PARIS WATCH 2021

HONG KONG CLIMATE ACTION REPORT

Hong Kong's Contribution To The Paris Agreement Goals

URGENT CALL FOR ENHANCED AMBITION

PARIS WATCH

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Abbreviations

AIRIA	Automobile Inspection & Registration Information Association, Japan
AR5	Fifth Assessment Report of IPCC
AR6	Sixth Assessment Report of IPCC
C40	C40 Cities Climate Leadership Group
CBI	Climate Bonds Initiative
CCA	Carbon Care Asia
CCIL	Carbon Care InnoLab
CDP	Carbon Disclosure Project
CLP	China Light and Power Group (Hong Kong)
CNG	Compressed Natural Gas
COP26	The 26th United Nations Climate Change Conference of the Parties
COVID-19	Coronavirus Disease of 2019
CSD	Census and Statistics Department, HKSAR
ENB	Environment Bureau, HKSAR
EF	Energy Foundation, China
EMA	Energy Market Authority, Singapore
EMSD	Electrical and Mechanical Service Department, HKSAR
EPD	Environmental Protection Department, HKSAR
ESG	Environmental, Social and Governance
ETHZ	Singapore-ETH Centre
EV	Electric Vehicle
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GPA	Government Property Agency, HKSAR
GMPG	Guangzhou Municipal People's Government
HKE	Hong Kong Electric Investment Group
HKJCDPRI	Hong Kong Jockey Club Disaster Preparedness and Response Institute
HKMA	Hong Kong Monetary Authority
HKSAR	Hong Kong Special Administrative Region of People's Republic of China
ICLEI	International Council for Local Environmental Initiatives (usually known as Local Governments for Sustainability)
IEA	International Energy Agency
IPCC	United Nations Intergovernmental Panel on Climate Change
KEPCO	Korea Electric Power Corporation
LTA	Land Transport Authority, Singapore
MEE	Ministry of Ecology and Environment, People's Republic of China
MLIT	Ministry of Land, Infrastructure, Transport and Tourism, Japan
MOLIT	Ministry of Land, Infrastructure and Transport, Republic of Korea
NCCS	National Climate Change Secretariat, Singapore
NDC	Nationally Determined Contributions
NPTD	National Population and Talent Division, Singapore
OECD	Organisation for Economic Cooperation and Development
PBC	People's Bank of China
PD	Planning Department, HKSAR
PV	Photovoltaic
RVD	Rating and Valuation Department, HKSAR
SFC	Securities and Futures Commission, HKSAR
SMG	Seoul Metropolitan Government
SMPG	Shenzhen Municipal People's Government
SR15	IPCC's Special Report on Global Warming of 1.5°C
SSP	Shared Socio-economic Pathways[1]
SZDRC	Development and Reform Commission of Shenzhen Municipality
TEPCO	Tokyo Electric Power Corporation
TMG	Tokyo Metropolitan Government
URA	Urban Redevelopment Authority, Singapore

CONTENT

INTRODUCTION

This is the third annual report assessing the Hong Kong SAR's performance against the goals of the Paris Agreement. The Paris Watch Hong Kong Climate Action Report 2021 examines progress against the same five questions we have asked since 2018 and continues to seek comparisons between climate action in Hong Kong and nearby cities in East Asia. We also take stock of global trends and developments relevant to the implementation of the Paris Agreement.

In spite of the big gap between the NDCs and the Paris Agreement targets, COP26 parties have continued to increase the ambition level towards achieving commitments necessary to holding temperature rise to within 1.5 degree Celsius (1.5°C) above pre-industrial levels. The IPCC's Sixth Assessment Report (AR6) describes the next ten years as a narrow window of opportunity to avert a climate crisis. The IPCC estimates that without deeper action, the world is likely to reach 1.5°C temperature rises in 11½ years.

This report summarizes the key results from the UN COP26 climate talks held in November 2021 that are relevant to tracking and comparing the performance of Hong Kong and the selected East Asian cities against Paris Agreement targets. We conclude that Hong Kong needs to substantially step up its ambition in order to play its part in averting a deeper climate crisis.

EXECUTIVE SUMMARY

The Hong Kong SAR Government released “Hong Kong’s Climate Action Plan 2050” (the Plan) on 8 October 2021, setting out plans for achieving the goal of carbon neutrality before 2050. The Plan announces a target to reduce 50% GHG emissions by 2035 from 2005 levels, and includes a number of carbon reduction and energy saving measures and sub-targets related to electricity generation, transport, building and waste. While these targets are welcomed, these plans do not set a clear and calibrated decarbonisation pathway towards carbon neutrality before 2050.

> In addition, the plans fail to address the 10-year window prescribed by the IPCC by setting a revised 2030 carbon reduction target and a deeper pathway leading to it. Without raising ambition levels for 2030, it will be less likely that the 2050 net zero goal will be achieved.

Our estimation echoes a global projection[2] that emissions from Hong Kong should be reduced by 60% by 2030, rather than 2035, from 2005 levels. Hong Kong should heed the call for enhanced ambition to set a more realistic pathway to achieving net-zero emissions in 2050, and to use less of the global carbon budget between now and that point.

The ambition in the most critical areas of energy efficiency and renewable energy uptake is insufficient. There is little analysis showing how these measures and sub-targets in the Plan add up within each sector or combine across all sectors to achieve overall reduction targets. With the availability of the research on renewable energy potential, Hong Kong should be able to set a higher target. In addition, making all energy saving measures in buildings and transport both mandatory and comprehensive are necessary steps towards improving the targets in both sectors.

Climate adaptation action plans contain a mix of engineering projects, heavy with self-congratulation for past initiatives as well as ongoing efforts, but with little evaluation and reflection on any weaknesses or areas for improvement despite this being a vital area of public safety.

The Plan must be an integrated strategy putting people at the centre of the process. The process of just transitioning to avoid the social and human impacts of the climate crisis and climate action must be acknowledged and prioritised. There are better examples of adaptation plans adopted by other cities in East Asia, that demonstrate good practice in transparency, accountability, monitoring and evaluation.

A credible climate action plan needs to include clear KPIs, regular and frequent milestones, costings, financing details, governance and decision-making mechanisms, as well as monitoring, reporting and verification plans. Details of how different elements such as the interrelationship of renewable energy strategies with energy savings targets should make use of scientific models such as Integrated Assessment Models. Without a more rigorous, scientific plan we foresee uncertainties and challenges facing Hong Kong's journey towards becoming a safe, net-zero city. Hong Kong businesses need clear and consistent signals from the government setting out the challenges and opportunities related to Hong Kong's transition to a climate-ready, low carbon future.

METHODOLOGY

The analysis of climate action by Hong Kong and selected East Asian cities – namely Seoul, Singapore, Tokyo, Shenzhen and Guangzhou – is based on a mix of quantitative and qualitative indicators required by our five key questions.

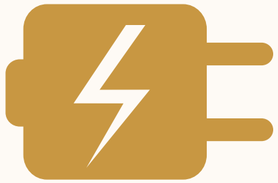
It is noted that the comparisons between the selected East Asian cities are limited by the availability of relevant data in the public domain. Therefore, not all cities can be included in comparisons for each of these questions.

1

The question, "Is Hong Kong on track?" requires a year-on-year comparison of current and projected carbon emissions as well as a comparison across Hong Kong and other East Asian cities. This relies on quantitative measurement of annual carbon emissions by the environmental authorities of each city. As well as absolute carbon emissions, based on the pledges by cities' governments, we also compare per capita carbon emissions and carbon intensity for each dollar of GDP. We contrast Hong Kong's pledge with the carbon budget necessary for the 1.5°C scenario set out by the IPCC scientists in AR6.

2

The question, "Are we transitioning to a low carbon economy by developing renewable energy?" requires a year-on-year comparison of the percentage of renewable energy in the energy mix and a yearly comparison across selected East Asian cities. A comparison of carbon intensity of electricity generation across years and across cities also reveals the actual impact of energy production, especially whether deployment of renewable energy is reducing carbon emissions. This primary data is available from energy authorities of the city governments and electricity generation companies.



3

The question is:"Are we using energy more efficiently in Hong Kong?" There are two principal areas of energy consumption in cities like Hong Kong, namely buildings and transport. For buildings, we compare the energy consumption per floor area in both commercial and residential buildings on a year-on-year basis and across cities. For the transport sector, we compare the percentage of new energy vehicles, including electric vehicles, hydrogen-fuelled, hybrid-fuelled and CNG-fuelled vehicles, on year-on-year basis and across cities in order to measure the take-up of such vehicles. This primary data is available from the transport authorities of the cities' governments and electricity generation companies.

4

The question, "Are we adapting to make Hong Kong a safe and healthy city in the face of global heating?" requires reporting against a mix of indicators, covering seven key areas we have identified as essential for adaptation to climate change hazards. These comprise: heatwave-induced illness; heat and precipitation related vector-borne diseases; water shortages and drought; increased fire risk; sea level rise, sea flooding and coastal erosion; typhoons, flooding and landslips; and reduced biodiversity and damage to ecosystems. To assess this, we have checked the availability of related research, public engagement activity and monitoring, evaluation and verification systems. We also make reference to rating or ranking of climate adaptation by other research agencies.

5

The question, "Are we developing the right governance and financial systems to tackle climate change?" requires reporting against a mix of indicators, covering five areas of climate governance: political leadership; policies and plans; transparency, accountability, monitoring and evaluation; advancing climate finance; and international cooperation. To evaluate progress, we check the availability of explicit elements of these activities in the cities' climate strategies and action plans.

PARIS AGREEMENT PROGRESS[3]

The combined GHG reduction pledges made by countries committing to the Paris Agreement before and during COP26 in Glasgow, known as their “nationally determined contributions”, or NDCs, show that these will not be large enough to keep the global temperature rise within the 1.5°C limit by the end of this century.

As the Figure 1 (page 12), combining all the current policies and climate actions, the global average temperature will likely rise by 2.7°C or even more by 2100. Even if we count all the NDCs and pledges made towards 2030, it is still likely that the temperature rise will reach at least 2.4°C. However, temperature rises will only be limited to these figures if all these NDCs and pledges are fully implemented.[4] If we still aim at keeping the temperature rise within 1.5°C by 2030 there is an emission gap of 19-23 $GtCO_2$-e.Therefore, COP26 parties resolved to demand enhancement of the NDCs and pledges towards 2030, and requested a review of carbon reduction targets and plans in the 2022 COP27 meeting to be held in Egypt, rather than five years later.

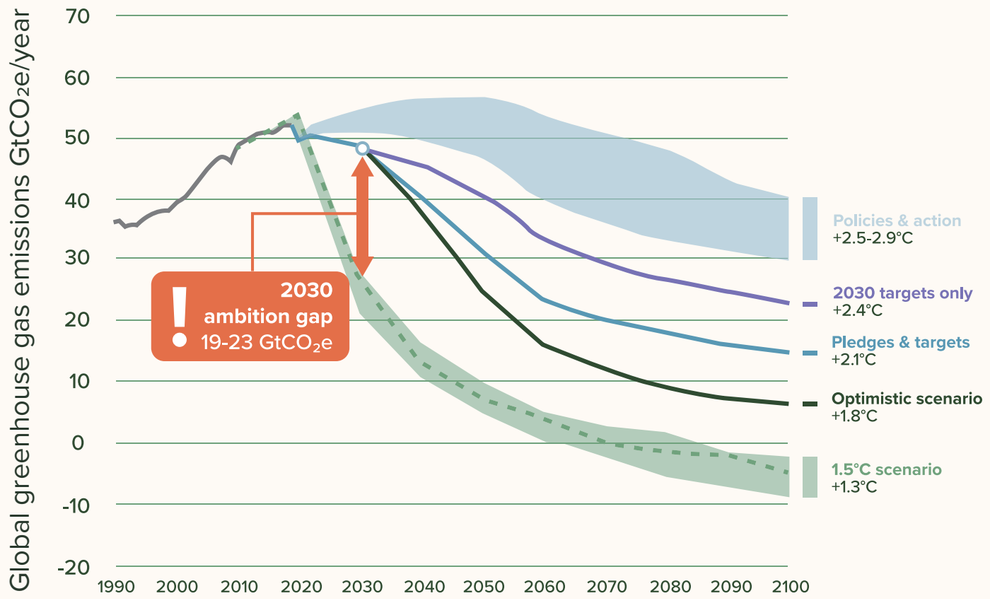
COP26 parties recognised that “the impacts of climate change will be much lower at the temperature increase of 1.5 °C compared with 2°C.” and also recognised that “limiting global warming to 1.5°C requires rapid, deep and sustained reductions in global greenhouse gas emissions.”[5]

Therefore, they resolved to demand enhancement of the NDCs and pledges towards 2030, and requested a review of carbon reduction targets and plans in the 2022 COP27 meeting to be held in Egypt, rather than five years later.

