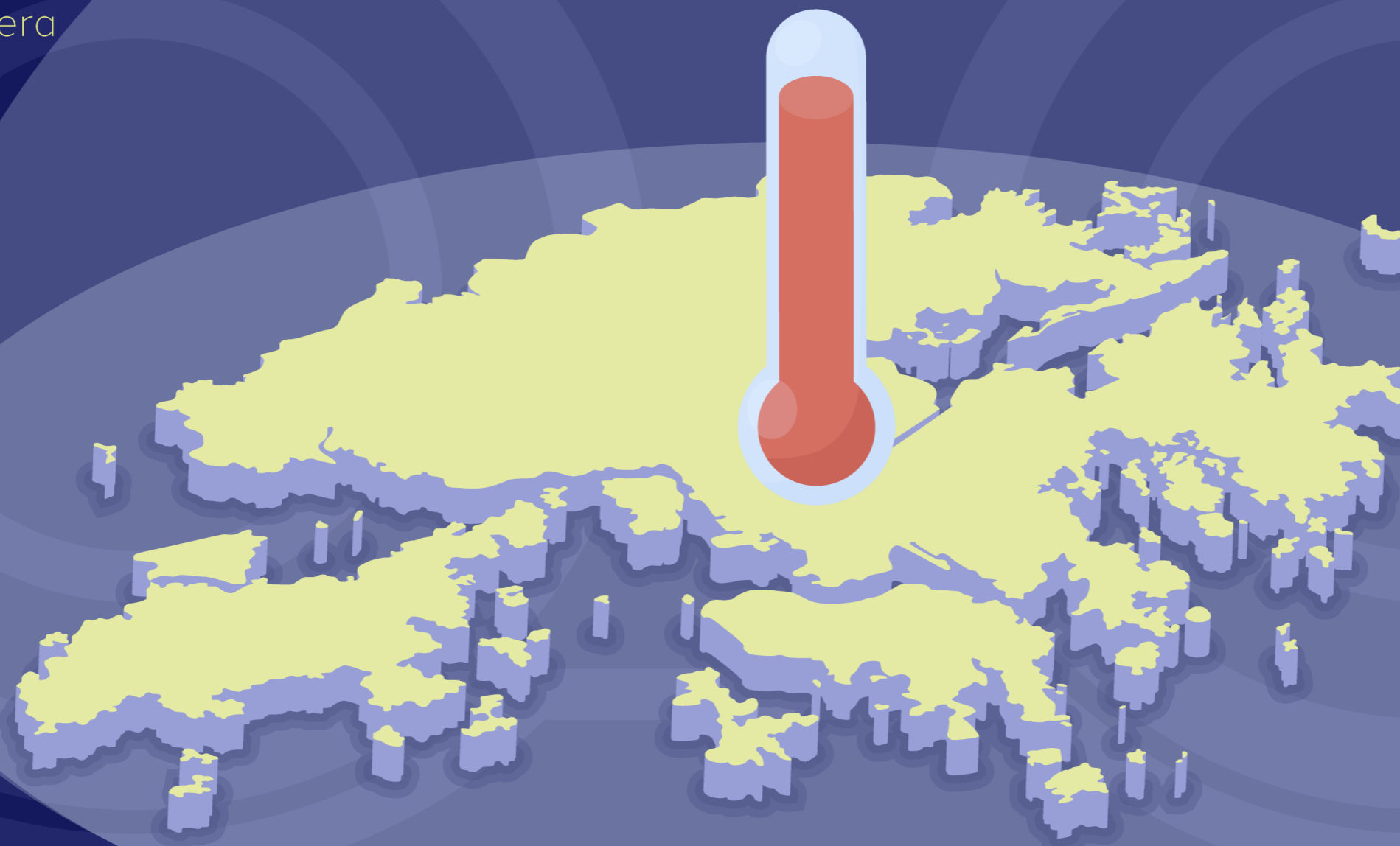


PARIS WATCH

2022

HONG KONG CLIMATE ACTION REPORT

Ambitious progress is called for in achieving net-zero in the post-pandemic era



Hong Kong's contribution to the Paris Agreement goals

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HEADLINE

We are seeing alarming evidence of increased physical impacts of climate change. Record temperatures in Hong Kong and Tokyo, flash flood in Seoul and the flooding in Pakistan are among recent examples. Increasing risks from fires, floods, heat and drought are apparent across Asia and around the world. Yet greater risks are not being matched by the increased scale and urgency of climate adaptation and resilience action in East Asian cities.

EXECUTIVE SUMMARY



Our research finds that carbon emissions and energy consumption in Hong Kong and East Asian cities have rebounded in the post-pandemic period, in line with global trends. Despite a slight increase in the use of renewable energy and the introduction of climate change adaptation measures, the overall progress in reducing carbon emissions has not been enough to achieve the goal of limiting global temperature rise to 1.5°C.

We are concerned that if current carbon emissions continue, it will undermine the climate action plan and fail to meet the medium-term goal. Hong Kong and Singapore, in particular, can only meet the recommendations of the Intergovernmental Panel on Climate Change (IPCC) if they strengthen measures to significantly reduce carbon emissions before 2030.

A lot of work needs to be done, including substantial improvements in carbon reduction targets, accelerating the implementation of renewable energy plans and energy transition, and strengthening climate change adaptation and governance.

The main findings of this study for Hong Kong and nearby East Asian cities include:



1.

East Asian cities have not adopted a science-based targets approach in their climate action plans

2.

Even when aggressive targets have been set, there are no realistic plans to achieve them.

3.

Most East Asian cities have made modest progress in adaptation and resilience building, but shown inadequate disaster preparedness for increased frequencies and severity in heatwaves and sudden torrential rains and floods caused by climate change.

4.

Greenhouse gas emissions declined in East Asian cities during the COVID-19 pandemic, but energy consumption has rebounded, and greenhouse gas emissions are expected to rebound as well.

5.

Increasing the proportion of natural gas in the energy mix is a factor in the cities' recent reduction of greenhouse gas emissions. However, natural gas still emits greenhouse gases and is not a viable long-term strategy for carbon reduction.

6.

The proportion of renewable energy and the use of zero-emission vehicles have both increased, and progress is encouraging, but still too little.

7.

Residential sectors' energy consumption continued to rise during the COVID-19 pandemic, while commercial sectors' energy consumption has now rebounded.

8.

East Asian cities can play a larger role in promoting international cooperation on climate change. Seoul and Tokyo, both selected as finalists for the 2022 C40 Cities Awards, are the best examples.

We make the following recommendations to the Government of the Hong Kong Special Administrative Region:



- 1.** Our Climate Action Reports 2020 and 2021 advised that the government, in its Climate Action Plan, should adopt science-based targets and the trajectory endorsed by the IPCC and the International Energy Agency for achieving net zero emissions and milestones. So far this recommendation has not been adopted. This year we take a step further and suggest that the same approach be used for all sectors including power generation, building and transportation, with clear timetables and emissions reduction targets, and an explanation of how such targets will be met. We recommend new reporting standards for business, i.e. the Sectoral Decarbonisation Approach (SDA) tools developed by the Science Based Targets Initiative. These standards and tools provide a more detailed decarbonisation pathway to achieve the goals of the Paris Agreement.
- 2.** The 2030 and 2035 targets must be raised and aligned with IPCC recommendations and the Paris Agreement requirements, to limit temperature rises to 1.5° C above pre-industrial level. By 2030, Hong Kong needs to reduce greenhouse gas emissions by 45% compared to 2005. An even more ambitious target of 60% reduction in greenhouse gas emissions needs to be adopted based on the science-based target approach.
- 3.** More ambitious targets 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 remove any policy obstacles that hinders the development of these renewable energy facilities.
- 4.** The government should expand the scope of the Buildings Energy Efficiency Ordinance (Cap. 610) to make energy audits mandatory for all industrial, commercial and residential buildings. It should also provide financial support for retrofitting existing buildings to meet energy efficiency standards, such as through renewable energy installations. In light of mandatory energy efficiency measures, building energy efficiency and carbon reduction targets should also be revisited and revised.
- 5.** Fossil-fuelled vehicles should be fully phased out, in addition to the ‘no longer registered by 2035’ as a target set by the SAR Government, with a clear timeline and transition plan, in order to raise the market share of zero emission vehicles.
- 6.** Key performance indicators, baseline data, and monitoring and evaluation systems for all climate change adaptation measures must be set up and updated in the Government’s Climate Action Plan.
- 7.** The processes for monitoring and evaluation should take into account the principle of just transition, to ensure engagement and dialogue with social groups in Hong Kong likely to be affected by climate change and climate action plans. Annual evaluation reports on the Climate Action Plan should be published, to encourage public engagement and suggestions for improvements to the plan and its targets.
- 8.** Sufficient financial resources should be allocated to strengthen cooperation and coordination between departments, to support carbon neutrality goals and carbon reduction pathways.



INTRODUCTION

This is the fifth annual report assessing the Hong Kong SAR's performance against the goals of the Paris Agreement. The Paris Watch Hong Kong Climate Action Report 2022 examines progress against the same set of 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.

The Intergovernmental Panel on Climate Change (IPCC) recommends that in order to limit the global average temperature increase within 2° C, preferably 1.5° C by the end of this century, carbon emissions need to be reduced by 45% from 2005 level by 2030, and reach net zero by 2050. At the 26th Conference of the Parties to the United Nations Framework Convention on Climate Change (COP26) in Glasgow, UK, in 2021, parties made pledges to reduce carbon emissions. However, even if the governments were able to implement their commitments, global temperature could still rise at least 2.4° C in 2100, which is far away from the requirements of the Paris Agreement. Therefore, each country is required to review its Nationally Determined Contribution (NDC) at COP every year, to ensure the carbon reduction target can be met by 2030. In line with this arrangement, we propose that the Hong Kong SAR Government reviews its carbon reduction target every year.

