promote water conservation and further exploration of new water resources.

PROPERTY HOLDING AND MANAGEMENT SECTOR



Risks	Under RCP 8.5, by 2050 likely to see:
<p>Assets: Damage to built assets and equipment, from flooding, heavy rainfall affecting roofs, strong winds loosening tiling, windows or fixtures on external façades. Older buildings at a particular high risk from damage due to adverse weather.</p> <p>Operations: Older buildings likely to be more seriously affected eg high winds damage windows, flooding, overheating. Buildings may be closed or access made impossible at times.</p> <p>People: Discomfort if buildings poorly built or maintained. Exposure to extreme heat in exposed areas.</p> <p>Costs: Overheating of buildings due to the urban heat island effect, leading to higher energy and maintenance costs. Water use and related costs may also rise.</p> <p>Market: Damage to foundations affecting value and reputation.</p>	
Adaptation Measures Needed	
<ol style="list-style-type: none"> 1. Building standards enhanced to address these risks. 2. Drainage systems and coastal defences to reduce risk of flooding. 3. Developing cost-effective retrofitting measures for older buildings. 	
Business Actions to Date	Government Actions to Date
<p>a. New buildings have the benefit of drainage impact assessments, wind speed guidelines, and higher levels of energy efficiency.</p> <p>b. Commitment by some businesses to energy or carbon reduction across portfolio and to developing strategies to meet them.</p> <p>c. Commitment by some to providing support for energy audits and green labelling assessment to tenants.</p> <p>d. A Task Force has been formed under the Hong Kong Green Building Council's Policy and Research Committee to investigate adaptation and resilience measures in relation to the built environment in Hong Kong, including the building envelope, to address various climate change risks such as flooding, water scarcity and landslides.</p>	<p>a. Housing Authority: Comprehensive design and planning against heavy rainstorm in public housing estate, and in relation to reducing heat island impacts. For example an estate at Ngau Tau Kok, Kowloon East makes use of "passive design" concepts, which rely on natural air movement.</p> <p>b. Electrical and Mechanical Services Department: Introduced building standards relating to energy efficiency through the Buildings Energy Efficiency Ordinance, which include the Code of Practice for Energy Efficiency of Building Services Installations (known as the Building Energy Code) and the Code of Practice for Building Energy Audit. The Building Energy Code sets minimum energy performance standards of four major building services installations (lighting, air conditioning, electrical and lift and escalator installations). The Buildings Energy Efficiency Ordinance requires energy audits and mandates application of the Buildings Energy Code through certification for new buildings and major retrofits.</p> <p>c. Hong Kong Energy Efficiency Registration Scheme for Buildings This is a precursor to the Building Energy Efficiency Ordinance and is still in place. It provides for voluntary registration under the Building Energy Codes.</p> <p>d. Buildings Department: guidance on structural design to withstand current levels of risk as to wind speed, and requirements as to the buildings insulation envelope for commercial (RTTV) and residential buildings (OTTV)³⁴.</p>

Business is encouraged to:

- a.** Continue to improve energy efficiency of buildings: design buildings so they fully address impacts of hot weather, and input into building codes and standards so they are sufficiently high e.g. in terms of insulation, reducing solar gain, natural ventilation, materials like tiled frontages, and use of energy efficiency technologies. There may be potential for increasing the extent to which solar shading is factored into design including in public buildings and for making more use of natural ventilation.
- b.** Develop approaches to manage buildings to increase energy efficiency. This could include the use of Energy Performance Contracting (possibly using specialist Energy Service Companies), green leases, regular optimizing of ventilation systems, retrofitting existing buildings, and behaviour change measures for staff.
- c.** Explore and address risk relating to storm surge and surface water flooding, taking into account risks to the specific building and in that locality.
- d.** Ensure contingency plans in place for flood risk, from surface water and storm surge.
- e.** Ensure materials specified are designed to be resilient under extreme weather conditions.
- f.** Fix designs of buildings earlier to allow for pre-fabrication during construction.
- g.** Adopt a contracting model that allows contractors to be involved earlier in design stages, enabling resilience in buildings and in construction methods to be developed.

Government is encouraged to:

- a.** Provide better information: targeted government publications and explanation/publicising the climate risks faced by the property sector and identifying critical infrastructure needs, in particular to explain residual risk from sea level rise and storm surge after Government action.
- b.** Strengthen policy measures to encourage retrofitting of buildings and address resilience to flood risk.
- c.** Publish performance data for government facilities.
- d.** Consider extending mandatory application of basic green building requirements, e.g. to minimise heat island effect, and use WELS (Water Efficiency Labelling Scheme) products.
- e.** Consider updating Hong Kong's Planning Standards and Guidance, in particular with requirements for shading pedestrian areas, rainwater infiltration, green roofs and other heat island reducing measures.

