

Climate Change Challenges for Hong Kong:
An Agenda for Adaptation

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Executive Summary

Climate change is inevitable and therefore there is a need to examine adaptation measures that can manage the challenges presented by changes in the climate that we will experience in Hong Kong.

Climate change will mean that Hong Kong will experience a warmer climate, at times with significantly more rainfall but will also face the risk of seasonal water shortages. Hong Kong will also experience a significant increase in the frequency and intensity of extreme weather events, such as heat waves, tidal surges, typhoons and very heavy rainfall. Sea levels will continue to rise for decades. The impacts of these changes on Hong Kong will be increased risks of flooding, droughts and dangerously hot weather. There will also be secondary and indirect impacts, including an increased risk of infrastructure damage, ground instability and landslides, and further increases in dangerously poor air quality periods. This will all impact on human health and quality of life and pose significant risks for the economy of Hong Kong.

It is important that Hong Kong begins to recognize the risks of climate change and puts into place both mitigation and adaptation measures now. Early anticipatory adaptation will be more effective and less costly than retrospective, emergency action. Although the scale of climate change risk is uncertain, it is increasingly clear that like many of the world's leading cities, Hong Kong faces huge changes as a result of climate change and that adaptation measures must become a strategic priority.

In Hong Kong adaptation will be needed to deal with the following issues:

- **Extreme weather events** including heavy rainfall, high temperatures, sea-level rises, tidal surges and super-typhoons;
- **Flooding**, overstressed drainage systems and groundwater pollution leading to possible disease, damage to property, soil degradation and personal injury;

- **Decreasing water availability**, periods of drought, and increased water evaporation;
- **Heat waves** and dangerously hot days with the potential to cause death, severe health problems and economic losses through damage to infrastructure;
- **Health impacts** and rising social inequities with the poorer suffering more health problems associated with heat exhaustion, respiratory problems and pollution effects;
- **Threatened ecosystem services** through impacts on wetland areas and other crucial ecosystems which affect species distribution, spawning, flowering, water retention and replenishment.

Hong Kong's position as a world city could easily be undermined unless it tackles climate change and starts adapting to its impact. There is a role for all sectors of society including the government, NGO community and the private sector in ensuring that the economic prosperity of Hong Kong is protected therefore.

Hong Kong's ability to remain as a world city will be in part a function of how it prepares for and adapts to climate change. It needs to be able to continue to provide a base for internationally competitive firms in the finance and business sectors as well as attract new investment. To do this, it will need to be able to train, attract and retain high quality human capital. If Hong Kong fails to address the impacts of climate change it can rapidly become an unattractive place to live and work impacting on the quality of the workforce available to employers.

If Hong Kong continues to want to be positioned as a world city it will have to demonstrate leadership on climate change issues. Located at the heart of a typhoon zone Hong Kong could position itself as a leader on climate change adaptation in the region as well. A new partnership between government,

civil society and business will be needed if Hong Kong is not to lose its global position and competitiveness to other locations less at risk from climate change.

This report outlines how Hong Kong faces huge changes as a result of the impacts of climate change. Adaptation measures must become a strategic priority for both government and the private sector if the full impacts are not to impact on the competitiveness of the economy.

Key recommendations of the report include:

1. The need for public education, community-based adaptation planning and incentives for businesses to put in place mitigation and adaptation measures.
2. The need for more research into the possible impacts of climate change on Hong Kong and the most cost effective adaptation strategies that should be put in place. Such research should include risk

Introduction

Greenhouse gases (GHGs) emitted in the last century are still present in today's atmosphere and are unlikely to be reabsorbed into oceans and forests until the middle of the 21st century. Yet we continue to add carbon dioxide to our environment at an increasing and alarming rate. Even if all emissions stopped today, carbon dioxide levels could take 50 to 150 years to reduce, during which time we will continue to experience the impacts of climate change. Since emissions are set to increase for some time we are clearly going to see accelerations in climate change trends requiring ongoing mitigation and adaptation measures.

If greenhouse gases are not drastically reduced, then the world faces a significant temperature change and potentially irreversible damage to the planet's ability to buffer extreme changes in our climate.

assessments of the impacts of climate change on all facets of society.

3. The need for the business community, in particular, to respond to both climate change risks as well as examine possible business opportunities by undertaking climate risks assessments, carbon foot-printing, developing climate change strategies and preparing a business continuity plan.
4. The need for Hong Kong to demonstrate a degree of leadership on climate change issues if it is to maintain its reputation for a high degree of competitiveness and innovation. Other parts of Asia have already developed more sophisticated plans than Hong Kong to date.
5. The need for government to convene a task force, which includes representation from business, civil society, the research community and climate change experts to begin to plan for climate change adaptation in Hong Kong.

Tackling climate change therefore requires mitigation measures that limit the magnitude of further climate change and avoid catastrophic consequences by reducing GHG emissions.