This report will compare the performance of Hong Kong with that of other East Asian cities in reducing carbon emissions from major sources before and after the COVID-19 pandemic, and offer preliminary predictions of future trends.



CONTEXT ANALYSIS



The combined impact of global economic uncertainty, growing climate crisis and global COVID-19 pandemic outbreak from 2020 to the present has exposed the fragility of human society. When the restrictions on cross-border travel and social distancing measures around the world are gradually being lifted, many uncertainties are still evolving, including the inflation cycle, the war in Ukraine, geopolitical tensions between China and the United States, the rising price of natural gas and coal, and disruptions in global supply chains. We have yet to determine and still need to monitor closely how these factors intertwine and influence the pace of decarbonisation.

Figure 1. Annual Global Greenhouse Gas Emissions (1900-2021)



Against this background, we look at changes in carbon emissions and take stock of key climate policies and actions over the past year. The COVID-19 pandemic disrupted global production and logistics systems, for a time reducing air pollution and greenhouse gas emissions. Reduced transport, increased social distancing restrictions, and government-mandated city lockdowns directly contributed to a 5.2% drop in global carbon emissions in 2020, compared to 2019. But carbon emissions have rebounded as lockdowns and social distancing measures have been lifted around the world. By 2021, global carbon emissions returned to pre-pandemic level. Clearly, the reduction in carbon emissions in 2020 was not enough to have a long-term impact on the global climate. The climate policies announced by the world's major economies this year, as well as the relevance of the latest IPCC reports to cities like Hong Kong, give us some insights.

Key Climate Actions and the Global Stocktake Mechanism

Faced with a post-COVID-19 rebound in greenhouse gas emissions, countries have run out of time to delay climate action. The major greenhouse gas emitters in the world, such as China and the United States, have announced their action plans to mitigate climate change.

1.



In **China**, the National Development and Reform Commission and the National Energy Administration jointly released the “14th Five Year Plan for a Modern Energy System” on 22 March, detailing plans for China’s energy sector up to 2025. Analysts view the plan as an attempt by the Chinese government to balance between ensuring short-term security in supply chain and long-term energy transition, ahead of its 2030 carbon peaking and 2060 carbon neutrality targets. However, the plan lacks robust sectoral targets. Meanwhile, on 7 June, the Chinese government released a new climate adaptation strategy up to the year 2035, which emphasises “proactive adaptation” to actively prepare for, rather than passively respond to, climate impacts. A key component of this proactive approach is to strengthen the monitoring and assessment of climate risks.

2.



In the **United States**, the Congress finally passed and implemented the "Inflation Reduction Act" on 12 August. It is the most important federal climate law in history, providing US\$370 billion to support the development of clean energy and electric vehicles, strengthen climate adaptation, and provide financial support to reduce the burden of climate actions on low-income households. Analysis suggests legislation could assist the United States in reducing carbon emissions by about 40% from 2005 level by 2030, a major step toward its climate goal of 50-52% reductions by 2030.

3.



This year’s **G7** leaders announced on 28 June the creation of a Climate Club to build the momentum in climate actions among the members and mobilise other key actors like European Union and China.

Rich nations are far from doing enough. The progress towards the Paris Agreement goal is far from adequate. The Paris Agreement has been in force for seven years. In COP26, the combined commitments of the nations would result in temperature rise of 2.4° C, far from the 1.5° C goal. And the nations agreed to review in COP27 in Egypt in 2022. However, checking the Nationally Determined Contributions (NDCs) submitted by the parties for COP27, little improvement has made. At the Bonn UN Climate Change Conference held in June 2022, it was observed that many parties had only engaged in procedural discussions, with little or no progress in implementation.



4.

Furthermore, as millions of people in poverty suffer from floods in Pakistan and drought in the Horn of Africa, as well as elsewhere, the issue of climate justice cries out to be addressed. The people who are least responsible for climate change suffer the most from its consequences. However, the "loss and damage mechanism" vigorously advocated by developing countries was not discussed at the UN Climate Change Conference in Bonn, and is only included in the official agenda for **COP27**. It is foreseeable that COP27 will be a difficult negotiation.



5.

Policy makers are not heeding the warning from the scientists. The IPCC in February and April 2022 released the Working Group 2 and 3 reports of its Sixth Assessment Report, which examined research on global impacts, adaptation and vulnerability to climate change, as well as climate change mitigation that limits the global temperature increase to 1.5° C.

The **IPCC** report is an essential reference for the annual United Nations Climate Change Conference, and provides an important basis for reviewing the implementation of the Paris Agreement. Meanwhile, we must pay attention to the fact that climate change is affecting the most vulnerable communities, resulting in increasing risks and inequality. In the following section, we will examine Hong Kong's role in addressing climate change, particularly through the lens of the IPCC report.





HONG KONG'S PROGRESS IN VIEW OF THE IPCC REPORT

Climate Change Impacts, Adaptation and Vulnerability

The IPCC's Working Group 2 report focused on the impacts of climate change on cities, and the role cities can play. More than half of the world's population currently lives in cities, and by 2050 it is likely that cities will have two-thirds of the world's population. But by the middle of this century, about one billion residents of coastal cities will be threatened by rising sea level. In addition, heat waves and air pollution will affect the health of city dwellers, and the operation of urban infrastructure – including transportation, water supplies, energy and power systems – will also be affected. The report further indicates that climate adaptation may not be adequate to effectively resist serious disasters.

The report noted the "unequal" impact of climate change on vulnerable groups. For example, the use of air-conditioning increases the burden of electricity costs for poor households. In the summer of 2022, Hong Kong experienced its longest heat wave. Hong Kong's high temperatures in July broke 11 historical records, with 21 days of extremely hot weather (daytime temperature rising to 33° C or above) and 25 hot nights (minimum night-time temperature 28° C or above). Many subdivided flat residents and outdoor workers in Hong Kong faced this extreme heat every day.

For those facing structural poverty and social and economic inequalities, which exacerbate the plight of people with disabilities and the urban poor, the report notes that climate impacts are often multiple and interlocking. The elderly, subdivided flat residents, outdoor workers and people with disabilities face particular hardships in extreme weather. The report pointed out that vulnerable groups, including people in developing countries and small island countries, indigenous peoples, women, ethnic minorities, the elderly and children, are most affected by climate change. In line with the principles of equity and justice, it advocated the inclusion of the needs of vulnerable groups, the elderly and children, and soliciting the views of people with different interests, opinions and values in the making of climate actions.

In extreme weather, citizens' quality of life deteriorates, negative sentiment rises, and various sports activities, social activities, and recreational activities are reduced. In addition, there is a clear relationship between increased heat or rainstorms and mental health problems. There is a rise in incidents of suicide, anxiety, depression, and mental illness, with an increase in psychiatric hospital admissions and medical visits. Across Asia, heat has led to an increased risks of mental disorders, depression and anxiety. Studies from all over the world, including Hong Kong, show that the occurrence of suicide increases for every degree Celsius increase in temperature. In addition, hospitalizations for various diseases, heat stroke and accidents increase. Salmonella outbreaks are closely linked to rising temperatures, and increased allergens such as pollen lead to increases in asthma and allergic sinusitis.

Coastal cities like Hong Kong need to strengthen their climate change assessments and climate risk research and management. The most effective way to limit climate risk for coastal cities is to avoid new development in areas vulnerable to storm surges, flooding or sea level rise. Ensuring reserve flooding space is the most widely used adaptation strategy. Experts also warn against maladaptation, however, the misuse of resources in abusive ways that deprive vulnerable groups rather than protecting them against disaster.

Therefore, the report proposes "Climate Resilient Development" for the first time, as a way for cities to cope with climate change. The report proposes that cities need to adopt a combination of nature-based and built-in approaches, building green and water-friendly public spaces, developing urban agriculture to increase food security, and creating social safety nets to protect vulnerable groups from climate disasters.

As for strengthening climate resilience, the report proposes five important principles that cities like Hong Kong need to consider: policy leadership, setting clear goals and responsibilities, the accumulation and sharing of knowledge, the establishment of monitoring and evaluation mechanisms, and ensuring equity and justice for the most vulnerable groups. The Paris Watch Climate Action Report 2021 pointed out that the

government's "Hong Kong Climate Action Plan 2050" appears to focus on past and current climate adaptation "achievements", without strengthening climate change adaptation and disaster response work in various areas. There is room for improvement in public participation and transparency, as well as in monitoring and evaluation of project effectiveness. These principles also apply to examining how large-scale infrastructure projects, such as the airport's third runway and Lantau Tomorrow, can enhance climate resilience. As pointed out in the 2021 Paris Watch Climate Action Report, only if we accelerate the pace of decarbonisation and energy transition, strengthen climate adaptation, and upgrade the goals and targets of the Hong Kong Climate Action Plan 2050 as soon as possible, will we be able to reduce the impacts of climate change.



Climate Change Mitigation

The IPCC's Working Group 3 report points out that if we do not accelerate actions to significantly reduce greenhouse gas emissions, the global average temperature will inevitably rise by 3.2 ° C compared with pre-industrialization level, and the global climate and ecosystem will deteriorate. Cities play a pivotal, and increasing, role in carbon emissions, the report points out. In 2015, urban carbon emissions accounted for about 62% of the world's total, rising to 67% - 72% in 2020.