TRANSPORT AND LOGISTICS SECTOR



Risks

Under RCP 8.5, by 2050 likely to see:

Assets: Flooding can damage transport infrastructure, including rail and bus stations, overhead power lines and vehicles. Heat stress can damage infrastructure including roads and cause buckling of tracks.

Operations: Service disruptions due to unpredictable/ extreme weather for all modes of transport. Flooding may damage private cars and put more stress on other travel modes such as the buses and the railway.

People: Heat stress and higher levels of disease including influenza, resulting in lost staff days.

Costs: Extreme wet weather events delay construction projects and hamper future project development; and higher costs of air-conditioning.

Markets: Reputational risks for public transport that result from accidents and delay.

Adaptation Measures Needed

1. Flood resistant and resilient structures.
2. Preparing recovery procedures and testing them.
3. Testing infrastructure and materials against heat stress, flood risk.
4. Constructing flood defences and ensuring flood risk resilience of buildings and infrastructure to withstand residual risk.
5. Emergency warning and evacuation plans.
6. Changes to working hours and clothing to reduce heat stress for workers.

Business Actions to Date:

The larger transport businesses have:

- a.** Planned alternative routes for emergencies and redundant systems where possible.
- b.** Put in place measures to ensure staff available when needed
- c.** Adapted cooling systems to improve air conditioning for underground networks, stations, ports and trains.
- d.** Upgraded vehicles to more efficient, low carbon alternatives to reduce energy usage.
- e.** Begun to use heat resistant materials within infrastructure, and increase maintenance and monitoring of structures.
- f.** Developed emergency management plans and responses for disruptions.
- g.** Incorporated risk assessments related to climate change risks.

Government Actions to Date:

- a.** Rail:
 - i.** Highways Department: Structure Design Manual for Highways and Railways - BS5400 regards the use of raw materials, testing materials against heat stress,
 - ii.** Internal procedures and guidelines.
- b.** 'Guide to Design of Piers and Dolphins' & 'General Design Consideration for Marine Works'.
- c.** Transport Department: have set up and enhanced the Intelligent Transport System to keep track of real-time traffic, incidents, gather and synthesize information from private sector through its Transport Information System.

Business is encouraged to:

- a.** Take more steps to test and ensure resilience of transport infrastructure and related infrastructure to flood risk.
- b.** Work together across the sector. The development of a traffic management/control centre to coordinate the inter-modality of disparate transport systems and provide real-time information to the public is critical. Government support may help make this happen.
- c.** Develop systems for addressing heat stress impacts on workers e.g. appropriate clothing and working hours.
- d.** Carry out further analysis as to climate impacts on logistical systems including shipping.

Government is encouraged to:

- a.** Make data available more quickly, enabling business to develop their approach to mitigate and adapt to climate change.
- B.** Initiate and facilitate a strategic and collaborative approach by business, to help in reducing impact including through developing a sectoral risk exposure matrix.
- C.** Infrastructure: this is not only about coastal defences and drainage, but simple measures like tree planting and permeable surfaces, which can help make walking more comfortable and reduce risks of flooding.

ANNEX B



Hong Kong Observatory – Projections Explained

1. It is important to note that climate projections are very different from weather or seasonal forecasts. Climate projections involves assumptions in future greenhouse gas concentration/emission scenarios and aim at describing the plausible change in the future climate from a long-term perspective, rather than depicting the “day-to-day” or “year-to-year” variations in weather.
2. Although a majority of the model projections suggest in general consistent trends for the changes in the climate of the 21st century, inter-model differences sometimes can still be large. This, to a certain extent, reflects that climate projection is still subject to various uncertainties in the model simulation of the future climate, which depend very much on such factors as future greenhouse gas emissions, the choice of models, model skills, the downscaling methodology, the stability of the statistical downscaling relationships in the future. The technique is expected to continue to improve with time as scientists know more about various climate processes and atmospheric processes that impact on the climate.
3. The Observatory utilizes data of a number of climate models in the IPCC Fifth Assessment Report (AR5) to project the temperature, rainfall and sea level changes in Hong Kong in the 21st century. Urbanization effect has been considered in the temperature projection. Data is provided to support climate research and impact studies.
4. The Government of Hong Kong Special Administrative Region (including its servants and agents) makes no warranty, statement or representation, express or implied with respect to the accuracy, completeness or usefulness of the data supplied, and in so far as permitted by law, shall not have any legal liability or responsibility (including liability for negligence) for any loss, damage or injury (including death) which may result whether directly or indirectly, from the supply or use of such data.



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BEC Climate Change Business Forum Advisory Group ("BEC CCBF AG") promotes awareness of, and builds capacity in relation to, climate change mitigation, adaptation and resilience activities amongst the BEC membership and generally amongst the business community in Hong Kong. It also aims to provide a platform for BEC to engage relevant regulatory bodies on climate change related matters, and forge collaboration links between local and global expertise on climate change.



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