Yet, climate change is still inevitable and therefore there will also be a need for adaptation measures that can manage the challenges presented by changes in the climate that we will experience. Adaptation measures should not only take into account the need to prepare current infrastructure and assets and set in place protective measures such as flood barriers and sea walls. There is a need also to examine adaptation in the context of economic competitiveness, human health, ecosystem services and biodiversity.

This report examines the risks associated with climate change in Hong Kong and the types of adaptation that will be required.

The Hong Kong situation

The physical location of Hong Kong, surrounded by water, on traditional typhoon tracks and with a dense urban setting, makes it particularly vulnerable to climate change. Climate-related impacts on infrastructure in Hong Kong could be very costly, but it also needs to be recognized that the full effects of climate change will impact on human health, community cohesiveness, longer term economic values, competitiveness, biodiversity and the ability to recruit and retain talented human resources.

Figure 1 demonstrates that temperatures have been steadily rising in Hong Kong over the last

five decades. In post-war years from 1947 to 2007, the average rise amounted to 0.17 °C per decade. The warming at the Hong Kong Observatory Headquarters has become significantly faster in the period 1989 to 2007, at a rate of 0.34 °C per decade.

The increase in annual mean temperature can be attributed to global warming as well as local effects such as urbanization. In Hong Kong, the rates of temperature rise at Ta Kwu Ling (in the rural area of the New Territories) over the same period was smaller than the rise observed at the Hong Kong Observatory Headquarters, situated in the heart of an urban area (see figure 2).

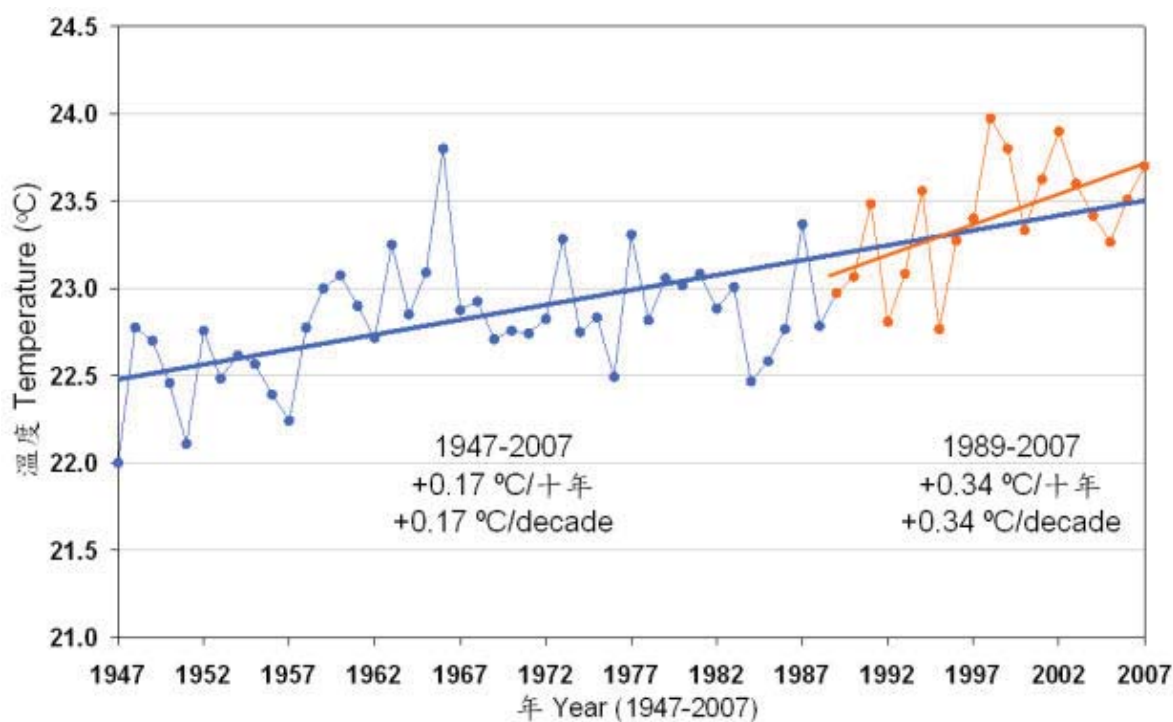


Figure 1: Annual mean temperature recorded at the Hong Kong Observatory Headquarters (1947-2007)
(Source : Hong Kong Observatory)