The report also points out that some countries are moving towards limiting temperature rises to within 2° C, and that 826 cities and 103 regions around the world have adopted net-zero emissions targets. This is encouraging. Although the "Hong Kong Climate Action Plan 2050" published in 2021 aims at carbon neutrality by 2050, and sets out a series of steps to achieve that goal, does it correspond to the analysis of the Working Group 3 report? We initially made the following comparisons:



The world must "peak carbon emissions" as soon as possible and accelerate "carbon neutrality"

The report proposes that carbon emissions throughout the world should peak by 2025, and be reduced by 50% in 2030, if global warming is to remain below 1.5° C. It means that the implementation of decarbonisation measures must accelerate now. To reach carbon neutrality in 2050, the "Hong Kong Climate Action Plan 2050" proposes to reduce carbon emissions by 50% in the medium term, by 2035, which is inconsistent with the report's recommendations. We hope to raise the medium-term carbon reduction target for 2030 to align with the report's recommendations.



Renewable energy technologies should be widely adopted as soon as possible

The report pointed out that solar and wind power generation technologies are mature, and their costs of power generation have dropped by 85% and 55% respectively in the past decade, while the cost of lithium batteries has also dropped by 85%. The report also predicts that renewable energy could increase its share in the global energy mix by 150-270% by 2030, compared to 2019, if countries move towards limiting temperature rises to 1.5° C. The "Hong Kong Climate Action Plan 2050" proposes to increase the proportion of renewable energy to 7.5-10% of the total power generation by 2035 and 15% by 2050. It seems that Hong Kong has failed to grasp the trend of declining costs and is not keeping pace with the global increase of renewable energy.

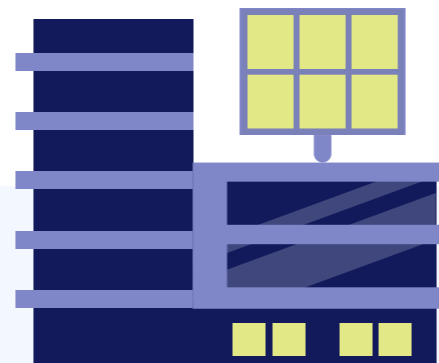
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Reducing demand helps reduce carbon emissions

Compared with the previous focus on the role of energy and industry in carbon reduction, this report places more emphasis on the importance of citizens' participation in carbon reduction. The report proposes that we need systemic changes in resource demand, such as food production systems that reduce meat consumption; transport systems that discourage driving and promote walking, cycling and electrified public transport, as well as reducing air traffic; and retrofitted buildings to increase energy efficiency. These adjustments would require changes in individual behaviour, and more importantly, changes in the logic of urban planning to reduce energy consumption and air pollution. Cities need to consider development of district cooling systems, waste reduction and treatment systems, and expansion of urban green areas for carbon removal by nature-based solutions. The report estimates that reducing resource demand could cut carbon emissions by 40 - 70% by 2050. Although some of the above measures are listed in the Hong Kong Climate Action Plan 2050, its approach is fragmented and does not set out a systematic approach to resource reduction.

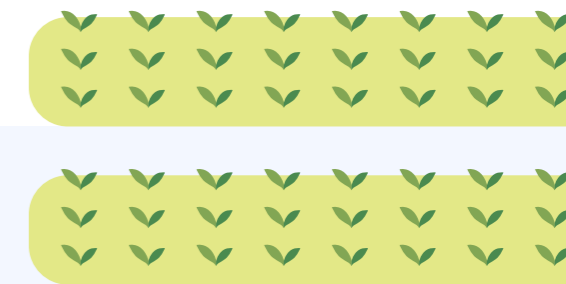
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The importance of building energy efficiency

The report suggests that buildings can achieve net zero emissions by 2050, but early action within the next decade is critical. Building energy consumption in Hong Kong accounts for 90% of carbon emissions from electricity generation. Compared with the net zero targets set out in the report, the building energy efficiency targets proposed by the SAR government in the "Hong Kong Climate Action Plan 2050" are too modest. The current incentives are all voluntary, and have not been able to accelerate the retrofitting of existing buildings; Also, not all new buildings meet energy-saving standards. We must be consider raising building energy efficiency targets and mandating building energy efficiency measures to accelerate progress toward net zero building emissions.

5



Carbon emissions from land use changes

The report affirms that land use is an important factor of carbon emissions and carbon sequestration. Protecting and restoring ecosystems can help remove carbon dioxide from the atmosphere and store carbon in the land. However, there is currently a lack of research on the impact of land use changes on carbon emissions in Hong Kong; therefore it is impossible to assess the impact of future large-scale infrastructure projects on carbon emissions, which needs to be addressed by the relevant authorities.



METHODOLOGY

The analysis of climate actions 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.

The first question

“Is Hong Kong on track?”

Requires a year-on-year comparison of current and projected carbon emissions as well as a comparison between Hong Kong and other East Asian cities. This relies on quantitative measurements of annual carbon emissions by the environmental authorities of each city. We also track carbon emissions from key sectors in Hong Kong and East Asian cities.

The second 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 the deployment of renewable energy is reducing carbon emissions. This primary data is available from city energy authorities and electricity generation companies.

The third question

“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 a year-on-year basis and across cities, in order to measure the take-up of such vehicles. This primary data is available from the city transport authorities and electricity generation companies.

The fourth 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 risks; 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.

The fifth 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.

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.



CLIMATE ACTION REPORT ANALYSIS



Report Analysis

Is Hong Kong on track?

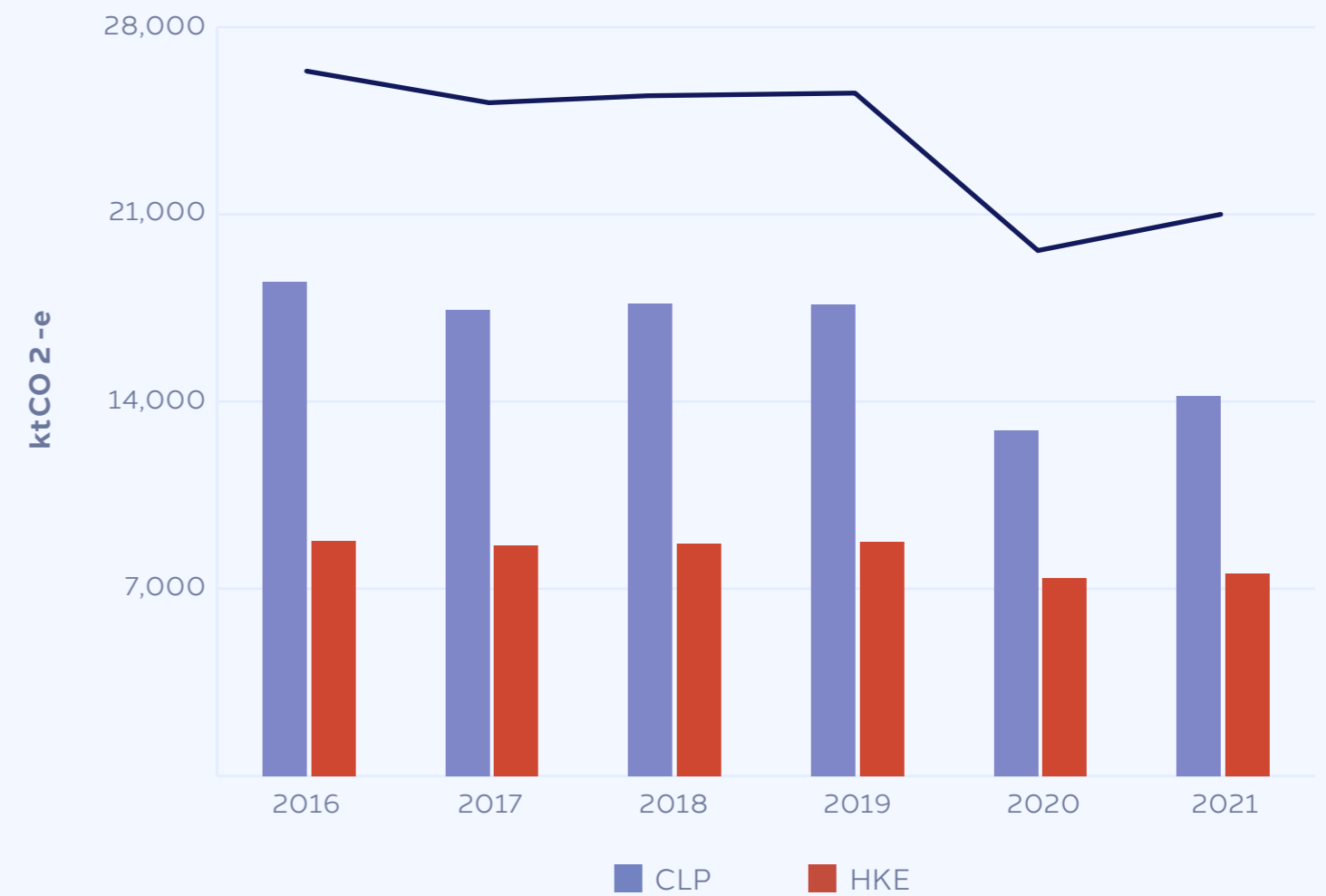


In the latest figures released by the HKSAR Government, per capita emissions in 2020 were 4.5 tons of carbon dioxide equivalent. This is a significant reduction from 5.3 tons of CO₂-equivalent in 2019, with absolute emissions of 33,795 kilometric tonnes of CO₂-equivalent and a carbon intensity of 0.013 kg of CO₂-equivalent per Hong Kong dollar of GDP.