According to the Global Carbon Project,[6] in 2021, the global energy-related CO_2 emissions are projected to rebound by at least 4.9% from 2020 level, back to pre-pandemic levels as demand for coal, oil and gas rebound with the economy and a global energy crunch occurred in the latter half of the year.

Phasing out coal-fired power is a key step towards greenhouse gas reduction. COP26 parties resolved for the first time to reduce coal-fired power but could not reach consensus on cancelling fossil fuel subsidies and phasing out coal power altogether. The proposed wording on these issues was weakened to a call to “phase down unabated” coal use and to “phase out” “inefficient” fossil fuel subsidies.

Figure 1. 2100 Warming Projections
Emissions and Expected Warming based on Pledges and Current Policies



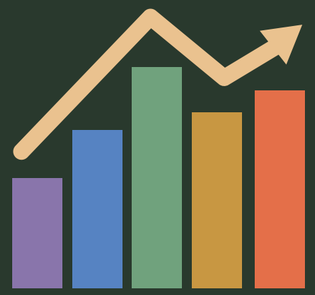
(Source: Climate Action Tracker)

On climate finance, richer nations failed to raise the US$100 billion annual Green Climate Fund they promised to provide to vulnerable countries by 2020. It is now expected the gap in funding will only be filled in 2023. COP26 also saw a failure to agree a funding mechanism for loss and damage, which refers to reparation for the unavoidable impacts of climate change, from flooded villages to drought-stricken farms. The debate on loss and damage will be extended to COP27 to be held in 2022.

Article 6 of the Paris Agreement[7] covering international trade in emissions reductions, offers a path to increase climate ambition, engage the private sector and increase finance, technology and expertise into new mitigation initiatives. COP26 parties finally reached a deal that covers the global carbon market, and decided that adaptation finance from a "share of proceeds" of trade in emissions cuts would derive from some parts of Article 6. COP26 also settled another outstanding aspect of Article 6 by reaching agreement on rules that closed off the "double counting" of emissions cuts by two parties for carbon offsetting projects.

In the financial year 2019/20 global funding for climate change adaptation was only 7.3% of total annual climate finance.[8] The lower attention previously paid to climate change adaptation rather than mitigation did receive attention at COP26. The lack of funding risks there being a poor understanding of the necessary actions required and consequently poor adaptation plans and targets.[9]

Considering these latest developments at COP26, the HKSAR Government should take proactive steps in aligning its climate action plan with international practice. The HKSAR Government should review their climate action plan and targets every year. They should also phase out subsidies for fossil fuel and look to take advantage of opportunities in carbon market mechanism in line with decisions on Article 6 of the Paris Agreement. Finally, as an international financial hub, Hong Kong should also seek to contribute to global finance for climate change adaptation and loss and damage mechanism.



CLIMATE ACTION
REPORT ANALYSIS

IS HONG KONG **ON TRACK?**

As the HKSAR Government reported in its recently published "Hong Kong's Climate Action Plan 2050"[10] , per capita emissions in 2020 were tentatively measured at 4.5 tCO2-e (the final figure is due to be released in 2022). This is a substantial reduction from 5.3 tCO2-e in 2019, indicating a 15% drop. Taking into account a slight decrease (0.35%) in population, absolute emissions were estimated at 33,634 kg CO2-e, and the carbon intensity at 0.012 kg CO2-e per HK$1 of GDP.

Table 1. Comparison of Carbon Intensity, Per Capita Emissions and Absolute Emission of Hong Kong SAR between 2005, 2019, 2020 data and 2030 target

Year	Carbon Intensity (kg CO_2-e per HK Dollar GDP)	% Reduction comparing to 2005	Per capita emissions (tonnes CO_2-e)	% Reduction comparing to 2005	Absolute Emission (kt CO_2-e)	% Reduction comparing to 2005
2005	0.022	-	6.1	-	41,300	-
2019	0.014	-36%	5.3	-13%	40,100	-3%
2020	0.012*	-45%	4.5*	-26%	33,634*	-18.6%
2030 (Target)	0.007	-65-70%	3.3	-46%	26,432	-36%

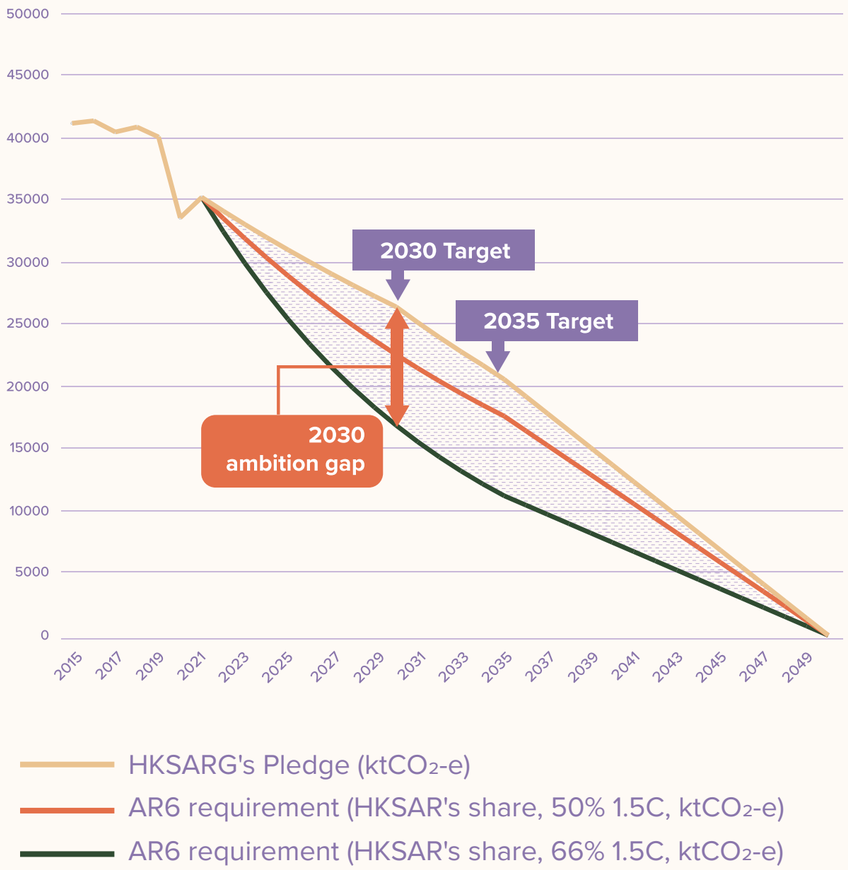
*Source: HKSAR Environment Bureau, with provisional official data (2020) and its estimates**

Comparison with HKSAR's own targets

The intensity figure misses the first-ever carbon reduction target set out in the "Hong Kong Climate Change Report 2015,"[11] where Hong Kong's carbon intensity should have been reduced by 50-60% by 2020 from its 2005 level. In the end, it was only reduced by 45%. To demonstrate accountability, this should have been reported in the Climate Action Plan 2050, but the HKSAR government failed to do so. This sends a worrying signal. Climate action requires transparency and accountability for it to succeed, and there is no place for selective public relations exercises in such a serious undertaking.

That said, the overall emissions reductions are basically on track to meet the HKSAR government's own stated 2017 target in the "Hong Kong's Climate Action Plan 2030+"[12] to reduce carbon intensity by 65%-70% by 2030 using 2005 as the base. The table above shows the progress Hong Kong has made in carbon reduction against these earlier targets.

Figure 2. HKSAR's Pledge vs. AR6 Carbon Buget

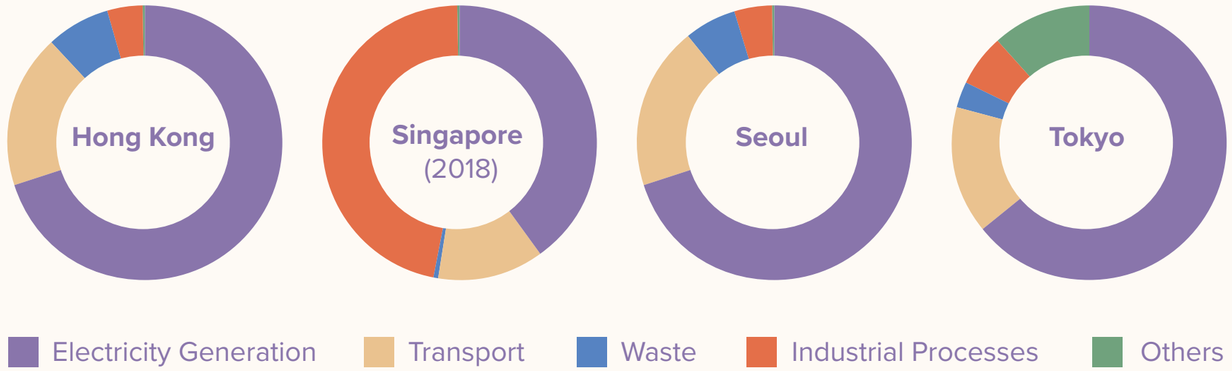


(Note: Calculations using the data from HKSAR Environment Bureau and IPCC's AR6)[13]

Comparison with IPCC AR6 carbon budget

In its Climate Action Plan 2050, the HKSAR Government followed up on the Chief Executive's pledge made in the 2021 Policy Address to "achieve carbon neutrality before 2050"[14] by setting a carbon reduction target for 2035. Total carbon emissions will be reduced by 50% before 2035 using 2005 emissions as the base. Unfortunately, the earlier target to reduce carbon intensity (per unit of HK$ GDP) by 65-70% by 2030 (using 2005 as base year) is retained in the new plan. We have calculated the potential cumulative carbon emissions created by these targets, and contrast this with Hong Kong's share[15] of the carbon budget[16] for both a 50% and 66% chance of avoiding 1.5°C temperature rise as calculated by the IPCC in their AR6 report. As shown in Figure 2, we found that the carbon reduction target will slightly exceed the budget needed for a 50% chance of avoiding 1.5°C, and is considerably above the emissions limit for a 66% chance of meeting the global goal. In other words, the new pledge heads towards achieving the 1.5°C temperature rise limit with a 50% or lower probability. If Hong Kong wants to raise the probability, the government should reach at least a 60% reduction by 2030 from the 2005 level. This also aligns with the proposal of Paris Watch Hong Kong Climate Action Report 2020, which set the Science-Based Target at 2.03 tCO_2-e per capita (or 16 $ktCO_2$-e in total) in 2030. The reduction curve should be much steeper than the HKSAR government currently presents in order not to overshoot the carbon emissions budget between now and 2050. The HKSAR Government could remedy this by enhancing its ambition in an annual review.

Figure 3. Greenhouse Gas Emissions by Sector (2019)



(Source: EPD (HK), NCCS (Singapore), SMG (Seoul), TMG (Tokyo))

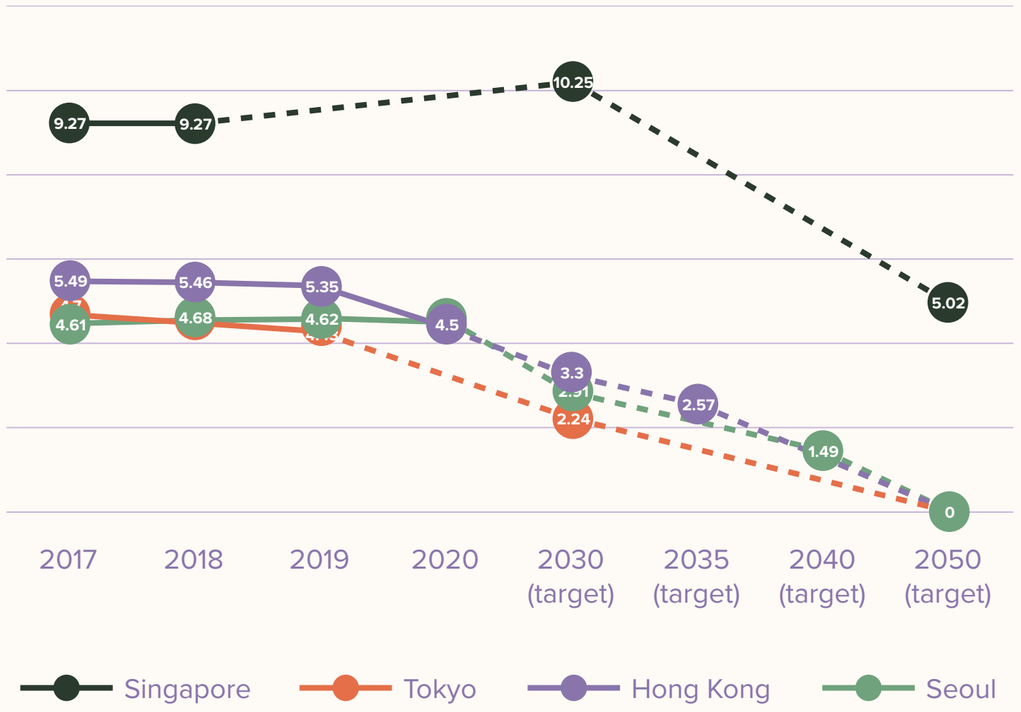
Comparison with other East Asian cities

We compare the key composition of carbon emissions in selected East Asian cities by sector, as shown in Figure 3. Guangzhou and Shenzhen are not included because such data is not available from official sources. According to these figures, electricity production and building energy use make up about 60% of carbon emissions on average in these cities. This explains our focus on renewable energy, energy use and efficiency in transport and buildings in the next two sections of this report.