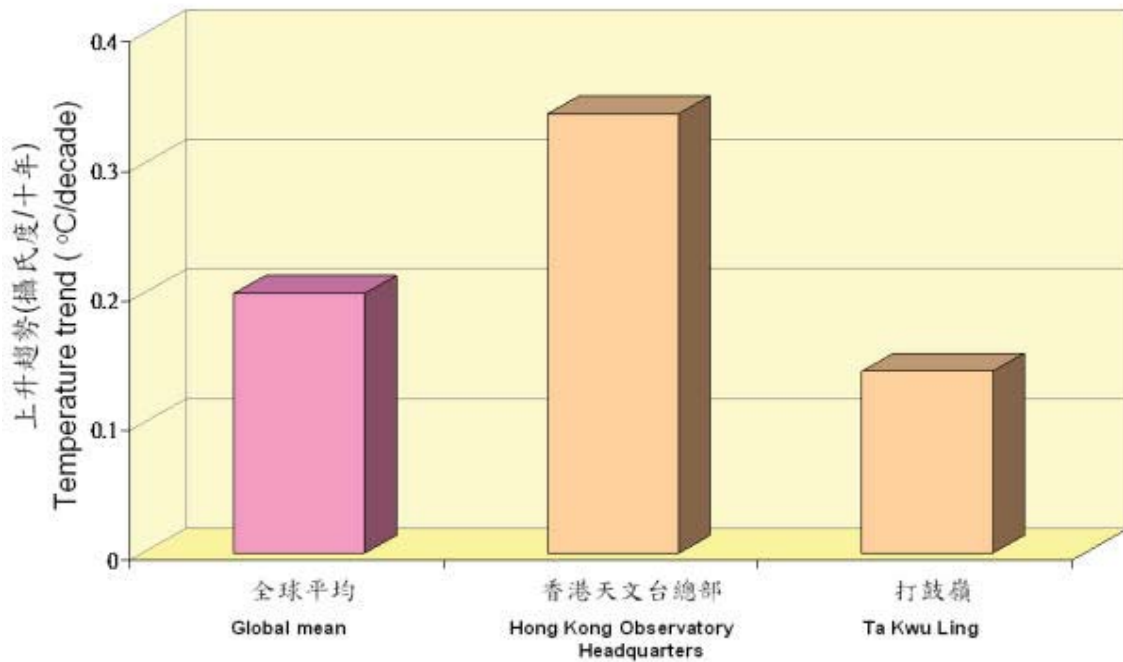


Figure 2: A comparison of temperature trends within Hong Kong (Source: Hong Kong Observatory)

Compared with the 1980-1999 average of 23.1 degrees C, the annual mean temperature in Hong Kong in the decade 2090-2099 is expected to rise by 4.8 degrees C according to the median projection. The corresponding low-end and high-end values are 3.0 and 6.8 degrees C respectively (see figure 3).

As for extreme weather, the annual number of hot nights (days with a minimum temperature of 28 degrees C or above) and very hot days (days with a maximum temperature of 33 degrees C or above) in summer will increase. On the other hand, the annual number of cold days in winter (days with a minimum temperature of 12 degrees C or below) will continue to drop.

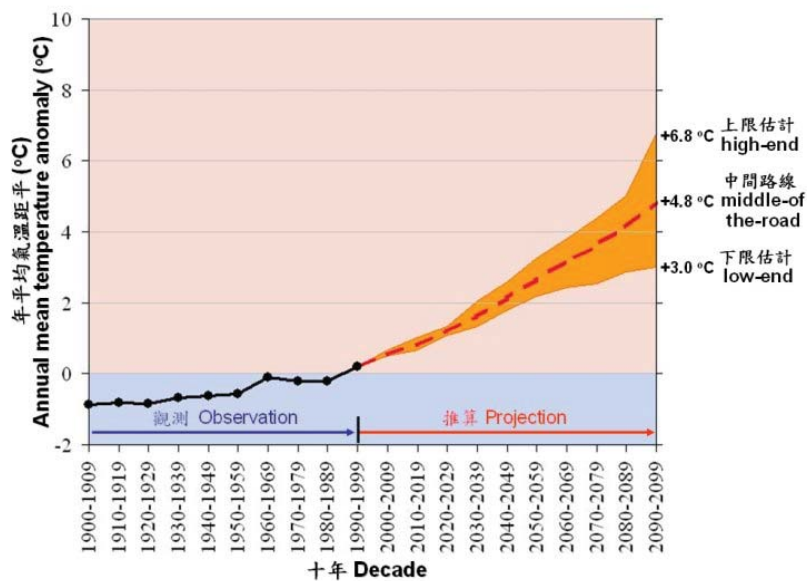


Figure 3: Past and projected annual mean temperature anomaly for Hong Kong (Source: Hong Kong Observatory)

Hong Kong's contribution to carbon dioxide emissions per capita is above the world's average, yet significantly below those to be found in places such as the USA and Australia. They are considerably higher than in China and much of the rest of Asia however (see Table 1).

Climate change will mean that Hong Kong will experience a warmer climate as reinforced by observations and scenarios developed by the Hong Kong Observatory. At times this will come with significantly more rainfall but Hong Kong will also face the risk of seasonal water shortages. Hong Kong will further experience a significant increase in the frequency and intensity of extreme weather events, such as heat waves, tidal surges, typhoons and very heavy rainfall. Sea levels will continue to rise for decades. The impacts of these changes on Hong Kong will be an increase to the risks of

flooding, droughts and dangerously hot weather. There will also be secondary and indirect impacts, including an increased risk of infrastructure damage, ground instability and landslides, and further increases in dangerously poor air quality periods. This will all impact on human health and quality of life. There will also be significant risks for the economy of Hong Kong.