Comparison with HKSAR's own targets

We estimate that carbon emissions will rebound in 2021, even as official figures show an acceleration in emissions reductions in and before 2020. It is worth observing that in the power generation sector, which accounts for 60% of greenhouse gas emissions, due to social distancing measures during the COVID-19 pandemic, electricity sales of Hong Kong's two main power companies, CLP and HKE, in 2020 recorded a slight decrease of 1.6% compared with 2019. The greenhouse gas emissions of the two power companies dropped by 23%. However, in 2021, the electricity sales of the two power companies rebounded by 3.7% compared with 2020, and the greenhouse gas emissions will rebound by 7% compared with 2020, while the global average was 4.9%. Assuming that electricity generation accounted for a similar proportion of GHG emissions in 2021, the total emissions in Hong Kong in 2021 were projected to be about 35,200 ktCO₂-e.

Figure 2. Greenhouse Gas Emissions from Electricity Sold by CLP and HKE (ktCO₂-e)

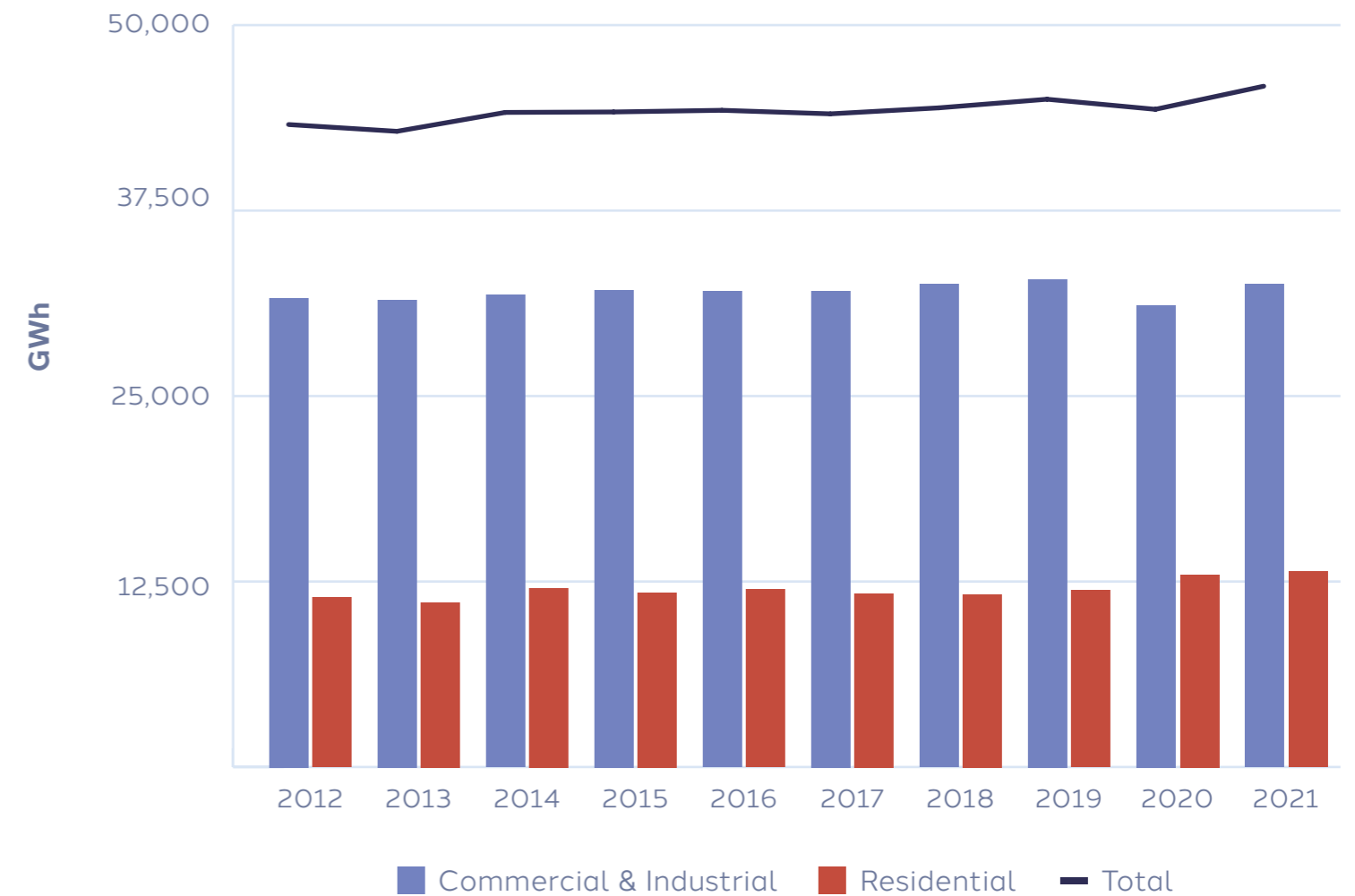


Electricity sales of the two power companies to the industrial and commercial services sector and residential buildings

Another notable trend is the electricity sales of the two power companies to the industrial and commercial services sector and residential buildings. Although greenhouse gas emissions recorded a significant drop of 16% in 2020, electricity sales of the two power companies in 2021 rebounded by 3.7% compared with 2020. Let's look at the two major sources of electricity consumption: the industrial and commercial services sector and the residential sector. Although electricity sales to the industrial and commercial sector from the two power companies fell by 5.3% in 2020, they rebounded by 4.5% in 2021, returning to the 2018 level. The sales of electricity to the residential sector also rebounded by 4.5% in 2021. Electricity sales rose even during the COVID-19 pandemic, up by 10.5% from 2019. From the above figures, we can confirm that the impact of the pandemic on Hong Kong's greenhouse gas emissions has been slight, but most of the decline can be attributed to the switch to natural gas. We have also observed that South Korea's electricity sales rebounded to pre-pandemic level in 2021 after a decline in 2020. Therefore, it is estimated that the electricity sales of other East Asian cities will also rebound when social distancing measures are relaxed.

Therefore, if we fail to significantly reduce electricity consumption in the short term, even though we can completely switch to natural gas, greenhouse gas emissions will likely rise to pre-2020 level. This would undermine the government's climate action targets of halving carbon emissions by 2035 and achieving net-zero by 2050.

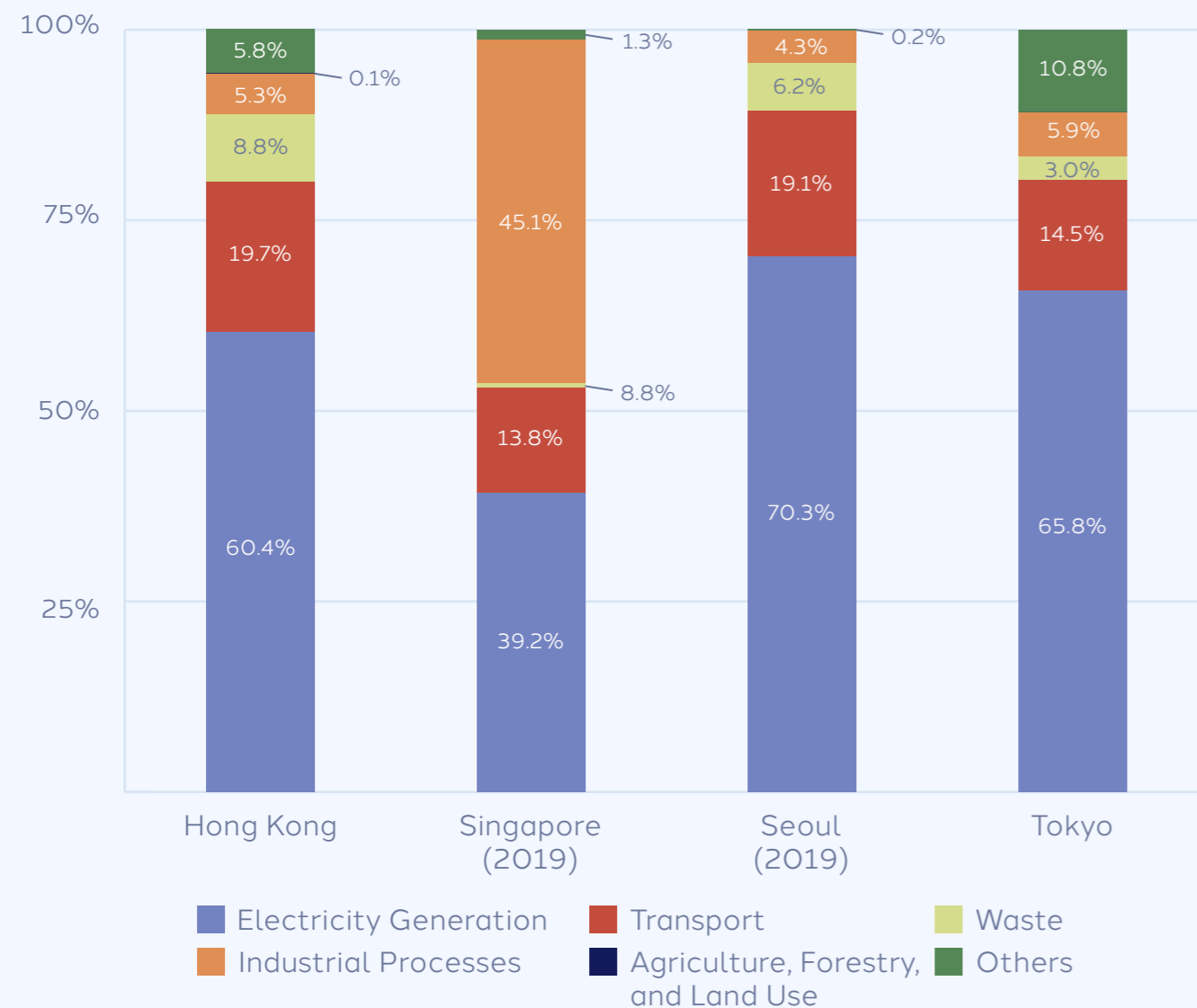
Figure 3. Electricity Sold by CLP and HKE (Commercial & Industrial vs. Residential) (GWh)