Table 2. Comparison of carbon neutrality pledges between six East Asian cities

	2030	2035	2040	2050	2060
Hong Kong	Carbon intensity down by 65- 70% (or absolution emissions down by 26-36%) from 2005 level	Halved carbon emissions from 2005 level	N/A	Carbon Neutral	N/A
Singapore	Peaking carbon emissions at 65 Mt CO_2	N/A	N/A	Halved carbon emissions at 33 Mt CO_2 from 2030 level	Achieving net zero in the second half of the 21st century
Seoul	GHG emission down by 40% from 2005 level	N/A	GHG emission down by 70% from 2005 level	Carbon Neutral	N/A
Tokyo	GHG emission down by 50% from 2000 level	N/A	N/A	Carbon Neutral	N/A
Shenzhen	Peaking carbon emissions	N/A	N/A	N/A	Carbon Neutral
Guangzhou	Peaking carbon emissions	N/A	N/A	N/A	Carbon Neutral

Figure 4. Per Capita Carbon Emissions in four East Asian Cities (tCO_2-e)



(Source: EPD, CSD (HKSAR), NCCS, NPTD (Singapore), SMG (Seoul), TMG (Tokyo)

We have made a comparison of per capita emissions in Hong Kong, Singapore, Seoul and Tokyo, as shown in Figure 4. Singapore is the worst performer, as it has the highest carbon emissions per capita among them, while the carbon emissions of Tokyo, Seoul and Hong Kong are at similar level in 2019/2020.

When comparing the emissions reduction pledges of the six cities, Tokyo, Seoul and Hong Kong have made carbon neutrality or net zero pledges by 2050, while Guangzhou and Shenzhen follow the national pledge of mainland China for carbon neutrality by 2060 and for peaking carbon emissions by 2030. Singapore's NDC only pledges peaking the city's emissions at 65 $MtCO_2$-e in 2030 and reducing this by half by 2050, and aims at achieving net zero "as soon as viable in the second half of this century."[17]

Though Tokyo, Seoul and Hong Kong are frontrunners among the six cities by targeting carbon neutrality by 2050, they are lowering their carbon emissions at different paces. When comparing their common interim targets for 2030, Tokyo aims to reduce absolute emissions by 50%, Seoul by 40% and Hong Kong by 26-36%. That said, all three cities are seeing challenges in reaching much steeper pathways in the coming 10 years in order to set a realistic path to achieving net-zero by 2050.

1

IS HONG KONG **ON TRACK?**

Conclusion

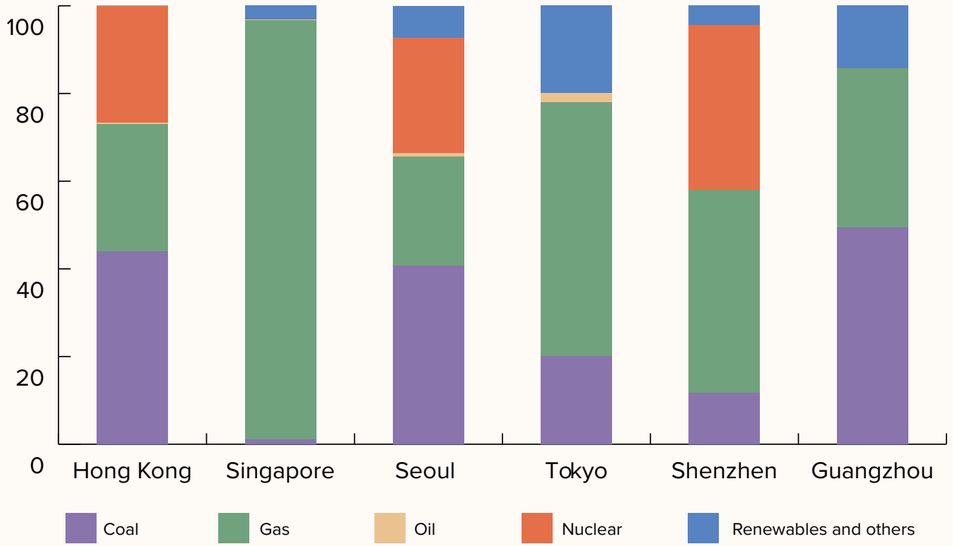
Since the announcement of the carbon neutrality goal for 2050 over a year ago, Hong Kong has taken the positive step to set an interim reduction target in 2035. In addition, 2020 carbon emissions per capita have reduced by 15% from the previous year. However, it is highly likely that Hong Kong cannot achieve its 2050 target without enhancing its reduction target for 2030.

These new targets are not aligned with the IPCC's recommendation for a reduction of 45% carbon emissions by 2030 relative to 2010 levels. In addition, in order to align with Hong Kong's share in keeping the global temperature rise within 1.5°C, our projection estimates that emissions from Hong Kong should be reduced by 60% by 2030, rather than 2035, from 2005 levels. Without reaching this interim level, the likelihood of missing the 2050 targets is high. Hong Kong should enhance its ambition and set 5-year targets in carbon reduction that match recommendations by IPCC and C40.[18] The targets should also be reviewed every year with regard to the emission data in the previous year in terms of both achievement and adequacy.

The fact that 2020 carbon emission levels fell short of the target set in the 2015 plan also casts doubt over the government's determination to report openly on progress towards meeting its targets.

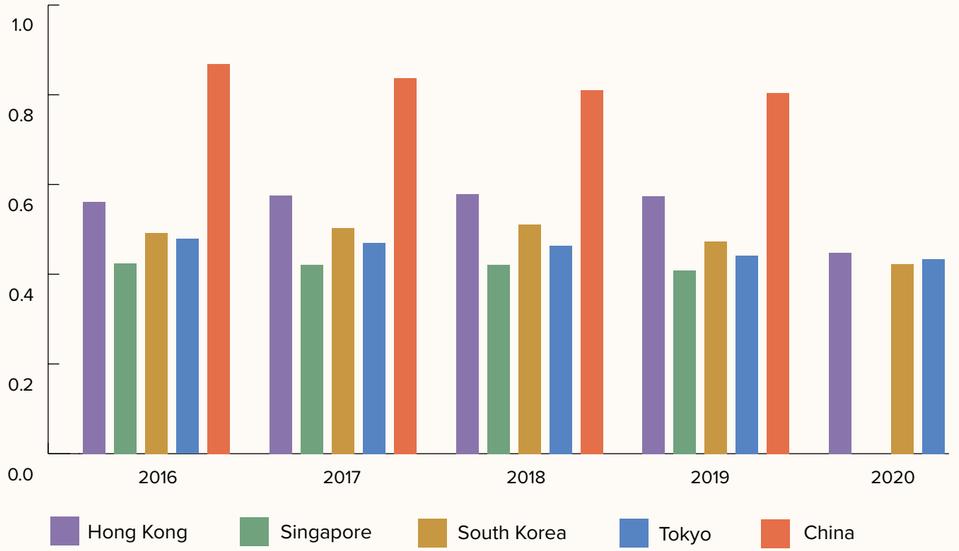
ARE WE TRANSITIONING TO A LOW CARBON ECONOMY **BY DEVELOPING RENEWABLE ENERGY?**

Figure 5. Electricity Fuel Mix of six Selected Cities as of 2020*



(Source: CDP-ICLEI (HK, Singapore, Seoul, Tokyo), GMPG (Guangzhou), SZDRC (Shenzhen).
**Note: The figures for Seoul and Tokyo are as of 2019 and 2018 respectively, while those for Shenzhen and Guangzhou are estimated based on the data from the cities' energy planning.*

Figure 6. Carbon Intensity of Electricity Generation



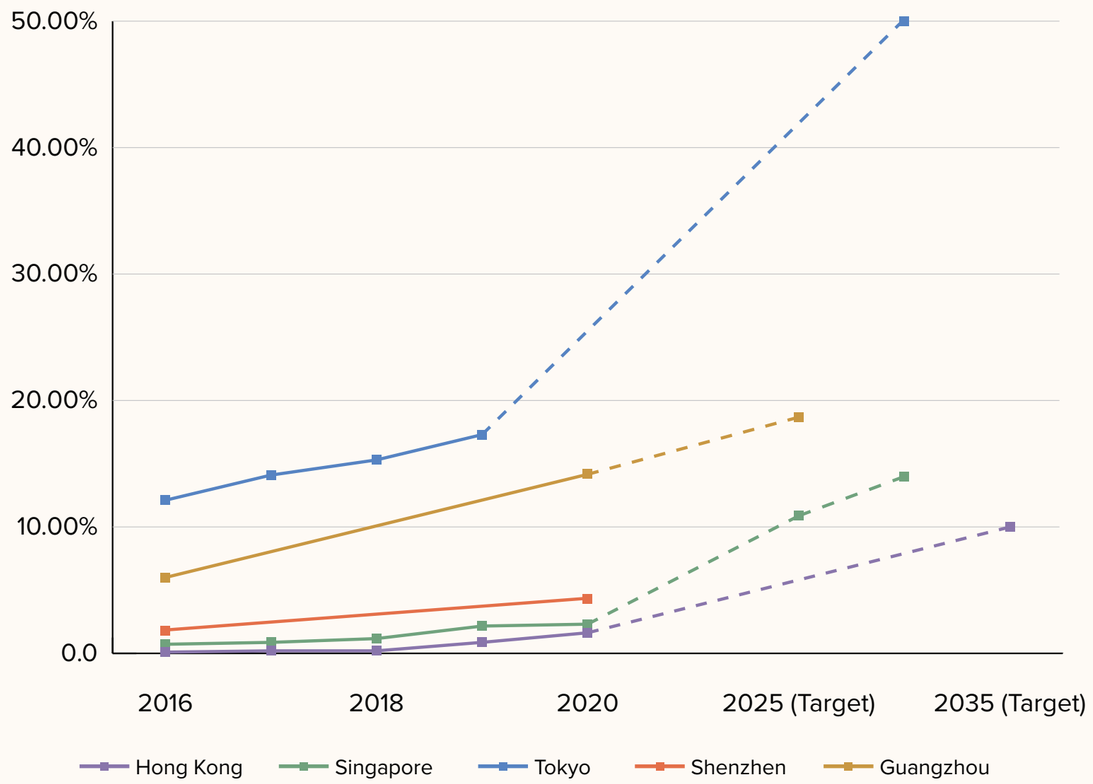
(Source: CLP & HKE (HKSAR), KEPCO (South Korea), EMA (Singapore), TEPCO (Tokyo), MEE (China))
**Note: Singapore's data is up to 2019 only.*

Current Energy Portfolio

The electricity used in the six selected East Asian cities is dependent on either coal or natural gas for nearly 50% to over 90% of power generation, as shown in Figure 5. Electricity generation is a key carbon emission source in these cities. The carbon intensity of electricity generation gives us an indication of its contribution to these cities' carbon emissions. The trends of gradual, slight reduction of carbon intensity reflects the reality of decreasing use of coal and increasing use of natural gas in the cities' electricity fuel mix, as shown in Figure 6. Hong Kong, Seoul[19] and Singapore[20] have pledged to phase out the use of coal by 2035 and 2050 respectively. This is reflected in the increased use of natural gas in both CLP and HKE's power stations, and new natural gas power generators in Seoul.

The use of renewables and other alternative energies, even though there is a slight uptake, has yet to have a significant impact on the carbon intensity of electricity production.