It is important that Hong Kong begins to recognize the risks of climate change and puts into place both mitigation and adaptation measures now. Early anticipatory adaptation will be more effective and less costly than retrospective, emergency action. Although the scale of climate change risk is uncertain, it is increasingly clear that like many of the world's leading cities, Hong Kong faces huge changes as a result of climate change and that adaptation measures must become a strategic priority.

Location	Per capita carbon dioxide emissions (Metric tons)	
	1990	2004
World	4.10	4.32
Hong Kong	4.59	5.36
China	2.09	3.84
USA	18.83	20.40
European Union (15)	8.60	8.42
Japan	8.67	9.84
Indonesia	1.17	1.67
Bangladesh	0.17	0.25

Table 1: Carbon dioxide emissions per capita in selected locations
(Source: UNSD Millennium Development Goals Indicators database)

Extreme weather events

Hong Kong experiences extreme weather events on a regular basis and these are set to become both more frequent and more damaging. In the South China Sea, the annual number of tropical cyclones landing over the south China coast within 300 km of Hong Kong in the past 40 years (1961 to 2007) has slightly decreased from about 3 tropical cyclones in the 1960s to about 2.5 in the 1990s, at a rate of about 0.18 per decade which was not statistically significant¹. However, 2008 saw five typhoons. Prediction of how global warming may affect the frequency, intensity or tracks of tropical cyclones is highly uncertain.

But most observers do suggest that climate change will definitely impact on the frequency, intensity and the duration of extreme weather events including heavy rainfall, high temperatures, tidal surges and typhoons. Rainfall is set to increase substantially in the coming decades. Rainfall may indeed double in zones such as Hong Kong during the traditional wet seasons. But there are also likely to be increased periods when it does not rain and this could become associated with regular droughts. Temperatures are set to increase substantially and will result in serious harm to the environment, biodiversity and human health. Climate change will increase

the frequency and height of tidal surges, increasing the likelihood of coastal damage and flooding to low lying areas of Hong Kong. Much of this is inevitable. However, climate scientists are now much more worried that continued warming of the planet may lead to so called 'runaway' effects such as the release of methane (which is a twenty times more powerful GHG than carbon dioxide), the die back of forests that are crucial in trapping carbon dioxide and a reduction in sea ice which acts as a heat natural reflector. Further warming could see the disintegration of the West Arctic ice sheet which would result in sea levels rises of 5 metres and the disintegration of the Greenland ice sheet that could result in sea levels rises of 7 metres. In such circumstances much of Hong Kong's valuable real estate would be under water.

There is general consensus that in order to prevent catastrophic climate change the rise in global annual average temperatures should not exceed 2 degrees C, which means, in turn, that carbon dioxide levels must not exceed 450 parts per million (ppm). Many climate scientists believe that stabilization at 450ppm is now impossible and that even 550ppm may be unattainable without drastic mitigation which is unlikely. This further emphasizes the need for adaptation measures.

Flooding

Hong Kong is vulnerable to flooding in low lying areas and the threat of increased flooding will increase as the climate changes. Flooding is likely to come from sea surges and tidal flooding as sea levels rise, from heavy rain overcoming drainage systems and from rising groundwater. It is possible for a combination of these flood sources to occur simultaneously.

The consequences of flooding have the potential to be serious and include:

- Loss of life, personal injury and water borne diseases
- Contamination of water sources and degradation of soils
- Direct damage to property, infrastructure and utilities
- Loss of income and working days and associated economic impacts
- A break up of communities in some areas
- Increased costs and need for insurance

¹ The Hong Kong Observatory. 2004. Technical Note No. 107 – Climate Change in Hong Kong.

For Hong Kong it will be important to assess the line of flood defences that may be required and to put in place improved flood management systems. Barriers to flooding and the storage and discharge of flood water needs to be considered. Future planning will need to fully take into account the increased risks of flooding. The efficiency of flood response measures and the ability to recover after a flood are central in limiting the human and economic consequences of flooding.

An important adaptation focus required to deal with flooding will be the capacity to deal with flood waters in dense urban areas. This should

begin with an urban greening programme to create and enhance permeable green spaces, examine the increased use of permeable materials, increase street tree cover and improve drainage systems. Hong Kong's developers should be expected to contribute to flood prevention through their building designs as well as contribute to the proper development of areas around their developments which would benefit both building users as well as the community. Considering the effects of urban developments on floods and designing with emergency response in mind will become increasingly important.

Water availability

Southern China has traditionally had enough water to satisfy its needs, yet we have seen periods of drought and these are set to continue. Hong Kong will need to develop a long term water strategy to balance both water demand and water supply in order to achieve a sustainable water management. In particular, a new emphasis on preventing

water mains leakage, tapping into alternative water sources, tackling the demand for water through behavioural changes and economic incentives and promoting water efficiency will be needed.

Hong Kong's rainfall is traditionally highly variable as Figure 4 demonstrates.