(Source: CLP, HKE)



Figure 4. Greenhouse Gas Emissions by Sector (2020)



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

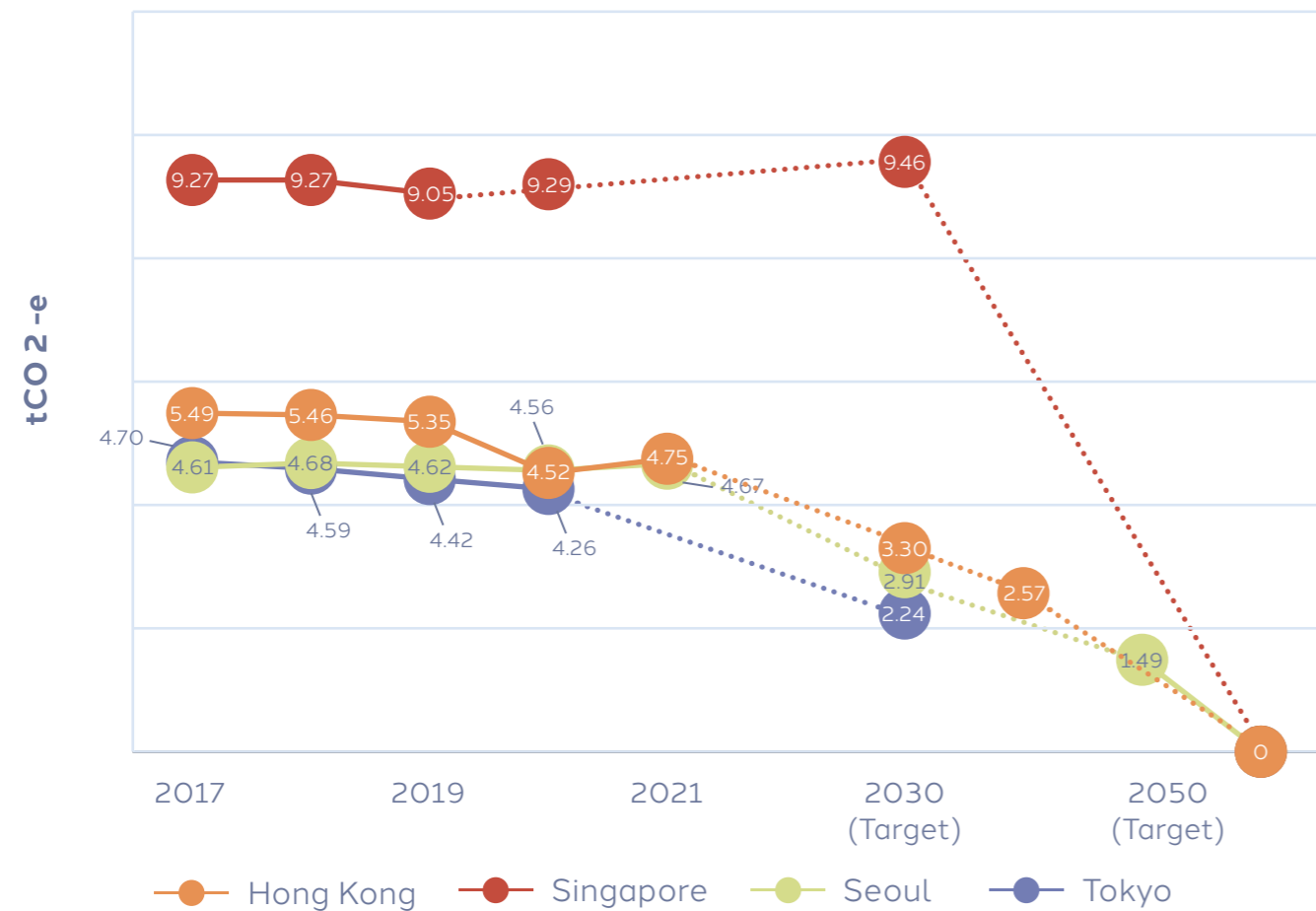
Key composition of carbon emissions in selected East Asian cities

We compare the key composition of carbon emissions in selected East Asian cities by sector, as shown in Figure 4. Guangzhou and Shenzhen are not included because the 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.

We have made a comparison of per capita emissions in Hong Kong, Singapore, Seoul and Tokyo, as shown in Figure 5. Singapore was the worst performer, with the highest carbon emissions per capita, while the carbon emissions of Tokyo, Seoul and Hong Kong were at similar level in 2020/2021. Although only Seoul has released official data on the rebound in the city’s carbon emissions in 2021, the carbon emissions data from the two power companies in Hong Kong show a rebound, and we can infer that carbon emissions in other East Asian cities will also rebound in 2021. In anticipation of a rebound in business and transportation activities following a post-pandemic relaxation of social distancing measures and cross-border movement controls, we are concerned that cities in East Asia will deviate from their net-zero paths in the short term, with substantial increase in the coming decade. Carbon reductions will thus face greater challenges.

Compared to 2021, of the six cities' net zero commitments, only Singapore update its target to be carbon neutral by 2050, Tokyo, Seoul and Hong Kong retain their carbon neutral targets for 2050, but at different rates of decarbonisation. Both Guangzhou and Shenzhen follow China's national “dual carbon” goals, i.e. peaking carbon emissions by 2030 and achieving carbon neutrality by 2060.

Figure 5. Per Capita Emissions in 4 East Asian Cities



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

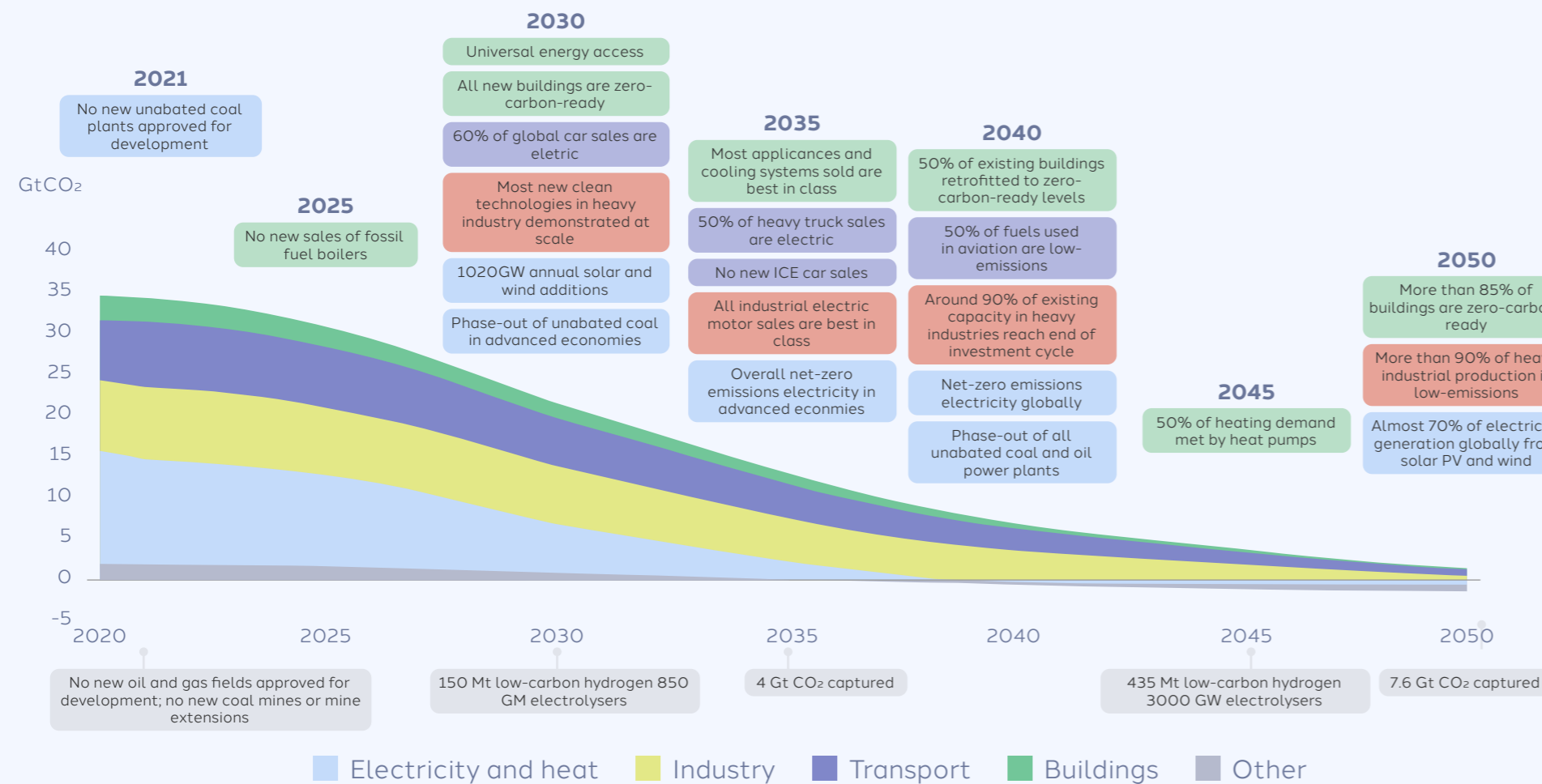
Table 3. Comparison of carbon neutrality pledges in six East Asian cities

	2030	2035	2040	2050	2060
Hong Kong	Carbon intensity down by 65-70% (or absolute 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 60 Mt CO ₂	N/A	N/A	Achieving net zero	N/A
Seoul	GHG emissions down by 40% from 2005 level	N/A	GHG emissions down by 70% from 2005 level	Carbon neutral	N/A
Tokyo	GHG emissions 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

Good practices for achieving science-based, robust milestones and a net-zero path

The IEA released a report in 2021 titled “Achieving Net Zero by 2050: A Roadmap for the Global Energy Industry”, calling on governments to provide credible, step-by-step plans to achieve net zero, in order to build confidence among investors, industries, citizens and other countries in the net zero plans. It recommends setting near-term milestones and long-term targets for key emissions sectors such as energy, buildings and transport. Governments must develop long-term policy frameworks that enable government departments and stakeholders to facilitate energy transition plans. These near-term milestones and long-term goals must be measurable and linked to policy.