Figure 7. Renewable Energy Status and Pledges (in%)



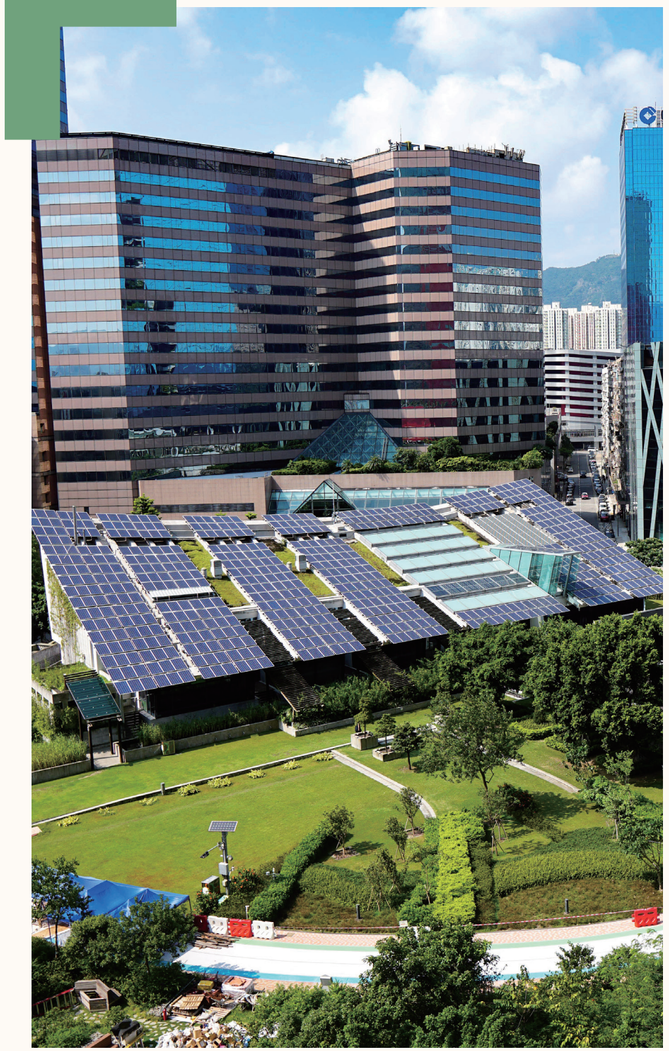
(Source: CLP & HKE, EMSD (HKSAR), EMA (Singapore), TMG (Japan), GMPG (Guangzhou), SMPG and SZDRC (Shenzhen))

Renewable Energy Status and Pledges

Despite current performance, all the cities have made different pledges to phase out coal and/or scale up renewable energy, ranging from 10% to 50% of energy fuel mix in the next 10-15 years, as shown in Figure 7. It is encouraging to see quite a substantial increase of renewable energy in the fuel mix in all of the cities. In the case of Hong Kong, with the support of the Feed-in Tariff scheme from 2018, the grid connection of rooftop solar PV energy has made some contribution to the total installed capacity of the city's renewable energy. The installed capacity of solar PV under the scheme was increased from only 1 MW to 176 MW[21]. However, when we look at renewable energy in the fuel mix in the past 5 years, the annual rate of increase is still slight and the proportion it represents is negligible.

Regarding the renewable energy pledge, the HKSAR government's plan for 7.5-10% renewable energy by 2035 projects that wind and waste-to-energy will take up 3-4% each while solar PV will take up 1.5-2%. However, since there is much higher renewable energy potential within the territory of the HKSAR, the HKSAR government should conduct a more thorough review of renewable energy potential, and set renewable energy targets for every five years, say in 2025, 2030, 2035 and onwards, and review these targets every year. On solar energy, the potential of floating solar systems, solar panels on community spaces and on rooftops should be studied. According to research done by Hong Kong Polytechnic University[22], the potential annual solar energy output could reach 4,674 GWh (Gigawatt-hour), or 10.7% of Hong Kong's energy consumption needs. According to the "Paris Watch Hong Kong Climate Action Report 2020," we also estimate that solar farms could be scaled up in public open spaces, disused farmlands, brownfield sites and reservoirs, to meet 20% of Hong Kong's electricity demand.

In comparison with other East Asian cities, Hong Kong's targets are lagging. Hong Kong is a member of C40, a network of the world's megacities committed to addressing climate change. But the city did not join the pledge made by 15 other city mayors, including Seoul and Tokyo, in committing to 100% renewables by 2035 or 2050[23]. The most substantive target from the HKSAR Government relating to energy so far refers to 60-70% "Zero Carbon" Energy by 2035. However, without commitments on 100% renewable energy, evidence for Hong Kong "striving to achieve net-zero" by 2050 is unconvincing.



IS WASTE-TO-ENERGY A RENEWABLE ENERGY?

Waste-to-energy should not act as a major source of renewable energy. According to the "Waste Blueprint for Hong Kong 2035,"[24] the recovery rate of Municipal Solid Waste (MSW) will be increased to about 55%, and in the long run, waste-to-energy facilities will move Hong Kong away from reliance on landfills. However, the EU's Waste Frame Directive[25], usually referred to as "waste hierarchy," requires as of 2020 that 50% of waste by weight must be recycled or prepared for re-use. The rate will be gradually increased to 65% by 2035. In addition, the European Parliament's report[26] on the European Commission's Circular Economy Action Plan[27] warns that reliance on waste incineration and waste-to-energy could hamper the development of a circular economy, and therefore calls for the minimising of waste incineration and optimising the treatment of non-recyclable residual municipal waste.[28] The EU demonstrates a better approach in optimising resource recovery, where non-recyclable waste should be gradually minimised in the long run. Under this approach, only a very small proportion of non-recyclable waste should eventually be left for waste-to-energy.

In addition, methane gas emissions are a key concern of waste-to-energy schemes, as this can be produced from organic waste, as well as from carbon dioxide from the waste combustion process. Methane gas has more than 80 times the Global Warming Potential of carbon dioxide in its first 20 years, and on average 30 times over 100 years.[29] During COP26, 103 countries, including Japan, South Korea and Singapore, signed up to the Global Methane Pledge,[30] which committed to reducing global methane emissions by at least 30% by 2030 from 2020 level.

Furthermore, ash from these waste-to-energy schemes needs careful handling as it can be highly toxic. The details of the design of waste to energy schemes will need to be made clear before an assessment can be made to check that the resulting energy is zero emission, "clean" and free of other pollutants. Currently, all the six cities have a certain portion of waste-to-energy in their energy portfolio. Some of them even count waste-to-energy as renewable energy. Uptake of waste-to-energy facilities as a renewable energy solution will undermine these cities' efforts to achieve effective greenhouse gas emissions reduction.

2

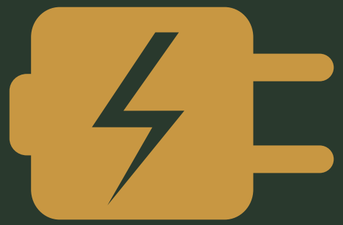
ARE WE TRANSITIONING TO A LOW CARBON ECONOMY **BY DEVELOPING RENEWABLE ENERGY?**

Conclusion

Whilst we can see that some positive steps having been taken towards a low carbon economy by looking at the interim renewable energy targets, the composition of current renewable energy plans remains questionable with low targets for solar PV and wind and a proportion of high waste-to-energy in the portfolio.

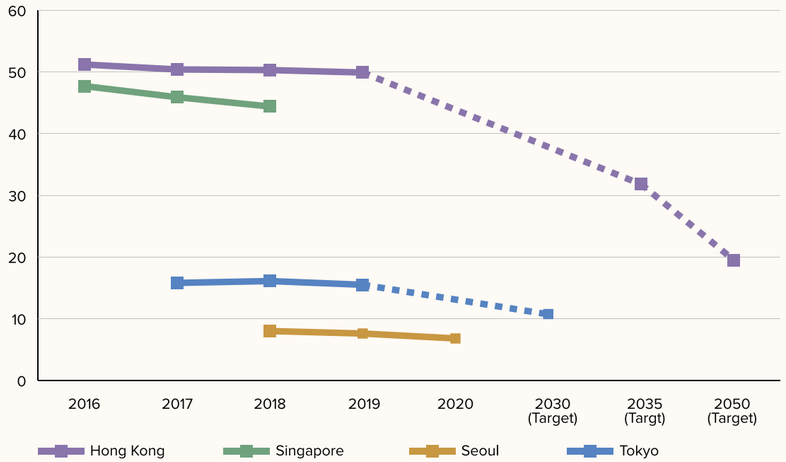
The increased deployment of renewable energy in the past year, especially under the continuous roll-out of the Feed-in Tariff scheme, has raised public awareness of the potential of renewables, but the current limited scheme will not make a very significant contribution to overall energy requirements.

Whether Hong Kong is really transitioning to a low carbon economy very much depends on how much efforts the HKSAR government puts into scaling up renewable energy generation: first by maximising renewables within territorial boundaries on a commercial scale, including altering current arrangements and incentives with the two electric power companies; and second, by incentivising the development of imported renewable energy with joint investment and other schemes. This will need to range from offshore wind to large-scale solar.



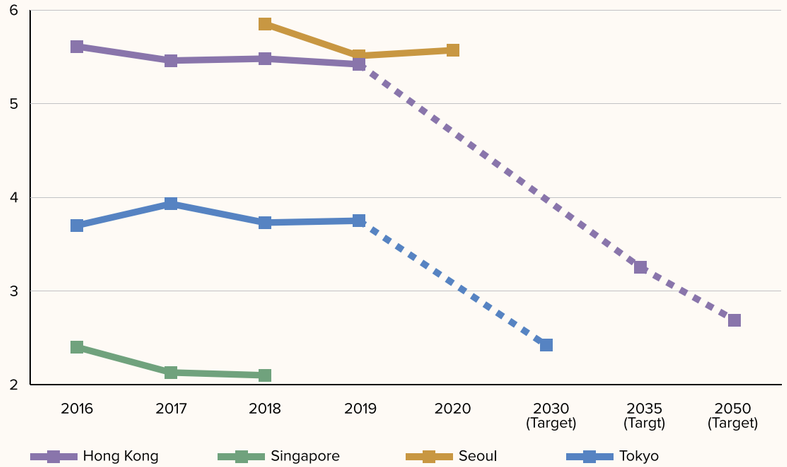
ARE WE **USING ENERGY MORE EFFICIENTLY** IN HONG KONG?

Figure 8. Building Energy Efficiency (Commercial, TJ/10,000 sq. m.)



(Source: Source: CLP & HKE, EMSD, RVD, GPA (HKSAR), KEPCO (South Korea), EMA (Singapore), TMG (Japan), GMPG (Guangzhou) and SMPG (Shenzhen))

Figure 9. Building Energy Efficiency (Residential, TJ/10,000 sq. m.)



(Source: Source: CLP & HKE, EMSD, RVD, GPA (HKSAR), KEPCO (South Korea), EMA (Singapore), TMG (Japan), GMPG (Guangzhou) and SMPG (Shenzhen))

In terms of energy consumption, buildings and transport account for over 60% of GHG emissions and therefore needs to be the focus of plans to increase energy efficiency and switch to clean sources of energy. Buildings' energy use

In Hong Kong, buildings account for 90% of the electricity consumption and 60% of carbon emissions. Comparison of building energy efficiency rates enables us to measure the effectiveness of energy saving measures in different cities.

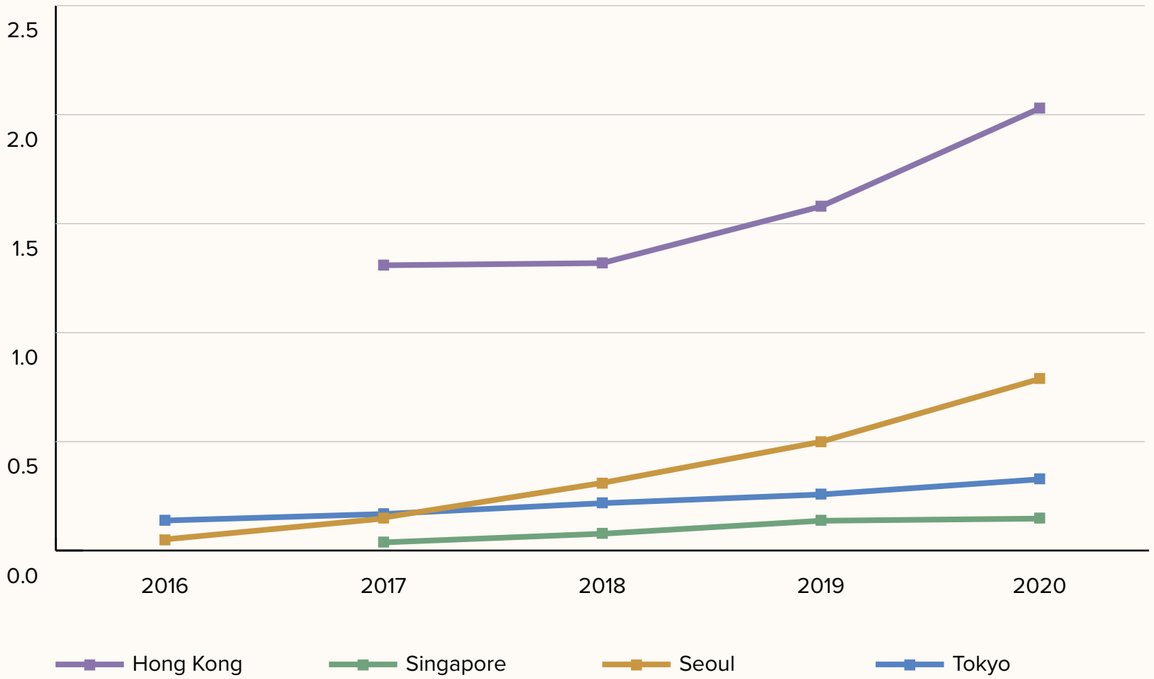
Among the four selected East Asian cities, Hong Kong's buildings consume the highest amount of energy in both commercial and residential buildings, as shown in Figures 8 and 9. Guangzhou and Shenzhen are not included in the comparison because such data is incomplete. There was only a slight improvement of about 1% in energy efficiency during the 2018 and 2019 period, and building energy efficiency measures remain non-mandatory. We find little detail as to how the HKSAR government plans to drive improved targets in future. It is encouraging, however, that Hong Kong's latest Climate Action Plan sets quantitative energy reduction targets for both commercial and residential buildings by 2035 and 2050, following Tokyo and Seoul.