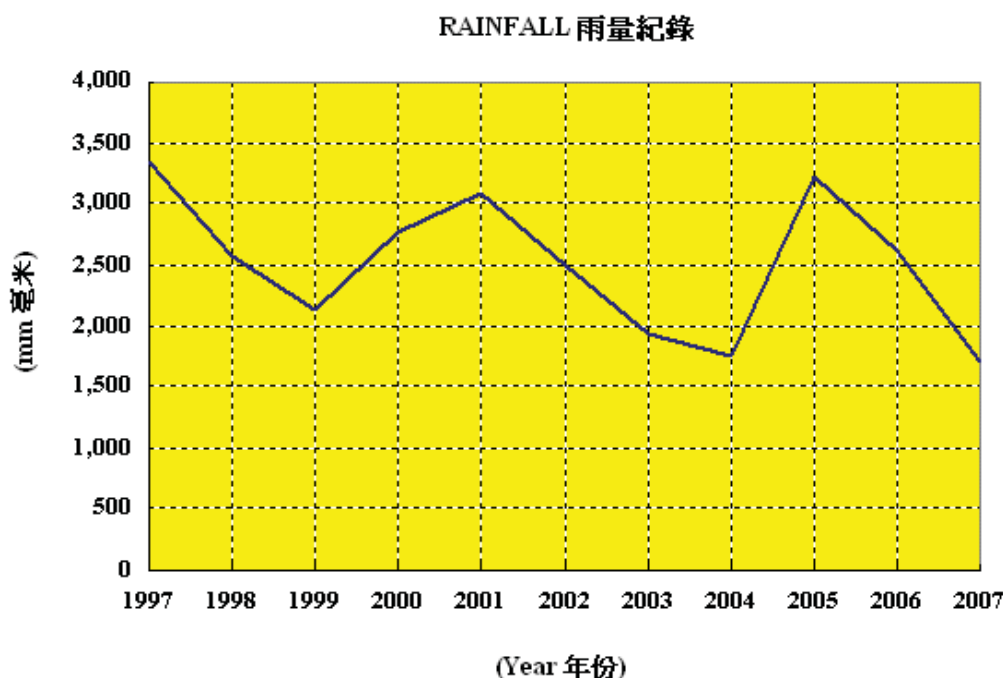


Figure 4: Changes in rainfall in Hong Kong (Source: Water Supplies Department, HKSAR)

Climate change is expected to affect water availability through changing river and stream flows, reducing groundwater levels, increasing evaporation, increasing accidental loss of water through extreme weather events causing soil shifts and broken water mains and increased demand for water in hot periods by people, other animals and plants. It is not going to be possible to avoid droughts in the future. However, it is possible to reduce the potential impacts of droughts through adaptation measures that reduce the impact of the drought and reduce the need for emergency drought measures.

In Hong Kong, water demand (both fresh water and salt water) has increased substantially over the last two decades. This increased consumption is linked to the purchase of more water consuming devices in the home, smaller household units, increased use of water linked to health and hygiene and a substantially increased water use by the private sector (mainly in offices, restaurants, hotels, health and leisure clubs and shopping malls). In order to avoid running out of water there will be a need to control demand as well as preserve supply.

According to OECD, 2008 estimates, per capita water extraction is relatively low in Hong Kong at 141 cubic metres. This compares with 438 cubic metres in China, 1730 in the USA, 890 for the OECD as a whole and 250 in the UK. However, this is explained by the fact that Hong Kong only has a very small agricultural sector where water use is often enormous. On the other hand, the personal consumption of water (for drinking, bathing, clothes washing

Heat waves

The number of extremely hot days is set to increase substantially in Hong Kong as a result of climate change. Hot weather will become more frequent and more intense. This has the potential to cause deaths, severe health problems and economic losses through damage to infrastructure (e.g. buckling rail lines and melting road surfaces), work day

and other domestic activities) is relatively high at 127 litres per capital per day² compared with an Asian average of 85 litres and 47 in Africa³.

Central to water efficiency is a need to substantially increase water use efficiency through water charging that reflects the true value of water, tightening up water efficiency standards in new developments, retrofitting improved water efficiency standards into existing developments and changing consumer behaviour to conserve water.

Hong Kong will also have to carefully examine the supply side of the equation as well. Extracting more water from the environment is not a sustainable solution and therefore there will have to be a focus on effluent reuse, increased reservoir capacity, desalination and water harvesting opportunities.

Hong Kong's environment is very vulnerable to drought. Wetlands, rivers and streams, for example, can withstand some degree of seasonal fluctuation in rainfall, but a serious and prolonged drought will affect the ability of some species to survive. Moreover, the loss of key species can dramatically affect the composition of some habitats, having a knock-on effect to other species.

Hong Kong will need a strategy to ensure that valuable water is not lost (e.g. through leaking pipes), to involve the household and commercial sectors in water efficiency and recycling measures, to increase the use of reclaimed water and to develop new water resources that help to protect the environment and biodiversity.

losses, increased water demand and increased energy demand for more cooling.