Figure 6. Key milestones in the pathway to net zero (Source: IEA)



Conclusion

After the global COVID-19 pandemic gradually wanes, we can foresee that the carbon emissions of East Asian cities will rebound in the short term, though there was a significant reduction from 2019. In the case of Hong Kong, per capita emissions in 2020 were 4.5 tons of carbon dioxide equivalent, down from 5.3 tons in 2019. However, we estimate that carbon emissions will rebound in 2021. We are concerned that Hong Kong will not be able to achieve its carbon reduction targets for 2030, 2035 and 2050.

One of the key steps is to raise the mid-term targets for 2030 and 2035. Comparing the 2030 targets of Hong Kong, Seoul and Tokyo, Hong Kong still has the highest per capita emissions. In addition, the 2030 target must be aligned with IPCC recommendations and the Paris Agreement requirement to limit temperature rise to 1.5 degrees Celsius above pre-industrial level, i.e. Hong Kong must reduce greenhouse gas emissions by at least 45% compared to 2005. Failure to reach this mid-term level will likely result in missing the 2050 net-zero target. In addition, we must enhance the capacity of city governments to implement effective carbon reduction measures in all major emissions sources, especially energy, buildings and transportation, to ensure that cities will not deviate from their carbon neutrality goals and pledges.

Are we transitioning to a low carbon economy by developing renewable energy?

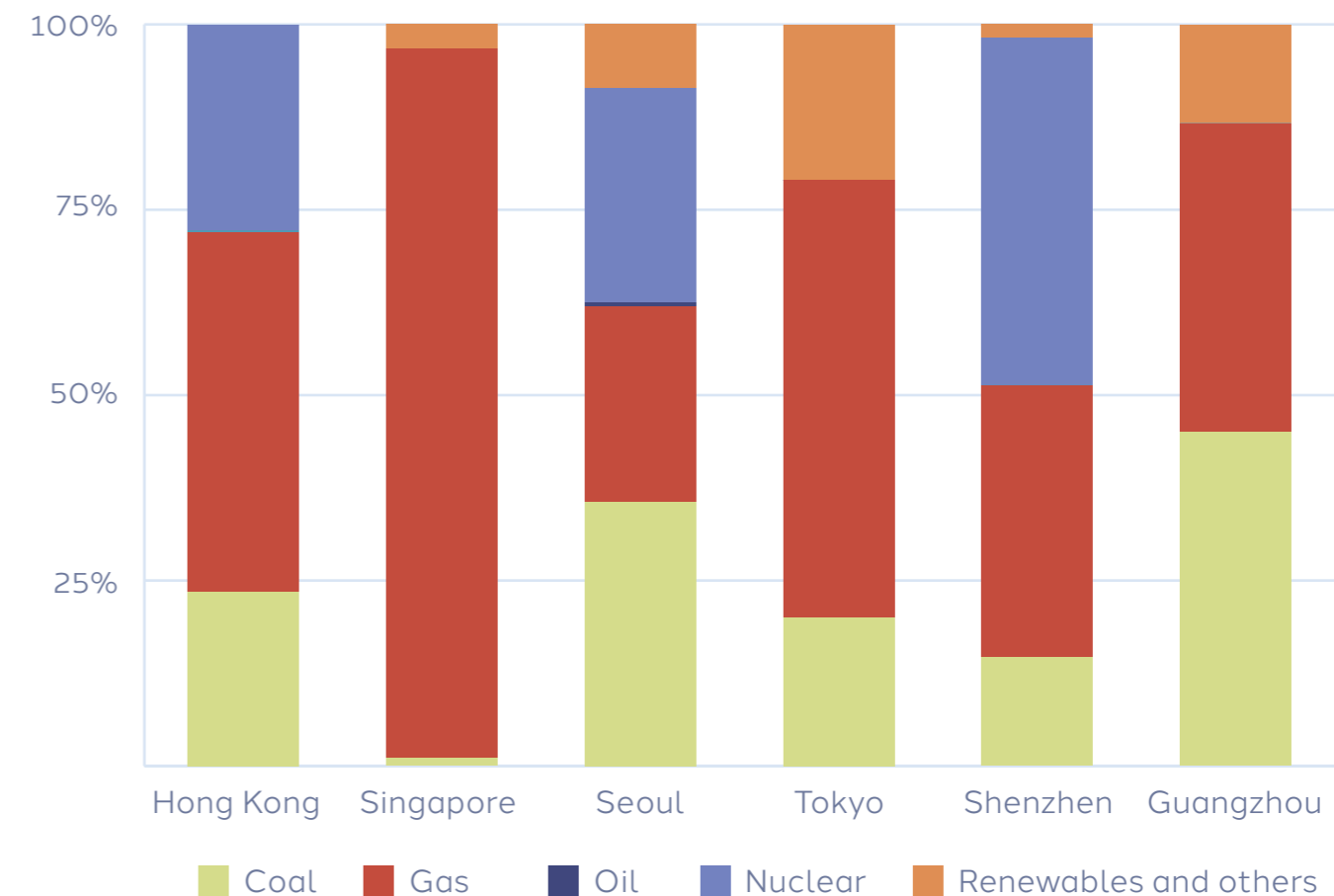


Current Energy Portfolio

In the six selected East Asian cities, nearly 50% to over 90% of electricity is produced by either coal or natural gas, as shown in Figure 7. Electricity generation is a key carbon emissions source in these cities. The trend of gradual, slight reductions in 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 8. Hong Kong, Seoul and Singapore have pledged to phase out the use of coal by 2035, 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.

Although the use of renewable and other alternative energy sources has increased, it has not yet had a significant impact on the carbon intensity of electricity production. Energy transition has not really taken place.

Figure 7. Electricity Fuel Mix of 6 Selected Cities as of 2021*



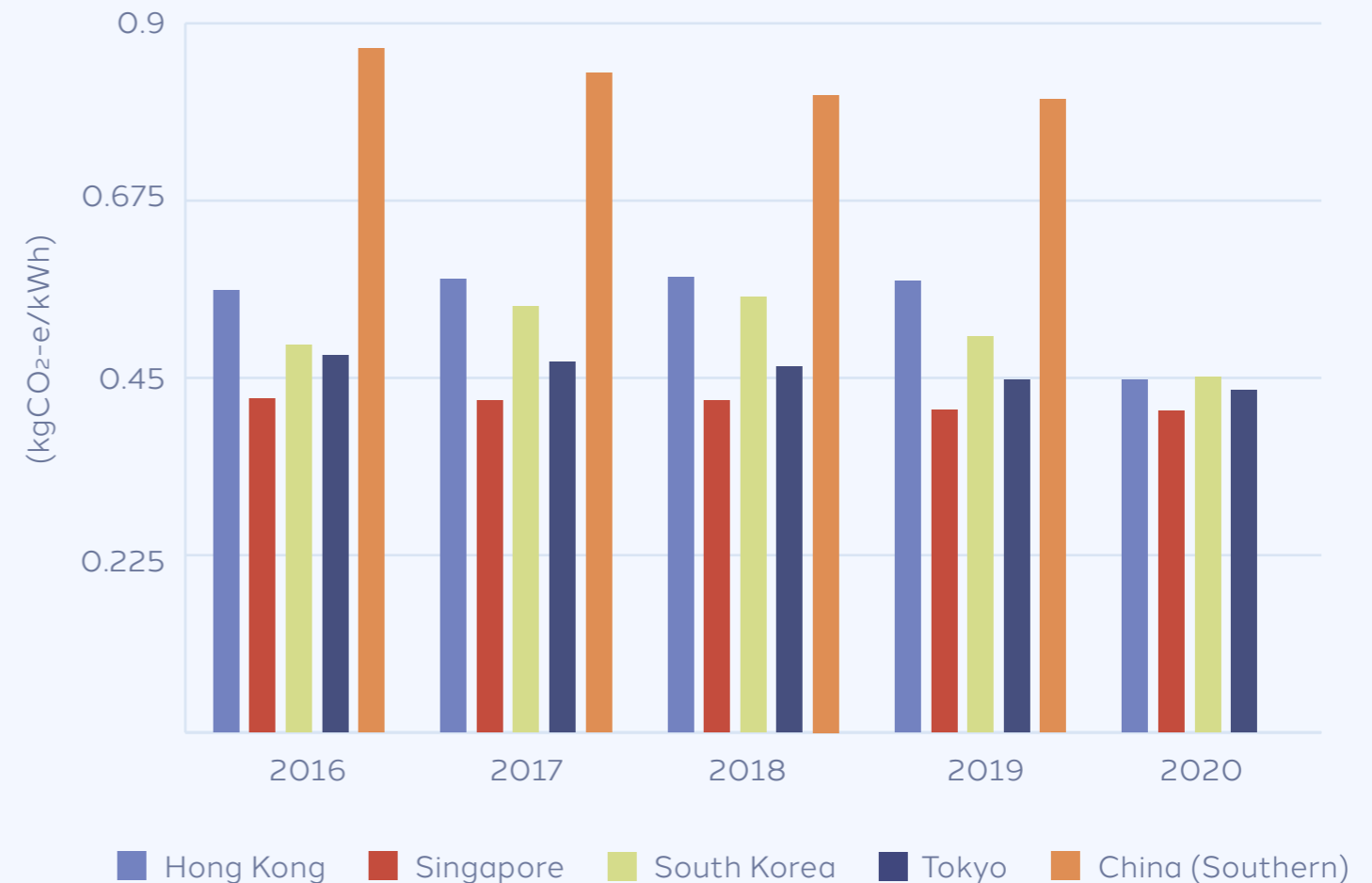
(Source: CDP-ICLEI (HK, Singapore, Seoul, Tokyo), GMPG (Guangzhou), SZDRC (Shenzhen)).