Both Tokyo and Seoul are the leaders in advancing building energy efficiency. Tokyo's Zero Emission Strategy (2020 Update)[31] sets targets of 50% reduction in both greenhouse gas emissions and energy consumption by 2030 from the 2000 level, and aims at zero emission from buildings by 2050. The city also sets a target of about 50% power generation from renewable energy in buildings by 2030. On the other hand, even though Seoul does not specify energy saving targets for buildings, the city's latest Climate Action Plan 2050[32] targets an 81% reduction in carbon emissions from buildings using 2005 as base year, with phasing in mandatory Zero-Energy Building in new buildings by 2029, mandatory energy auditing and promoting Building Retrofit Project for existing buildings. There are two distinctive features from both cities: (1) setting quantitative reduction targets for carbon emissions for buildings, and (2) introducing mandatory measures such as mandatory renewable energy installation in Tokyo and mandatory zero-energy buildings for new buildings in Seoul.

In the case of Singapore, even though there is no quantitative energy saving or carbon reduction target for all buildings, the city has introduced other targets for energy efficiency for certain types of buildings according to Singapore's Green Building Masterplan.[33] This is also something the Hong Kong SAR Government could learn from in setting up sub-sector targets, which help build the steps towards better reduction targets for all buildings.

Given the ambition to halve total carbon emissions by 2035, and the overwhelming role of buildings in these emissions, we are wary of plans that do not detail stronger and more comprehensive policy measures on building energy use.

Figure 10. Percentage of Zero Emission Vehicles (EV and hydrogen-powered vehicles)



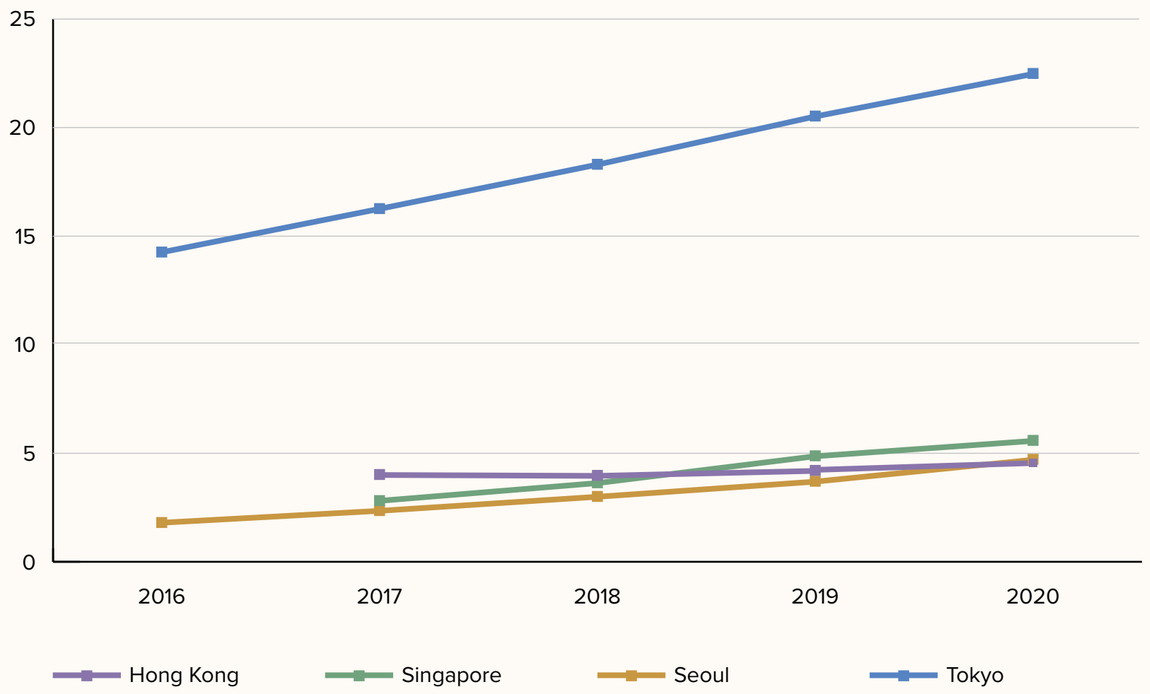
(Source: Transport Department (HKSAR), MOLIT (South Korea), LTA (Singapore), MLIT & AIRIA (Japan))

Transport emissions

The transport sector accounts for 18% of Hong Kong's carbon emissions. In March 2021, the HKSAR Environment Bureau launched the "Hong Kong Roadmap on Popularisation of Electric Vehicles," which outlines government plans and targets to pursue zero carbon transportation. Measures include tax concessions, lowering the registration fee for electric vehicles, widespread installation of EV charging facilities, and pilot schemes for electric public transport and commercial vehicles. It is planned that no fuel-propelled private cars including hybrid vehicles will be registered from 2035 or earlier. These measures are positive steps towards lowering GHG emissions from transport.

Since governments of four East Asian cities, Hong Kong, Seoul, Singapore and Tokyo started promoting the use of New Energy Vehicles, including Zero Emission Vehicles, there has been a steady rise in the number of these vehicles. Guangzhou and Shenzhen are not compared because relevant data from official sources is incomplete. Figures 10 and 11 show the percentage of Zero Emission Vehicles in Hong Kong is the highest among the four selected cities, but also that the overall percentage of these vehicles in all these cities is still low, ranging from 0.1% to 2.0%. The percentage of all types of New Energy Vehicles, including Zero Emission Vehicles, hybrid and CNG, is the highest in Tokyo (22.5%) because of the popularity of hybrid-fuelled vehicles in Japan, while the levels for these vehicles in the other three cities is similar, ranging from 4.6% to 5.6%.

Figure 11. Percentage of New Energy Vehicles (including Zero Emission Vehicles, Hybrid, and CNGs)



(Source: Transport Department (HKSAR), MOLIT (South Korea), LTA (Singapore), MLIT & AIRIA (Japan))

Hybrid and CNG vehicles, which still rely on fossil fuel, should only be a transitional solution, and in the long run, should be replaced by EV and zero carbon vehicles, such as vehicles fuelled by green hydrogen. Whilst ceasing registration of fossil-fuel powered vehicles including hybrids and a pilot scheme to introduce electric and hydrogen-fuelled public transport are positive steps, it is still far from meeting a viable carbon reduction pathway. There is a need to speed up the uptake of clean transport with new policies and measures. Investment and/or subsidies should be expanded to advance the wider applications of green transport technology, to promote the use of renewable energy for EVs and to boost the production and availability of green hydrogen fuels.

All four East Asian cities will cease the registration of gasoline-fuelled passenger vehicles between 2030 and 2040, and push for the uptake of Zero Emissions Vehicles through tax rebates or subsidies. Hong Kong will cease registration of such vehicles by 2035.

In order to reduce emissions from transport, the four East Asian cities plan to introduce zero emissions public transport, and deploy large numbers of EV chargers. Both Seoul and Tokyo will take more aggressive steps, by raising either the target ratio of new registrations or the target market share of Zero Emissions Vehicles to 50%. These proactive measures are something both Hong Kong and Singapore should take note of and learn from.

Table 3. Rating based on the comparison of mitigation impacts and pledges across the six selected Asian cities

CITIES	MITIGATION						
	Net-zero targets	Absolute Emissions	Emissions per capita	Emissions Intensity	Renewable Energy target	Zero emission and new energy vehicles	Building efficiency
Hong Kong	😐	😐	😐	😐	☹	😐	😐
Singapore	☹	☹	☹	😐	😐	😐	😐
Seoul	😐	😐	😐	😐	😐	😐	😐
Tokyo	😐	😐	😐	😐	😐	😐	😐
Shenzhen	😐	N/A	N/A	😐	😐	N/A	N/A
Guangzhou	😐	N/A	N/A	😐	😐	N/A	N/A

(Legend note: ☹ : Poor, 😐 : Average, 😐 : Acceptable, N/A: Data Incomplete)

3

ARE WE **USING ENERGY MORE EFFICIENTLY** IN HONG KONG?

Conclusion

We see slight progress in Hong Kong's energy savings and emissions reductions in buildings and transport. The targets set for building energy saving will require a much greater rate of change than has seen progress to date. These targets cannot be achieved without strong regulatory measures and supportive policies. For transport, plans to cease the registration of petrol and diesel cars by 2035 represents a clear regulatory approach designed to drive down emissions. A similar approach will be needed for the design, construction and operation of buildings, and for all other types of vehicles on Hong Kong's roads and waterways.

ARE WE ADAPTING TO MAKE HONG KONG **A SAFE AND HEALTHY CITY** IN THE FACE OF GLOBAL HEATING?

Hong Kong has already been witnessing the impact of extreme weather. The Hong Kong Observatory recorded as many as 53 days of extremely hot weather during May and October 2021, which is 35.53 days more than the same months in 1991-2020 period.[34] October rarely sees the approach of tropical cyclones, yet there were two tropical cyclone signal No. 8 warnings issued in October 2021, much higher than an average of 0.17 during the 1961-2020 period.[35] The most vulnerable groups of people, including the elderly and children, the disabled, ethnic minorities, frontline workers and residents of sub-divided flats, are more affected by extreme weather. Our question on adaptation becomes particularly relevant to the lives of these vulnerable groups of people.

To answer the adaptation question, we have evaluated policies and research covering seven types of climate hazards: heatwaves and heat-induced illness; heat and precipitation related vector-borne diseases; water shortages and drought; increased fire risk; sea level rise; sea flooding and coastal erosion; typhoons, flooding and landslips; reduced biodiversity and damage to ecosystems; and the availability of related climate adaptation plans and policies. Table 4 (page 37) is a summary of our ratings of climate adaptation plans across the six selected Asian cities.

One key observation is that not all seven types of climate hazards are covered in each cities' climate adaptation plans and policies. For example, increased fire risk is only covered in routine forest fire policies and practices, without attention paid to the increased risks associated with climate change. In addition, the policy link between reduced biodiversity and climate change is also weak. Lacking baseline data relating climate change to fire risk and reduced biodiversity would result in overlooking the linkage to climate impacts in both areas, leading to a lack of appropriate policies and practices.

Only Seoul and Tokyo treat climate change adaptation at the same level as mitigation. Both cities have more detailed policies and practices with timelines and key performance indicators. Monitoring and evaluation systems are also in place. For the other cities, climate change adaptation and action plans are heavy with self-congratulation for past initiatives as well as ongoing efforts, with little evaluation and reflection on any weaknesses or areas in need of improvement.

In addition, a Just Transition,[36] which was included as a key principle in the Paris Agreement, is not acknowledged nor addressed in any of these plans. A just transition sets out to ensure that climate action does not disadvantage vulnerable groups of people who are often already suffering from the physical impact of climate change or whose livelihoods might be affected by the change. However, these cities' adaptation plans rarely address these social differences nor engage these communities with policy support and transition plans.

In all the selected cities, governments highlight the impacts of **heatwaves and heat-induced illness**. Related research and analysis, especially in relation to health and urban planning, can be found. In mainland China's case, there is usually a country-wide study on cities, but rarely city-specific studies for cities like Shenzhen. That said, policies and practices to avoid heat island effect are incorporated into urban planning. Cooling centres, pools and water parks are being piloted in new development areas of the cities of Hong Kong, Singapore and Guangzhou, and are already applied in many parts of the cities of Tokyo and Shenzhen. Health and climate change strategies, including protection of the most vulnerable groups, are being applied in all selected cities except Singapore. Unfortunately, none of these cities' climate action plans explicitly address the impacts on vulnerable groups because of heatwaves and heat-induced illnesses.