Heat waves do not have defined geographic boundaries (the way that floods do) and they are therefore much more difficult to manage. However, given that much of Hong Kong is urbanized it is important to factor in so-called

² International Water Association, 2008

³ Johns Hopkins University, School of Public Health, 2008

urban heat island effects. This concept describes the pattern of warmth distribution across different types of surfaces. Urban areas are characterized by much higher temperatures than rural areas surrounding them due to the modification of land surfaces and waste heat generated by energy use. The dense nature of much of Hong Kong's urban areas is highly susceptible to heat waves and consequent impacts on human health.

Buildings and other concrete surfaces in the urban areas retain the heat produced by incoming solar radiation during the day and release the heat in the form of long-wave radiation during the night. High-rise buildings also inhibit the transfer of long-wave radiation to the atmosphere. This results in a slower fall of temperatures at night and a higher minimum temperature than when buildings were absent.

The temperature of the urban heat island is related to the types of material the surface is composed of and the orientation of the sun. Dry, dark coloured surfaces absorb solar radiation and heat up much more quickly than pale, wet or reflective surfaces. This has obvious policy implications.

Even within urban heat islands, temperatures will also differ, with heat increasing towards the centre of urban areas. Temperatures in urban areas can easily be 3-5 degrees C above outlying rural areas, but at times of long heat waves this can rise to 10 degrees. In Hong Kong, urban heat island effects are exacerbated by traffic and air conditioning systems. And as the heat rises so cooling systems add to the problem.

Prolonged periods of very high temperatures, particularly when night time temperatures remain high, have significant impacts on human health. It is highly likely that as a result of heat waves Hong Kong will experience increasing discomfort levels, illnesses and even deaths. Particularly vulnerable will be the very young and the elderly who are often unable to deal with very high temperatures. Women will be more vulnerable than men because of a higher core body temperature

that may affect menopause. Those with pre-existing diseases such as heart and respiratory disease, those taking certain types of medications and those with dementia will also be at risk.

Situational aspects will also be important when we examine the impacts of heat waves. Type of housing, condition of buildings, insulation, height of floor and aspect of the building all need to be factored in. But those living in poorer accommodation, those living in overcrowded conditions, those in workplaces impacted by higher temperatures and those in jobs requiring high levels of physical exertion will be most at risk.

Hong Kong is one of the most densely populated places in the world. The average population density as at mid-2007 stood at 6,410 persons per square kilometre, with urban Kwun Tong recording 51,790 persons per square kilometre, the most densely populated area among the District Council districts⁴. This is relatively high when compared with population density in other major cities such as Mumbai (29,650), Beijing (11,500), Tokyo (4,750), London (5,100), New York (2,050) and Sydney (2,100).

Heat waves also mean that there will be an increase in demand for energy for cooling. This, in turn, is likely to increase social inequity relating to those who live in poorly designed and overcrowded buildings, those unable to afford higher energy bills and those unable to protect themselves by installing blinds, awnings and cooling systems. There is a high likelihood of blackouts as a result of increased energy demand for cooling systems.

Heat waves also tend to increase the demand for water leading to an increased stress on water resources and possible water shortages. They will also cause damage to heat sensitive infrastructure including electrical systems, telecommunications systems and transport networks.

Most of the climate change models that have been developed to track changes in

⁴ Information Services Department, the Hong Kong Special Administration Region Government. 2008. Hong Kong: The Facts – Population

temperatures have not taken into account feedback effects from dense urban areas such as Hong Kong and therefore may underestimate the temperatures and the consequent problems associated with urbanization.

It is possible and crucial to start preparing for heat waves now. There are a number of structural measures that could be put in place to mitigate urban heat island effects. This includes incorporating green roofs and green walls into buildings, avoiding high glare

Health impacts

Climate change will impact on the quality of life and health of many people living in Hong Kong. Most importantly though, it has the potential to increase the social inequalities in the territory because it will have a disproportionately negative impact on those already experiencing poorer living conditions and poorer health. Ironically, it is expected that globally, increasing temperatures may, on average, improve people's health.

Increasing temperatures are likely to increase deaths from cardiopulmonary diseases. Heat-related illnesses such as heat cramps, heat exhaustion and heat stroke are all likely to increase. Climate change will also affect both the sources of air pollution and pollution mix in the atmosphere. Poor air quality combined with heat waves will increase death tolls amongst people with respiratory problems. Climate change is likely to increase air pollution during the hottest periods because higher temperatures will increase levels of ozone and will increase air stagnation and reduce pollution dispersal.

Increased freak weather events will increase morbidity and mortality. Floods and typhoons will have obvious direct impacts. However, they may cause other indirect impacts through contamination and disease from flood and sewer water and subsequent impacts on both physical and mental health. Mental health may be an under-considered aspect of climate

facades and finishings, planting more trees in urban areas to provide shade and ensuring that cooling systems vent waste heat above roof levels and take in air from cooler north sides or shaded sides of buildings. In addition, there needs to be a new emphasis on energy efficiency in buildings and more emphasis on preventing heat entering a building through shading and insulation. Ideally heat waves would be taken into consideration at the stage of land-use planning and developing urban growth strategies.

change. Significant evidence suggests that suicide attempts, post-traumatic stress disorder, depression and substance abuse all rise after severe weather disasters⁵.