Renewable Energy Status and Pledges

Despite currently low performance, all the cities have made pledges to phase out coal and/or scale up renewable energy, ranging from 10% to 50% of their energy fuel mix, in the next 10-15 years, as shown in Figure 9. It is encouraging to see 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 contributed 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 (2018) to 267 MW (2021). However, when we look at renewable energy in the fuel mix in the past 5 years, the annual increase is still minimal, only rising from 0.2% in 2018 to 0.38% in 2020.

East Asian cities have made their own renewable energy commitments. Seoul and Tokyo released their 2022 annual climate action plans and zero-emission strategy updates, and proposed fiscal and subsidy measures to stimulate renewable energy growth. However, the Hong Kong SAR government lowered the Feed-in Tariff (FiT) in April 2022, without public consultation. A member of the Legislative Council worried that the costs would not be recovered before the end of the FiT scheme in 2033, making it hard to achieve the solar energy target, with the high price of solar power installations. In fact, even though CLP and HK Electric have announced offshore wind farm plans, which are expected to be operational by 2028, the two plans together can only meet about 2% of the electricity demand, far below the government's 3-4% wind energy targets. Moreover, the proportion of solar power generation in Hong Kong is still very low. According to a study by the Hong Kong Polytechnic University, solar power generation could potentially reach 4.67 million kWh per year, accounting for 10.7% of Hong Kong's energy demand. The government should thoroughly review Hong Kong's renewable energy potential and whether the target can be raised.

Figure 8. Carbon Intensity of Electricity Generation



(Source: CLP & HKE (HKSAR), KEPCO (South Korea), EMA (Singapore), TEPCO (Tokyo), MEE (China))

*Note: China (Southern) data is up to 2019 only.

*Note: The figures for Shenzhen and Guangzhou are estimated using data from the cities' energy planning.

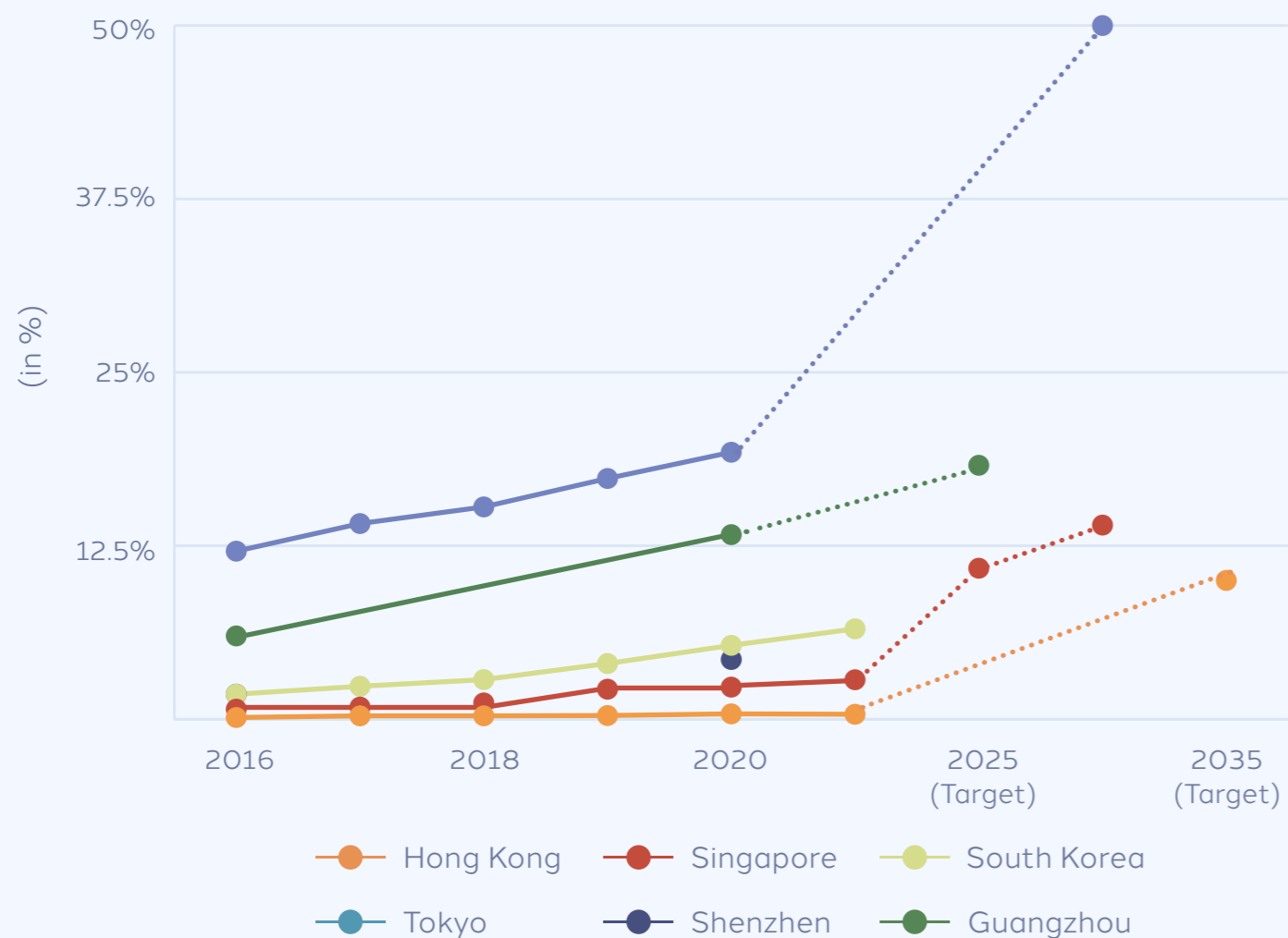
Hong Kong's RE target is lagging behind

In comparison with other East Asian cities, Hong Kong's targets lag far behind. 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 city mayors, including those of Seoul and Tokyo, in committing to 100% renewables by 2035 or 2050. 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.

The 2050 net zero plans of Tokyo and Seoul may also be influenced by the energy policies of the host countries. Affected by global economic fluctuations amid the coronavirus pandemic and the war in Ukraine this year, coupled with the desire to reduce dependence on imported fossil fuels, Japanese Prime Minister Fumio Kishida is considering restarting multiple nuclear power plants and supporting the construction of new nuclear power plants. On the other hand, South Korean President Yoon Suk-Yeol is fulfilling his campaign promise on reviving nuclear energy. The Ministry of Trade, Industry and Energy announced it will increase the proportion of nuclear energy in the total power generation capacity by 2030 to 32.8%, while reducing the proportion of renewable energy to 21.5%. The two countries' moves have added nuclear risks to their net zero plans, casting a shadow over the net zero plans of their capital cities.



Figure 9. Renewable Energy Status and Pledges



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

Conclusion

In the past year, the use of renewable energy in the East Asian cities we compared only made a very limited increase. A real energy transition has not occurred. At the current rates, these cities will not contribute greatly to energy conservation and carbon reduction. Restarting nuclear power in order to achieve net zero will increase safety and security risks. It is also worrying that before a real energy transition and renewable energy market have taken shape in Hong Kong, the city can't wait to lower its feed-in tariff, citing the world trend. It will send the wrong signal to the energy market and reduce potential investment, making it more difficult for the government to achieve its own net zero goals.

While other cities struggle to achieve energy transition, Hong Kong's decision to reduce the feed-in tariff at this time is questionable. If the government is sincere in its stated goals, it must withdraw this decision, and change the current Control of Scheme Agreements with the two power companies. The government should encourage maximising the potential of renewable energy within the territory, as well as the import of renewable energy from other places through joint investment and grid connections, including offshore wind and large-scale solar photovoltaics.