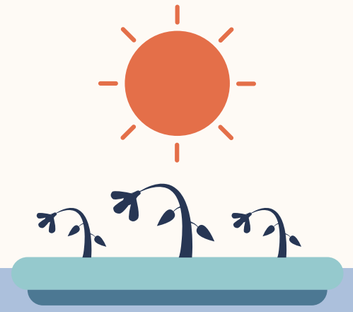
36

Table 4. Rating based on the comparison of climate adaptation plans across the six selected Asian cities

CITIES	ADAPTATION							
	Heatwaves and heat-induced illness	Heat & precipitation related vector-borne diseases	Water shortages & drought	Increased fire risk	Sea level rise, sea flooding & coastal erosion	Typhoons, flooding & landslips	Reduced biodiversity & damage to ecosystems	Adaptation plans and policies
Hong Kong	☺	☺	😐	😐	☹	☺	😐	😐
Singapore	😐	☺	☺	😐	😐	😐	😐	☺
Seoul	☺	☺	☺	☺	😐	☺	😐	☺
Tokyo	☺	☺	☺	😐	😐	☺	😐	☺
Shenzhen	☺	😐	☺	😐	😐	☺	😐	😐
Guangzhou	☺	☺	☺	😐	😐	☺	😐	😐

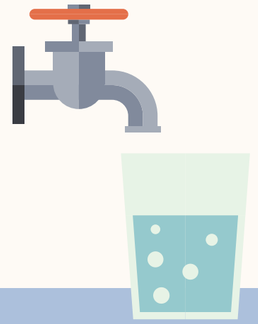
(Legend note: ☹ : Poor, 😐 : Average, ☺ : Acceptable)

(Source: Source: PD, EMSD, HKJCDPRI, EB (HKSAR), URA, ETHZ (Singapore), SMG (Seoul), TMG (Tokyo), SMPG (Shenzhen), GMPG (Guangzhou))



1

On heat and precipitation related vector-borne diseases, all selected cities have already rolled out testing and vaccination programmes for vector-borne diseases, done community engagement, implemented disease prevention measures (e.g. pest control), and analysis of the growth of vector-borne diseases. Analysis correlating hot weather periods and incidence of diseases can be found in all of the selected cities except Shenzhen.

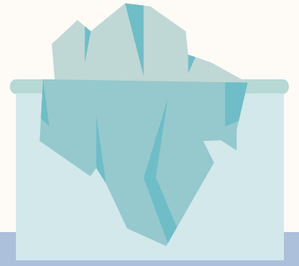


2

On water shortages and drought, all selected cities have their own water shortage plans and contingencies, community education and preparation for water conservation and rationing, water risk analysis and monitoring including up-stream supply conditions. Hong Kong has just started plans for diversifying its water supply by building a new desalination plant in Tseung Kwan O.

3

On increased fire risk, only Seoul covers this in the city's climate adaptation policies and action plans. Fire risk mitigation relies on the existing fire service contingencies for forest fires. Without taking in to account the climate-induced fire risk in the cities' climate adaptation research, policies and action plans, it is difficult to estimate to what extent climate change impacts cities' fire risks and how cities should best prepare to respond.



4

On sea level rise, sea flooding and coastal erosion, all selected cities highlight the issue as a key global threat, and apart from Seoul, all of these cities are likely to be directly impacted. Studies have been made on sea level rise modelling and flood mapping, and certain measures for crisis management and evacuation are in place. Some infrastructure is deemed flood-hazard resistant and some protection from natural sea barriers is also in place. However, in Hong Kong, Seoul and Guangzhou, there is a lack of baseline data to ascertain whether the current sea flood defences and crisis management plans in place are sufficient or would be sufficient for a deeper crisis.

5

On typhoons, flooding and landslips, all the selected cities except Singapore have their own typhoon warning and evacuation policies. They also have flood mapping and landslip risk mapping, and storm water capture systems and heavy rain drainage are in place. Building and infrastructure construction are required to be resistant to such hazards. There are also restrictions on development in flood prone and landslip risk areas. Only Singapore does not have post-typhoon recovery policies and practices as it is not in the typhoon belt and has few hills.

6

On reduced biodiversity and damage to ecosystems, all the selected cities have their own biodiversity research, policies and regulations. Hong Kong, Seoul and Singapore even include biodiversity in their climate action plans. However, linkages between biodiversity policies and climate change are weak in all the selected cities. We were not able to assess whether biodiversity loss is viewed at the same level as climate change.

Lastly, climate risk insurance[37] is one of the key issues in mitigating climate risks and impacts, though it is not directly addressed in any of the cities' climate action plans. The insurance industry across Asia has been exploring their multiple roles as risk assessors, risk advisers, risk underwriters and institutional investors, and looking at how climate impacts can be factored into insurance products.[38] The Monetary Authority of Singapore issued Guidelines for Environmental Risk Management for Insurers in December 2020, which could serve as an example that regulators in other Asian cities can learn from and from which the industry can build a sector-wide standard across Asia.[39]

Hong Kong's Climate Action Plan needs a genuinely people-centred climate adaptation plan, with key performance indicators, monitoring and evaluation processes and public engagement plans. More importantly, the Just Transition principle should be mainstreamed throughout such a plan. This approach is elaborated in the findings from the recent Oxfam Hong Kong's report, "Impacts of Extreme Weather on subdivided flat residents."[40] Since 2018 CCIL has planned a series of community dialogues with citizens active on various social issues to discuss the relationship between social and climate change issues. In 2021, CCIL has engaged a wide range of stakeholders in cross-sectoral exchanges and dialogues, including housing groups, welfare sector organizations, the health care sector, environmental groups and related researchers and experts on the climate impact upon subdivided housing residents and vulnerable communities. These dialogues seek to address both the physical impact of global warming on people's lives, especially on those vulnerable groups, as well as the social impact of measures to transition to a future net-zero economy.

4

ARE WE ADAPTING TO MAKE HONG KONG **A SAFE AND HEALTHY CITY** IN THE FACE OF GLOBAL HEATING?

Conclusion

Hong Kong's current Climate Action Plan consists of scattered, disconnected measures being implemented by the city's engineering departments. A complete climate adaptation plan should be developed and coordinated by a high-level Steering Committee on Climate Change and Carbon Neutrality, rather than the Environment Bureau alone. Hong Kong is lagging behind other cities in the areas of water source diversification and measures to prepare for sea level rise. There should be leadership from the government to provide oversight on all kinds of climate risks, linking these to disaster prevention, preparedness, and planning measures and to biodiversity loss. High level or cross agency authorities should be empowered to establish and disclose key performance indicators, baseline data and evaluation plans against the requirements set by the Paris Agreement. Hong Kong has not developed a genuinely people-centred climate change adaptation plan in which the Just Transition principle can be mainstreamed. There is an urgent need to adopt such an approach.

ARE WE DEVELOPING THE **RIGHT GOVERNANCE AND FINANCIAL SYSTEMS** TO TACKLE CLIMATE CHANGE?

Without strong institutional support, even the best climate mitigation and adaptation plans will not achieve their goals. This section looks at the structures and policies covering five areas of climate governance: political leadership; policies and plans; transparency, accountability, monitoring and evaluation; advancing climate finance; and international cooperation. To do this we assessed the availability of key elements of the cities' climate strategies and action plans. Table 5 (page.46) captures a summary of ratings of the key attributes of climate governance across the six Asian cities.

POLITICAL LEADERSHIP

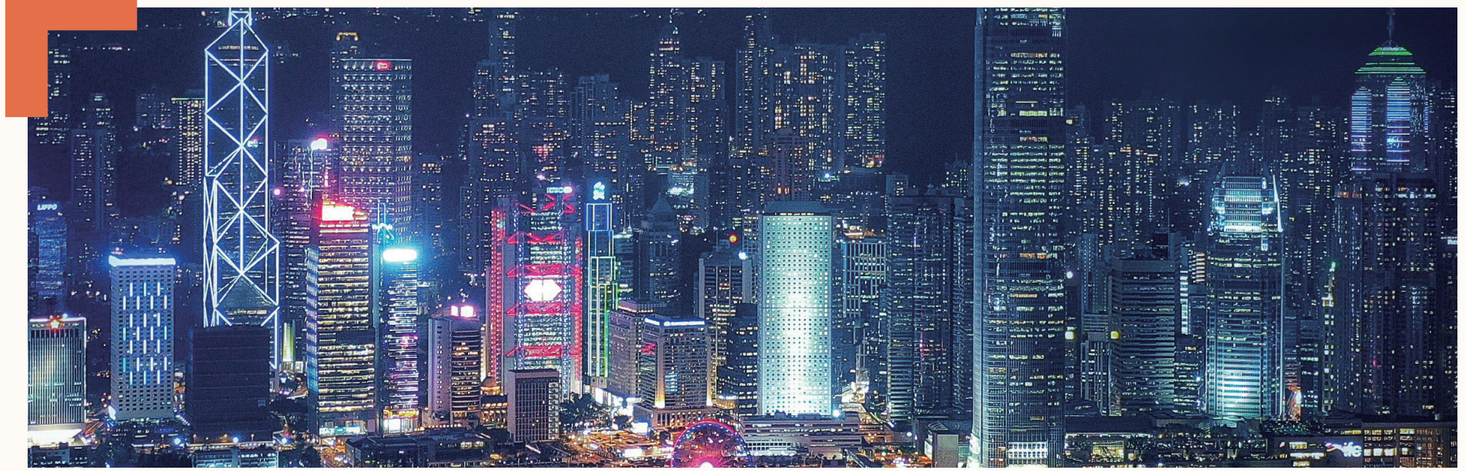
All the cities' governments demonstrate a high level of political leadership in climate change strategy by establishing mayoral leadership and high-level leadership groups to coordinate the city governments' climate actions. In the case of Hong Kong, the Steering Committee on Climate Change and Carbon Neutrality, which is chaired by the Chief Executive and includes the heads of relevant bureaux, will formulate overall strategy and oversee the co-ordination of various climate actions. The Environment Bureau will also set up the Office of Climate Change and Carbon Neutrality and an advisory committee to strengthen co-ordination and promote public participation. However, the main question is whether these climate actions are sufficiently resourced and monitored.

Concerning **policies and plans**, it is reassuring that all the cities' governments have set decarbonisation goals and have indicated areas of action necessary to achieve these. However, none of them have demonstrated how their plans are benchmarked against global targets and carbon budgets, and few have made a credible link between medium term targets and their ultimate carbon neutrality goals.

These cities' governments show little support to developing countries for climate change, because China, Japan and South Korea rely on their national governments' foreign policy and aid programmes. In the case of Singapore, the city-state provides only technical support.[41]

On transparency, accountability, monitoring and evaluation, the cities' governments disclose annual emissions measurements and energy use, except for Shenzhen and Guangzhou. There are also different degrees of transparency related to their climate policy review process. Only Seoul and Tokyo upload their key performance indicators and evaluation reports for public review. In Seoul, annual evaluation reports are available for review through the Citizens' Green Seoul Committee, which is a statutory consultancy body of the Seoul Metropolitan Government intended to promote stakeholder engagement.

On advancing climate finance, all the cities' governments have already identified climate mitigation and adaptation as a key policy item in their budgets, and identified green finance as an opportunity for their financial sector. Most of the cities have set up relevant bodies to oversee the growth of green finance, and have some form of ESG or sustainability reporting for listed companies. For example, the Hong Kong Monetary Authority (HKMA) set up the Green and Sustainable Finance Cross-Agency Steering Group in December 2020 to co-ordinate the management of climate and environmental risks to the financial sector, and to accelerate the growth of green and sustainable finance. Regarding green finance standards, China and Singapore have developed a green finance taxonomy and clear verification standards. Japan and South Korea only provide guidelines. Climate-related disclosure in Tokyo, Singapore and Hong Kong will be made mandatory and aligned with the recommendations of the Task Force on Climate-related Financial Disclosures (TCFD)[42] from 2022[43], 2023[44] and 2025[45]respectively. Hong Kong being an international financial hub should have a role in promoting such international standards in green finance. However, there are no apparent deterrents for lending to carbon intensive activities and fossil fuel subsidies remain in the energy sector.



On international cooperation, Hong Kong, Seoul and Tokyo have joined and are active in inter-city climate action platforms, including the C40 Cities Climate Leadership Group, Global Covenant of Mayors for Climate and Energy, and the International Council for Local Environmental Initiative (ICLEI). Singapore, Shenzhen and Guangzhou are all C40 members, but the latter two share little meaningful data on the CDP Cities Database.

5

ARE WE DEVELOPING THE **RIGHT GOVERNANCE AND FINANCIAL SYSTEMS** TO TACKLE CLIMATE CHANGE?

Conclusion

We have seen positive steps in climate governance taken by several of the cities' governments, including Hong Kong. However, transparency, accountability, monitoring and evaluation are key aspects of good governance, and for Hong Kong these aspects remain partial and fragmented. Hong Kong could learn from Seoul and Tokyo, both of which have demonstrated good practice in public engagement and disclosure. Further cooperation and expansion of well-regulated and clearly defined climate finance will also be an opportunity for regional cooperation.