Warmer temperatures may result in more people exposing themselves to ultra-violet radiation. The effect of this will be an increase in the numbers of skin cancers and cataracts. The incidence of malignant melanoma is also likely to lead to an increase in skin cancer deaths.

Climate change will also have an impact on food safety and hygiene. Higher temperatures will increase the risk of bacterial infections, increase contact between food and pests (particularly flies and cockroaches) and temperature-related changes in food preparation (especially outdoors) will increase various forms of food poisoning. Research indicates that a 1 degree Celsius increase in temperature might result in a 4.5 per cent increase in food poisoning⁶.

Higher temperatures will also increase perspiration and evaporation, so increasing the risk of dehydration. Older people and the young are most at risk. Amongst the elderly thirst responses decrease with age and involuntary dehydration increases. The young require more hydration to maintain their growth

⁵ UK National Health Service Confederation (2007), Taking the temperature: Towards an NHS response to global warming

⁶ UK Department of Health: Report on the Health Effects of Climate Change, 2008

and energy demands. Over time, dehydration impacts on mental health, causing anxiety irritableness, short attention spans, impatience and mild depression. It can in turn affect learning amongst the young and work performance amongst the working population⁷.

People working outside, engaged in heavy manual labour or working in poor indoor environments will experience increasing occupational health risks. Those who work in poor quality environments tend to be from lower socio-economic groups and who, on average, have worse health outcomes than other groups. Climate change is likely

Ecosystem services

Hong Kong actually has quite a diverse environmental portfolio, despite the common external perception that it is mostly urban. The quality and abundance of green space is surprising to many and allows people living in dense urban settings to explore a varied environment. But not only does this green space provide leisure services, it also provides a number of crucial ecosystem services that improve the quality of life of people living in Hong Kong. Yet, many of these services will be threatened by climate change.

Rural parts of Hong Kong and green areas within urban Hong Kong help to reduce flood risk by absorbing and retaining rainfall. They also moderate temperature through offsetting the urban heat island effect, help to reduce air pollution, protect biodiversity and provide spaces for recreational activities that can improve health.

However, there is a strong geographical divide between rural and urban Hong Kong and the density of the urban space with relatively few green spaces of significance means that there are considerable stresses put on ecosystem services inside the urban area.

Inside the urban setting more street trees, green roofs and green walls can help to reduce flood risk, offset the urban heat island

therefore to exacerbate these inequalities. Employers will have to be increasingly aware of these increased health risks and ensure that workers are provided with better quality work environments in many cases.

Climate change will disproportionately affect those living in poor quality and overcrowded homes. An aging housing stock, with severe overcrowding is one of Hong Kong's most pressing housing problems. People living in poor-quality housing and overcrowded conditions are also more likely to be living in areas with limited access to green spaces, unattractive streetscapes and lower air quality.

effect, reduce energy demand and support urban biodiversity. In rural areas the protection and enhancement of wetlands, woodlands and grassland will substantially reduce flood risk (of both rural as well as urban areas), support biodiversity and enhance recreation and leisure activities.

The challenge is therefore to protect the green spaces that do exist and to try to create more green spaces in urban settings. The proper management of existing spaces is a good starting point and this has generally been done well in Hong Kong. However, within urban areas there is a need to increase green space, even where there is no apparent space for greening the city (through, for example, more street trees, green roofs and green walls).

New and existing green spaces, particularly in urban settings, need to be designed with functionality in mind (for example, water absorption and retention and flood prevention). Many ecosystem services provided by green spaces would be enhanced through improved connectivity. New green spaces need to be designed to improve links between new and existing spaces for improved ecosystem services and wildlife migration.

Hong Kong is host to a number of important wetlands that have generally been protected

⁷ Foltz and Ferrara (2006) *Dehydration's Hidden Symptoms*, The Chiropractic Journal

well due to their importance locally and globally. However, wetlands are particularly sensitive to changes in the flow of water, water temperature and water chemistry, which can, in turn, affect species distribution, spawning

and flowering. Floods, droughts and pollution can have severe impacts on sensitive populations to be found in wetlands and the likelihood of these are all increased by climate change.

Economic impacts of climate change and a role for the private sector

Hong Kong is particularly vulnerable to climate change because of the agglomeration of people and assets in a small area. Hong Kong is also highly dependent on importing food, water, energy and products for the territory to thrive. All these facets of life in Hong Kong will be impacted by climate change and there is therefore a need for Hong Kong to become more resilient to the full impacts of climate change over coming decades. Unless it builds this resilience it will easily lose its competitive advantage as both people and businesses move to alternative destinations.

Hong Kong's position as a world city could easily be undermined unless it not only tackles climate change but also takes on a leadership role, providing the skills that the world needs to cope with a changing climate. There is a role for all sectors of society including the government, NGO community and the private sector in ensuring that the economic prosperity of Hong Kong is protected therefore.