Table 5. Rating based on the comparison of climate governance attributes across the six selected Asian cities

CITIES	GOVERNANCE				
	Political Leadership	Policies and Plans	Transparency, Accountability, Monitoring and Evaluation	Advancing Climate Finance	International Cooperation
Hong Kong	☺	😐	😐	☺	☺
Singapore	☺	😐	😐	☺	😐
Seoul	☺	😐	☺	☺	☺
Tokyo	☺	😐	☺	☺	☺
Shenzhen	😐	😐	☹	☺	😐
Guangzhou	😐	😐	☹	☺	😐

(Legend note: ☹ : Poor, 😐 : Average, ☺ : Acceptable)

(Source: Source: HKMA & SFC (HKSAR), NCCC (Singapore), EF, CB, PBC (Shenzhen & Guangzhou), SMG, OECD, Climate Transparency (Seoul), TMG, OECD, Climate Transparency (Tokyo))

RECOMMENDATIONS
AND CONCLUSION

Is Hong Kong Playing its Part to Achieve the Paris Agreement?

In contrast to achieving the global goal of keeping the temperature rise under 1.5°C, Hong Kong has so far made insufficient progress on carbon emission reduction. The recently published “Hong Kong’s Climate Action Plan 2050,” outlines the key targets and measures the HKSAR government is going to take to achieve net-zero emissions by 2050.

But the Climate Action Plan is undermined by the lack of explanation on how actions in each sector will combine and build to achieve the stated goal of overall net-zero. Separate targets for emission reduction and energy saving are not integrated in a way that explains their contribution to overall targets. Equally importantly, the 2030 targets set in the previous Hong Kong’s Climate Action Plan 2030+ have not been upgraded to reflect the new 2050 target, and are just carried over into the 2050 plan. In place of this, new targets are set for 2035 and beyond. This means that Hong Kong may discharge more greenhouse gasses in the years before it reaches its net-zero goal. Without more ambitious cuts in the near term, Hong Kong may use up more than its share of the global carbon budget underlying the science of the Paris Agreement.

It is also of considerable concern that for both climate change mitigation and adaptation, much of the new Climate Action Plan is taken up with backward-looking self-congratulation, giving the impression that the government sees climate action planning as partly a public relations exercise. A good deal of the new plan is also an inflated re-hash of 2030+ plan. This sits uncomfortably alongside introductory statements about the urgency and importance of far-reaching climate change action.

Therefore, with the 2050 net zero targets down the road, more urgent actions and deeper targets are immediately and desperately needed. Only the timely achievement of that goal with a steep decline in emissions in the near term would bring Hong Kong in line with the requirements of the Paris Agreement. Hong Kong needs plans that dramatically improve upon earlier 2030 targets, that set these new targets with action plans, milestones, costings, financing plans along with authoritative governance and management structures so obstacles may be more easily and effectively negotiated. Without more explicit public engagement in the monitoring, evaluation and verification systems, the effectiveness of climate adaptation measures also become questionable.

Key Recommendations for HKSAR Government

- Carbon emission reduction targets should be set every five years, i.e. 2025, 2030 and 2035 and onwards, to ensure we are on track to carbon neutrality. The current targets for 2030 and 2035 should be updated and aligned with the requirements of the Paris Agreement, i.e. keeping the temperature rise within 1.5°C above pre-industrial levels. Based on our projection we recommend a 60% greenhouse gas reduction by 2030 from 2005 levels.

- Clear reduction targets with timelines must be set for all major sources of greenhouse gas emissions, i.e. power generation, buildings, transport and waste management. These must combine to demonstrate how they contribute to overall reduction targets.

- A more ambitious target should be set for renewable energy. Solar energy and offshore wind energy should be prioritised over problematic waste-to-energy schemes in the renewables portfolio. The government should revisit any policy obstacles that might hinder the development of these renewable energy facilities.

- Energy saving measures for buildings should be made mandatory, including energy audit, renewable energy installation and zero emissions labelling scheme. The energy saving targets for buildings should also be revisited and revised given that all energy saving measures are to be made mandatory.

- Fossil-fuelled vehicles should be fully phased out from road transport, rather than just no longer registered, with a clear timeline and transition plan, in order to raise the market-share of zero emission vehicles.

- Key performance indicators, baseline data and monitoring and evaluation systems for all climate change adaptation measures must be set up and updated in the Climate Action Plan. Adaptation plans for sea level rise and for water shortages must be accelerated.

- The processes for planning and evaluation should take account of the principles of Just Transition to ensure engagement and dialogue with social groups in Hong Kong likely to be most affected by climate change and climate action plans.

- Evaluation reports for the whole Climate Action Plan must be disclosed every year, as these are the main tools for public engagement and drivers for improvements to the Plan and its targets.

Without immediate action plans and more ambitious short-term targets, Hong Kong's current climate plans are at best a dangerous delay and at worst greenwash. The later the action, the steeper the drop, and the greater the distress.

IPCC AR6 highlights[46]

The first part of the IPCC AR6, which was recently published in August 2021, pulls together the findings from more than 14,000 peer-reviewed studies. One of the key developments since the AR5 in 2013 and 2014 is the increased certainty of the fact that global warming and increasingly severe extreme weather are caused by human activities. In other words, the case that human activity causes climate change has become stronger.

In almost all emissions scenarios, global warming is expected to hit 1.5°C “in the early 2030s”. Without reaching net-zero emissions in the next few decades, the climate system might continue to warm irreversibly.

The UN scientists take into consideration the occurrence of record warming in the past five years, noting that every year was warmer than any prior year. AR6 concludes that temperatures have been rising faster than in previous IPCC assessment cycles.

“Observed changes in the atmosphere, oceans, cryosphere and biosphere provide unequivocal evidence of a world that has warmed. Over the past several decades, key indicators of the climate system are increasingly at levels unseen in centuries to millennia, and are changing at rates unprecedented in at least the last 2,000 years.” (IPCC AR6)

AR6 concludes that the Earth will be 1.4°C-4.4°C hotter than pre-industrial levels by the end of this century, depending on whether emissions are quickly cut to net-zero or whether they continue to rise. In comparison to AR5, the new report also projects slightly more warming under similar emissions scenarios, with a narrower range of uncertainty.

AR6 is also clear that climate change is already driving more extreme weather events. It states that evidence for the link between rising temperatures and heavy precipitation events has “strengthened since AR5”.

Last but not least, AR6 outlines the scientific advances in comparison to AR5 with high confidence: “Progress in our understanding of human influence is gained from longer observational datasets, improved paleoclimate information, a stronger warming signal since AR5, and improvements in climate models, physical understanding and attribution techniques. Since AR5, the attribution to human influence has become possible across a wider range of climate variables and climatic impact-drivers. New techniques and analyses drawing on several lines of evidence have provided greater confidence in attributing changes in regional weather and climate extremes to human influence.”

As for our common carbon budget, both the IPCC’s Special Report on Global Warming of 1.5°C (SR15) and AR6 suggest that the world has around 460 billion tonnes of CO2 (or GtCO2) remaining in the 1.5°C carbon budget, to give us a 50% chance of limiting warming to 1.5°C. In other words, the world will more likely exhaust the remaining carbon budget in 11½ years should the rate of emissions in 2020 continue. Following the easing of COVID-19 related restrictions and a global energy crunch in much of the world, the overall global emissions will have rebounded in 2021 to even higher levels, meaning at this higher rate the carbon budget will be consumed in less than the forecast 11½ years. For a 66% chance of limiting warming to 1.5°C, AR6 reports that the world has a remaining carbon budget of 360 GtCO2, or only nine years of 2020 level emissions.

Data Tables for all the Figures and Tables in this report

Figure 2.

	Calculation of Absolute Carbon Emissions (in $ktCO_2$-e)										
Year	**2015**	**2016**	**2017**	**2018**	**2019**	**2020***	**2021**	**2022**	**2023**	**2024**	**2025**
HKSAR's Pledge (estimate)	41,200	41,400	40,500	40,900	40,100	33,600	35,246	34,137	33,063	32,022	31,015
AR6 carbon budget (HKSAR's share, 50% 1.5°C)*	41,200	41,400	40,500	40,900	40,100	33,600	35,246	33,546	31,927	30,387	28,921
AR6 carbon budget (HKSAR's share, 66% 1.5°C)*	41,200	41,400	40,500	40,900	40,100	33,600	35,246	32,481	29,933	27,585	25,421

2026	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**
30,039	29,093	28,178	27,291	26,432	25,173	23,975	22,833	21,746	20,600	19,227	17,853	16,480	15,106
27,525	26,197	24,933	23,730	22,585	21,495	20,458	19,471	18,532	17,637	16,462	15,286	14,110	12,934
23,427	21,589	19,895	18,334	16,896	15,571	14,349	13,223	12,186	11,230	10,481	9,733	8,984	8,235

2040	**2041**	**2042**	**2043**	**2044**	**2045**	**2046**	**2047**	**2048**	**2049**	**2050**	**SUM**
13,733	12,360	10,986	9,613	8,239	6,866	5,493	4,119	2,746	1,372	0	565,036
11,758	10,582	9,406	8,230	7,054	5,879	4,703	3,527	2,351	1,175	0	506,046
7,486	6,738	5,989	5,240	4,492	3,743	2,994	2,246	1,497	748	0	395,973

**AR6 carbon budget (1.5°C 50% avoidance chance) is 460 MtCO2-e, while AR6 carbon budget (1.5°C 66% avoidance chance) is 360 MtCO2-e. Given that HKSAR's share of global greenhouse gas emission is 0.11%, the carbon budget for Hong Kong will be 506 ktCO2-e (1.5°C 50% avoidance chance) and 396 ktCO2-e (1.5°C 66% avoidance chance) respectively. It is assumed that (1) the emission reduction starts from pre-pandemic level, i.e. 2019, and (2) the rate of decrease is evenly distributed between all the years between 2021 and 2030, 2031 and 2035, 2036 and 2050.*

Figure 3.

Greenhouse Gas Emissions by Sector (2019, in %)						
City\Sector	Electricity Generation (including buildings)	Transport	Waste	Industrial Processes	Agriculture, Forestry, and Land Use	Others
Hong Kong	70.30%	18.10%	7.30%	4.30%	0.10%	0.00%
Singapore (2018)	40.10%	12.40%	0.60%	46.70%	0.00%	0.20%
Seoul	70.30%	19.10%	6.20%	4.30%	-0.10%	0.20%
Tokyo	64.30%	15.10%	3.10%	6.10%	0.00%	11.40%

*Singapore has official data up to 2018, while the rest of the cities up to 2019.

Figure 4.

Per Capita Carbon Emissions in four East Asian Cities (in tCO_2-e)								
City\Year	2017	2018	2019	2020	2030 (Target)	2035 (Target)	2040 (Target)	2050 (Target)
Hong Kong	5.49	5.46	5.35	4.5	3.3	2.57	N/A	0
Singapore	9.27	9.27	N/A	N/A	10.25	N/A	N/A	5.02
Seoul	4.61	4.68	4.62	4.56	2.91	N/A	1.49	0
Tokyo	4.7	4.59	4.43	N/A	2.24	N/A	N/A	0

Singapore has official data up to 2018, and Tokyo up to 2019. The Singapore's data is obtained by the total absolute emission divided by total population (residents and non-residents).

Figure 5.

Electricity Fuel Mix of Six Selected East Asian Cities (2020, in %)						
City\Fuel	**Coal**	**Gas**	**Oil**	**Nuclear**	**Renewables and others**	**Total**
Hong Kong	44	29	0.3	26.6	0.1	100
Singapore	1	95.7	0.2	0	3.1	100
Seoul	40.7	24.9	0.7	26.3	7.4	100
Tokyo	20	58	2	0	20	100
Shenzhen	11.7	46.3	0	37.6	4.4	100
Guangzhou	49.4	36.4	0	0	14.2	100

**Shenzhen's and Guangzhou's data are derived using the data from Guangzhou Municipal People's Government and Shenzhen Development and Reform Commission, while the rest of the cities directly from CDP-ICLEI.*

Figure 6.

Carbon Intensity of Electricity Generation (in $kgCO_2$-e/kWh)					
City\Year	**2016**	**2017**	**2018**	**2019**	**2020**
Hong Kong	0.561	0.575	0.578	0.573	0.448
Singapore	0.424	0.421	0.421	0.409	N/A
South Korea	0.492	0.502	0.51	0.473	0.422
Tokyo	0.479	0.47	0.464	0.441	0.434
China (Southern)	0.868	0.837	0.809	0.804	N/A

**South Korea's data is used here, instead of Seoul's, because Seoul's electricity supply is heavily connected at national level. The rest of the cities' power grids have certain levels of independence despite its connections with neighbouring regions.*

Figure 7.

Renewable Energy Status and Pledges (in %)								
City\Year	2016	2017	2018	2019	2020	2025 (Target)	2030 (Target)	2035 (Target)
Hong Kong	0.10%	0.20%	0.20%	0.87%	1.63%	N/A	N/A	10.00%
Singapore	0.72%	0.87%	1.17%	2.16%	2.31%	10.88%	13.99%	N/A
Tokyo	12.11%	14.10%	15.30%	17.30%	N/A	N/A	50.00%	N/A
Shenzhen	1.80%	N/A	N/A	N/A	4.30%	N/A	N/A	N/A
Guangzhou	6.00%	N/A	N/A	N/A	14.20%	18.70%	N/A	N/A

**Seoul's data is not used here, because its electricity supply is heavily connected at national level. Its renewable energy development only has significance at national level rather than local level.*

Figure 8.