Hong Kong's ability to remain as a world city will be in part a function of how it prepares for and adapts to climate change. It needs to be able to continue to provide a base for internationally competitive firms in the finance and business sectors as well as attract new investment. To do this, it will need to be able to train, attract and retain high quality human resources. In achieving this, Hong Kong will have to be able to invest in developing the quality of life it offers to its residents and current and future workforces.

Hong Kong is ranked the seventh most vulnerable megacity on a natural hazards risk

register for the world's 50 megacities⁸. Most risks are weather related and include tropical storms, flooding and sea level rises. Only Tokyo, San Francisco, Los Angeles, Osaka, Miami and New York rank above Hong Kong in terms of risks and in many cases this is because they have a high risk of earthquakes.

In the context of the many facets of climate change identified above, Hong Kong will need to ensure that it is seen as a safe and secure place to do business. It will have to identify its main risks associated with climate change and to begin to work on them now. It should take its world city status seriously and demonstrate leadership in mitigating and adapting to climate change.

One of the most important business sectors in Hong Kong is the financial services sector. This sector is hugely exposed to climate change because of its links to assets that are put at risk by climate change. One problem is that the impacts of climate change are beyond the time horizons upon which many of these businesses base their decisions. Yet, taking action now will reduce risks later. This is something that many companies currently fail to grasp adequately.

Of course, different segments of the financial services sector will experience differing risks and opportunities. Assets vulnerable to climate change risk losing value and fund managers may be held accountable for not considering climate change impacts sooner. The insurance sector has a clear role to play in climate change risk management. Weather-related insurance claims have risen steadily over

⁸ Munich Re (2004) Megacities: trends and challenges for insurance and risk managers

the past decade and are set to continue to do so. Many more assets are going to become uninsurable, however.

Both life insurance business and general insurance business are exposed to climate change risks through the people and assets that they insure and the portfolio of assets they own to pay for insurance claims. General insurers face two key risks. Firstly, an increase in the number of claims being made due to changes in the frequency, intensity and location of extreme weather events. Secondly, a potential devaluation of the capital assets they own to pay out on claims. Both put significant pressure on the sector meaning that insurers may decide not to provide cover for certain risks, may decide on the need to raise premiums which some people may not be able to afford, may raise excesses on certain risks, leaving some people still vulnerable and require those seeking insurance to take steps to reduce the risk of making a claim through mitigatory actions.

Apart from finance, Hong Kong is a large logistics hub with international trade the bedrock of many of its activities. Climate change will significantly impact on this sector both directly and indirectly as supply chains become more vulnerable.

Hong Kong's skyline might be part of its world city status but it also poses a risk as freak weather incidents, sea levels rises and flooding begin to impact real estate. There are therefore huge implications for building design, construction, maintenance and facilities

Conclusions and recommendations

It is urgent that Hong Kong recognizes the risks of climate change and puts into place both mitigation and adaptation measures now. Early anticipatory adaptation will be more effective and less costly than retrospective, emergency action. Although the exact ramifications of climate change risk remain uncertain for Hong Kong, it is increasingly clear that like many of the world's leading

management. However, many of the buildings most at risk from climate change are old, poorly managed and home to some of the most disadvantaged groups.

Businesses will also be impacted by many of the human dimensions associated with climate change. If Hong Kong fails to address the impacts of climate change it can rapidly become an unattractive place to live and work impacting on the quality of the workforce available to employers. But climate change may also be associated with changing lifestyles, changing patterns of consumer demand and changing expectations on the part of a wide range of stakeholders on the activities of business in the territory.

If Hong Kong continues to want to be positioned as a world city it will have to demonstrate leadership on climate change issues. Located at the heart of a typhoon zone, Hong Kong could position itself as a leader on climate change adaptation in the region as well. A new partnership between government, civil society and business will be needed if Hong Kong is not to lose its global position and competitiveness to other locations less at risk from climate change.

The business community, in particular, needs to respond to both climate change risks and possible business opportunities by undertaking climate risks assessments, carbon foot-printing, developing climate change strategies and preparing a business continuity plan.

cities, Hong Kong faces huge changes as a result of the impacts outlined in this report. Adaptation measures must become a strategic priority for both government and the private sector if the full impacts are not to impact on the competitiveness of the economy.

Levels of awareness in Hong Kong in relation to climate change remain relatively low. There

is a need for public education, community-based adaptation planning and incentives for businesses to put in place mitigation and adaptation measures.

Businesses need to recognize the key role that they can play in supporting climate change adaptation in Hong Kong. They need to take ownership of the specific climate risks faced and start developing adaptation measures that contribute to risk mitigation.

There is a need for more research into the possible impacts of climate change on Hong Kong and the most cost effective adaptation strategies that should be put in place. Such research should include risk assessments of

the impacts of climate change on all facets of society.

There is also a need for Hong Kong to demonstrate a degree of leadership on climate change issues if it is to maintain its reputation for a high degree of competitiveness and innovation. Other parts of Asia have already developed more sophisticated plans than Hong Kong to date.

Since it is important that all parts of society work together, the government needs to convene a task force, which includes representation from business, civil society, the research community and climate change experts to begin to plan for climate change adaptation in Hong Kong.