Building Energy Efficiency (Commercial, TJ/10,000 sq. m.)								
City\Year	2016	2017	2,018	2,019	2,020	2030 (Target)	2035 (Target)	2050 (Target)
Hong Kong	51.2	50.4	50.3	49.9	N/A	N/A	31.8	19.5
Singapore	47.7	45.9	44.4	N/A	N/A	N/A	N/A	N/A
Seoul	N/A	N/A	8	7.6	6.8	N/A	N/A	N/A
Tokyo	N/A	15.8	16.1	15.5	N/A	10.8	N/A	N/A

Figure 9.

Building Energy Efficiency (Residential, TJ/10,000 sq. m.)								
City\Year	2016	2017	2018	2019	2020	2030 (Target)	2035 (Target)	2050 (Target)
Hong Kong	5.61	5.46	5.48	5.42	N/A	N/A	3.25	2.69
Singapore	2.4	2.13	2.1	N/A	N/A	N/A	N/A	N/A
Seoul	N/A	N/A	5.85	5.51	5.57	N/A	N/A	N/A
Tokyo	3.70	3.93	3.73	3.75	N/A	2.43	N/A	

Figure 10.

Percentage of Zero Emission Vehicles (EV and hydrogen-powered vehicles)					
City\Year	2016	2017	2018	2019	2020
Hong Kong	N/A	1.31	1.32	1.58	2.03
Singapore	N/A	0.04	0.08	0.14	0.15
Seoul	0.05	0.15	0.31	0.5	0.79
Tokyo	0.14	0.17	0.22	0.26	0.33

Figure 11.

Percentage of New Energy Vehicles (including Zero Emission Vehicles, Hybrid, and CNGs)					
City\Year	2016	2017	2018	2019	2020
Hong Kong	N/A	4.03	3.99	4.22	4.58
Singapore	N/A	2.83	3.65	4.89	5.6
Seoul	1.82	2.37	3.02	3.72	4.73
Tokyo	14.27	16.27	18.31	20.53	22.49

Table 4.

Below tables are the basis of the rating for Table 4.

	Heatwaves and Heat-induced Illness						
City	**Heat mapping & thermal imaging**	**Cooling centres, pools and water parks**	**Community engagement & education**	**Health & climate change strategy, including protection of most vulnerable groups**	**Creation of green spaces & tree planting**	**Analysis to correlate hot weather periods & incidence of illness**	**Policies & practices to avoid heat island effect in urban design**
Hong Kong	Y	3	Y	Y	Y	Y	Y
Singapore	Y	3	Y	N	Y	Y	Y
Seoul	Y	N/A	Y	Y	Y	Y	Y
Tokyo	Y	66	Y	Y	Y	Y	Y
Shenzhen	Y	10	Y	Y	Y	Y	Y
Guangzhou	Y	3	Y	Y	Y	Y	Y

	Heat & Precipitation Related Vector-borne Diseases				
City	Testing & vaccination programmes for vector-borne diseases	Community engagement on risk, reduction & treatment	Disease prevention measures (e.g. pest control)	Analysis of growth of vector-borne diseases	Analysis correlating hot weather periods & incidence of diseases
Hong Kong	Y	Y	Y	Y	Y
Singapore	Y	Y	Y	Y	Y
Seoul	Y	Y	Y	Y	Y
Tokyo	Y	Y	Y	Y	Y
Shenzhen	Y	Y	Y	Y	N
Guangzhou	Y	Y	Y	Y	Y

	Water Shortages & Drought			
City	Water shortage plans & contingencies	Community education & preparation for water conservation & rationing	Water risk analysis & monitoring including up-stream supply conditions	Diversification of water supply
Hong Kong	Y	Y	Y	N
Singapore	Y	Y	Y	Y
Seoul	Y	Y	Y	Y
Tokyo	Y	Y	Y	Y
Shenzhen	Y	Y	Y	Y
Guangzhou	Y	Y	Y	Y

	Increased Fire Risk					
City	Real time risk monitoring	Hazard resistant infrastructure design	Crisis management including warning and evacuation systems	Community engagement / education	Analysis to correlate hill fires & dry / hot weather patterns	Stress test for electricity, IT and transport systems in events of fire
Hong Kong	Y	Y	Y	Y	Y	N
Singapore	N	Y	N	Y	N	N
Seoul	Y	Y	Y	Y	Y	Y
Tokyo	N	Y	Y	Y	N	N
Shenzhen	Y	Y	Y	Y	N	N
Guangzhou	Y	Y	Y	Y	N	N

	Sea Level Rise, Sea Flooding & Coastal Erosion					
City	Crisis management, including warning & community-based evacuation systems	Sea level rise modelling and flood mapping (including impact on electricity, IT & transport)	Community engagement/ education & public preparation (including drills)	Flood hazard resistant infrastructure design & construction	Protection of natural sea barriers (e.g. mangrove)	Sea flood defences development & operation
Hong Kong	Y	Y	N	Y	Y	N
Singapore	Y	Y	Y	Y	Y	Y
Seoul	Y	Y	Y	Y	N	N
Tokyo	Y	Y	Y	Y	Y	Y
Shenzhen	Y	Y	N	Y	Y	Y
Guangzhou	Y	Y	N	Y	Y	N

	Typhoons, Flooding & Landslips					
City	Typhoon warning & evacuation policies including public education and drills	Storm water capture systems & heavy rain drainage	Flood mapping & landslip risk mapping (including electricity supply, IT and transport systems)	Post-typhoon recovery policies & practices	Hazard resistant building and infrastructure construction (high wind, landslips & floods)	Restricted development in risk areas (flood or landslip)
Hong Kong	Y	Y	Y	Y	Y	Y
Singapore	N	Y	Y	N	Y	Y
Seoul	Y	Y	Y	Y	Y	Y
Tokyo	Y	Y	Y	Y	Y	Y
Shenzhen	Y	Y	Y	Y	Y	Y
Guangzhou	Y	Y	Y	Y	Y	Y

	Reduced Biodiversity & Damage to Ecosystems					
City	Monitoring & protection of natural habitats & areas of special scientific interest	Biodiversity issues integrated in planning & development policy & practice. e.g. urban forestry, natural species & corridors	Effective control of chemical use, invasive species & GMOs	Effective laws on illegal trade in endangered species & illegal poaching	Laws, enforcement & adequate penalties for illegal destruction of protected land & overfishing	Monitoring of conservation status of endangered species & biodiversity loss through surveys & assessment
Hong Kong	Y	Y	Y	Y	Y	Y
Singapore	Y	Y	Y	Y	Y	N
Seoul	Y	Y	Y	Y	Y	Y
Tokyo	Y	Y	Y	Y	Y	Y
Shenzhen	Y	Y	Y	Y	Y	N
Guangzhou	Y	Y	Y	Y	Y	N

	Adaptation Plans And Policies						
City	Formulated policies and plans covering aspects listed above with KPIs	Implemented plans, policies with timeline, clear KPIs	Authority (not too concentrated, not too dispersed)	Resourcing: adequate finance	Stakeholder engagement (including advisory bodies)	Monitoring, reporting and evaluation (including communications)	Integration with other city plans
Hong Kong	N	N	N	Y	Y	N	N
Singapore	N	N	N	Y	Y	N	N
Seoul	Y	Y	Y	Y	Y	Y	Y
Tokyo	Y	Y	Y	Y	Y	Y	Y
Shenzhen	N	N	Y	Y	N	N	Y
Guangzhou	N	N	Y	Y	N	N	Y

Table 5.

Below tables are the basis of the rating for Table 5.

	Political Leadership						
City	**Commitment by head of government**	**High-level leadership group**	**Clear decision-making**	**Effective inter-departmental coordination**	**Policy continuity**	**Adequate financial & human resources**	**Climate mitigation legislation in place**
Hong Kong	Y	Y	Y	Y	Y	2.20%	Y
Singapore	Y	Y	Y	Y	Y	N/A	Y
Seoul	Y	Y	Y	Y	Y	0.40%	Y
Tokyo	Y	Y	Y	Y	Y	1.70%	Y
Shenzhen	Y	Y	Y	N/A	Y	N/A	Y
Guangzhou	Y	Y	Y	N/A	Y	N/A	Y

	Policies and Plans							
City	**Long-term decarbonisation goals**	**Plans benchmarked against global targets & carbon budgets**	**Fair shares & concepts of common but differentiated responsibility acknowledged in plans**	**Sector specific action plans with targets to achieve goals**	**Just transition social issues acknowledged & addressed in plans**	**Near term plans & targets on track to achieve long term goals**	**Plans make effective use of regulations, incentives and standards**	**Support to developing countries for climate change (finance, technology, training)**
Hong Kong	Y	N	Y	Partial	N	Y	Y	N
Singapore	Y	N	N	N	N	Y	Y	Y
Seoul	Y	N	N	Y	N	Y	Y	Y
Tokyo	Y	N	N	Y	N	Y	Y	Y
Shenzhen	National	N	N	N	N	Y	Y	N
Guangzhou	National	N	N	Y	N	Y	Y	Y

	Transparency, Accountability, Monitoring and Evaluation					
City	**Accurate measurement of emissions**	**Transparent climate policy review process**	**Evaluations feed learning & policy revision**	**Stakeholder engagement process**	**Independent advisory bodies with defined roles**	**Climate change issues debated in society (business, media, civil society, academia)**
Hong Kong	Y	Partial	Some	Y	Y	Y
Singapore	Y	Partial	Some	Y	N	Y
Seoul	Y	Y	Y	Y	Y	Y
Tokyo	Y	Y	Y	Y	N	Y
Shenzhen	N	N	N	N	N	N
Guangzhou	N	N	N	N	N	N

	Advancing Climate Finance					
City	**Climate change mitigation objectives are reflected in the national/ regional financial architecture**	**Regulatory authorities have a green taxonomy & verification standards for the finance sector**	**Incentives are in place to promote green finance**	**'Financed emissions' and climate risk disclosure reporting required for investors and lenders**	**Deterrents are in place for lending to carbon-intensive activities**	**All subsidies for the fossil fuel energy sector have ceased**
Hong Kong	Y	Y	Y	Y	N	N
Singapore	Y	Y	Y	Y	N	N
Seoul	Y	Guidelines only	Y	Y	N	N
Tokyo	Y	Guidelines only	Y	Y	N	N
Shenzhen	Y	Y	Y	Y	N	N
Guangzhou	Y	Y	N	N	N	N

	International Cooperation: Membership of City-level Climate Action Organizations & Reporting Initiatives				
City	Global Covenant of Mayors for Climate & Energy	C40 Cities member	ICLEI Local Governments for Sustainability (member)	Mayor's Agenda for a Green and just Recovery (C40 Cities)	CDP cities reporting (in CDP database)
Hong Kong	Y	Y	Y	Y	Y
Singapore	N	Y	N	N	Y
Seoul	Y	Y	Y	Y	Y
Tokyo	Y	Y	Y	N	Y
Shenzhen	N	Y	Y	N	Partial
Guangzhou	N	Y	N	N	Partial

	Other Ratings And Ranking on Climate Action Performance (1)						
City	HDI	WGI	URI	100RC	Climate threats (Lloyd's)	Infrastructure Security 2021 (Economist)	Environmental Security 2021 (Economist)
Hong Kong	Very High	-	-	-	-	93	75
Singapore	Very High	High	-	Low-Medium	Low	92	70
Seoul	Very High	Medium-High	-	Medium	High	83	73
Tokyo	Very High	-	-	-	High	88	81
Shenzhen	Medium	-	Medium	-	-	-	-
Guangzhou	Medium	-	Medium	-	Medium	-	-

	Other Ratings And Ranking on Climate Action Performance (2)							
City	**Planet Sub-Index (Arcadis)**	**Cities A List 2020 (CDP)**	**2020 Cities Climate Hazards (CDP-ICLEI)**	**2020 Cities Adaptation Actions (CDP-ICLEI)**	**Emission Reduction Target Scenario (CDP-ICLEI)**	**Resilient Cities (Grosvenor)**	**CWR APACCT 20 Index**	**Pedestrian friendly city Planning (Score)**
Hong Kong	Medium	A	Medium	8	1.5 °C	Medium	Low	78.9
Singapore	High-Medium	-	Medium	7	2.0 °C	Medium	High	63.9
Seoul	High-Medium	A	High	1	1.5 °C	Low-Medium	Medium	66.6
Tokyo	Low-Medium	A	Medium-High	10	1.5 °C	Medium	Low	72.4
Shenzhen	Low-Medium	-	-	1	-	-	Medium	-
Guangzhou	Low-Medium	-	-	-	-	Low	Medium	-

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