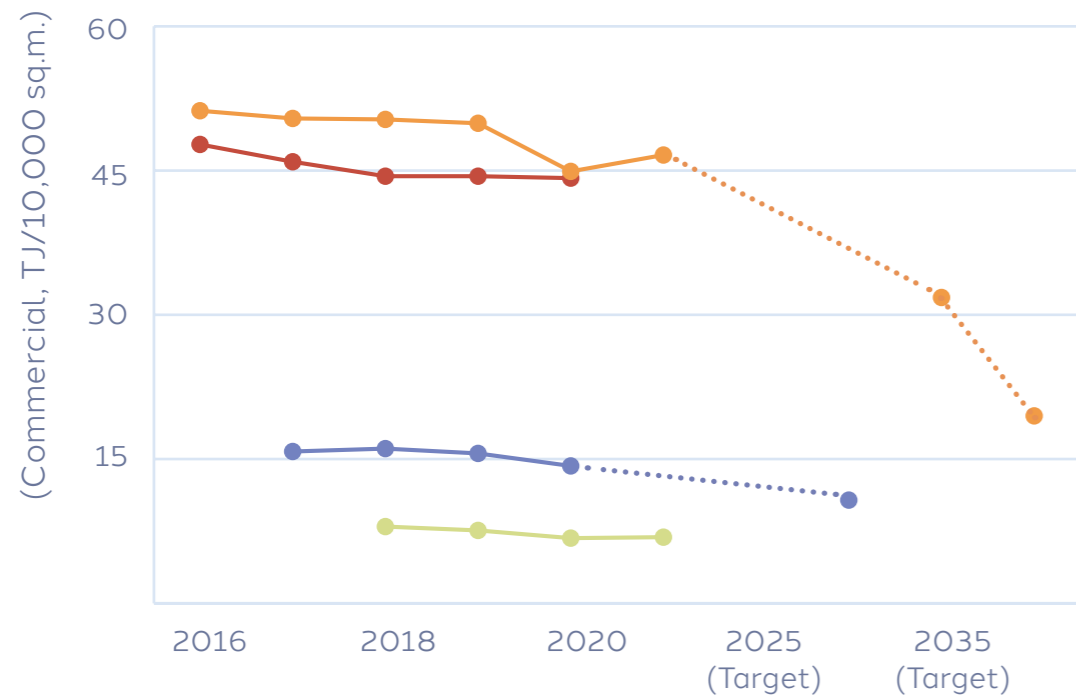
In terms of energy consumption, buildings and transport together account for over 60% of GHG emissions, and therefore need to be the focus of plans to increase energy efficiency and switch to clean sources of energy.

Buildings' energy use

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

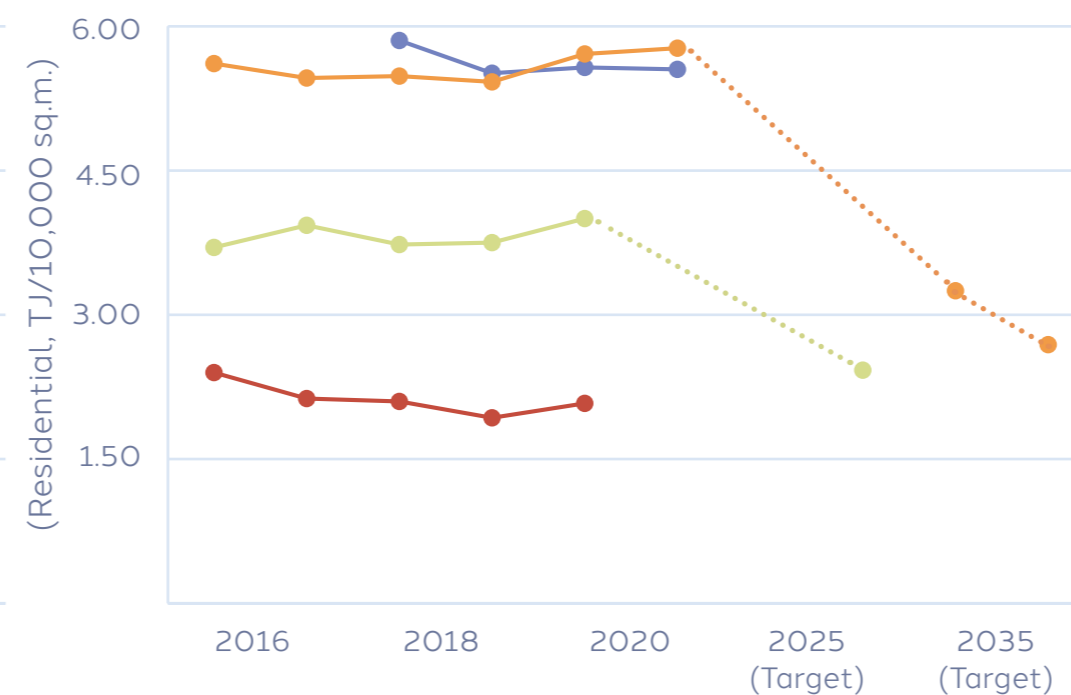
As shown in Figures 10 and 11, among the four East Asian cities, buildings in Hong Kong have the highest energy consumption among commercial and residential buildings. We were unable to put Guangzhou and Shenzhen in comparison because the official data was incomplete. The outbreak of COVID-19 in 2020 caused a decrease in electricity consumption in commercial buildings. However, in 2021, it rebounded due to the gradual relaxation of social distancing measures. In contrast, electricity consumption in residential buildings rose during the pandemic, due to the increase in work from home arrangements. This was

Figure 10. Building Energy Efficiency



(Source: CLP & HKE, EMSD, RVD, GPA (HKSAR), KEPCO (South Korea), EMA (Singapore), TMG (Japan))

Figure 11. Building Energy Efficiency



(Source: CLP & HKE, EMSD, RVD, GPA (HKSAR), KEPCO (South Korea), EMA (Singapore), TMG (Japan))

—●— Hong Kong —●— Singapore —●— Seoul —●— Tokyo

particularly the case in Hong Kong and Tokyo. As the COVID-19 outbreak continues to slow, and social distancing measures and cross-border movements of people continue to ease, we expect electricity consumption in commercial and residential buildings in East Asian cities to rebound in the short term. In the past few years, voluntary building energy efficiency measures have had little effect. In the face of a rebound in electricity consumption, we expect the building energy consumption will continue to rise. In 2021, Hong Kong followed the lead of Tokyo and Seoul in setting quantitative energy-efficiency targets for commercial and residential buildings in 2035 and 2050 in its Climate Action Plan 2050, but we are concerned that the targets will be difficult to achieve without effective building energy-efficiency measures.



The Tokyo Metropolitan Government updated its zero emission strategy in 2022. In addition to mandating the installation of solar photovoltaic panels in new large-scale buildings, the Tokyo authority has considered subsidising new, small and medium-sized houses to install solar photovoltaic panels, requiring that their energy efficiency must be higher than the national average. The relevant law amendments are currently undergoing public consultation. The Seoul Metropolitan Government has also introduced measures such as mandatory zero-energy buildings. As for Hong Kong, the Buildings Energy Efficiency Ordinance (Cap. 610) has been in place since 2012, requiring all public facilities in new buildings to meet energy saving standards and requiring commercial buildings to undergo energy audits every ten years. However, these requirements are too loose and lack clear carbon reduction targets. Hong Kong should follow the examples of Tokyo and Seoul, gradually implement mandatory renewable energy installations and zero-energy buildings, and actively promote and subsidise energy-saving retrofit projects for all existing buildings.

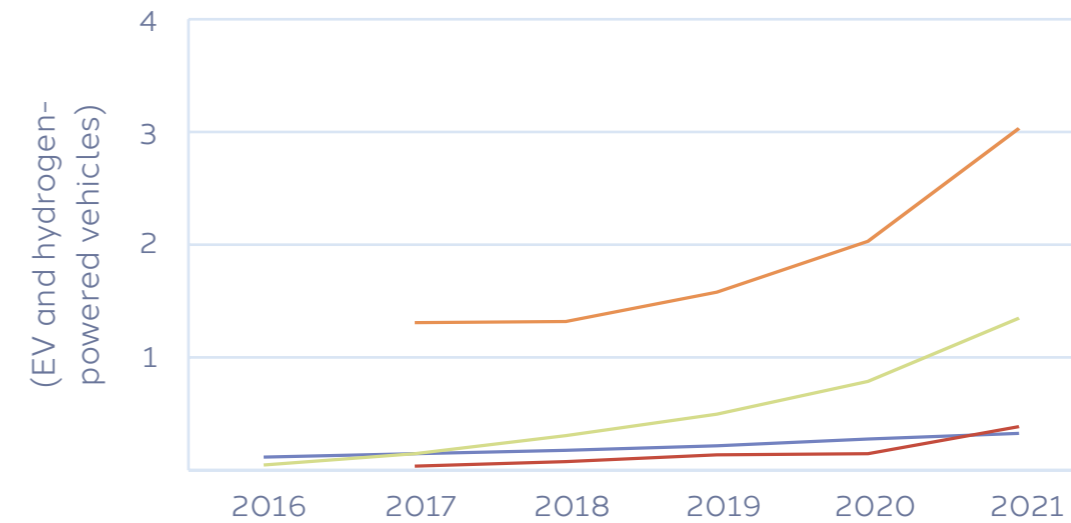
In the case of Singapore, even though there is no quantitative energy saving or carbon reduction target for all buildings, the city has introduced other targets for energy efficiency for certain types of buildings according to Singapore's Green Building Masterplan. This is also something the Hong Kong SAR Government could learn from in setting sub-sector targets, as steps towards better reduction targets for all buildings. Given Hong Kong's target to halve total greenhouse gas emissions by 2035, and the overwhelming role of buildings in these emissions, we are wary of plans and targets that do not detail robust and comprehensive policy measures on building energy use.

Carbon emissions from the transportation industry

Since the 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 9 and 10 show that 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 0.33% to 3.03%. The percentage of all types of new energy vehicles, including zero emission vehicles, hybrid and CNG vehicles, is the highest in Tokyo (20.3%) because of the popularity of hybrid-fuelled vehicles in Japan, while the ratio of these vehicles in the other three cities is similar, ranging from 5.54% to 7.17%.

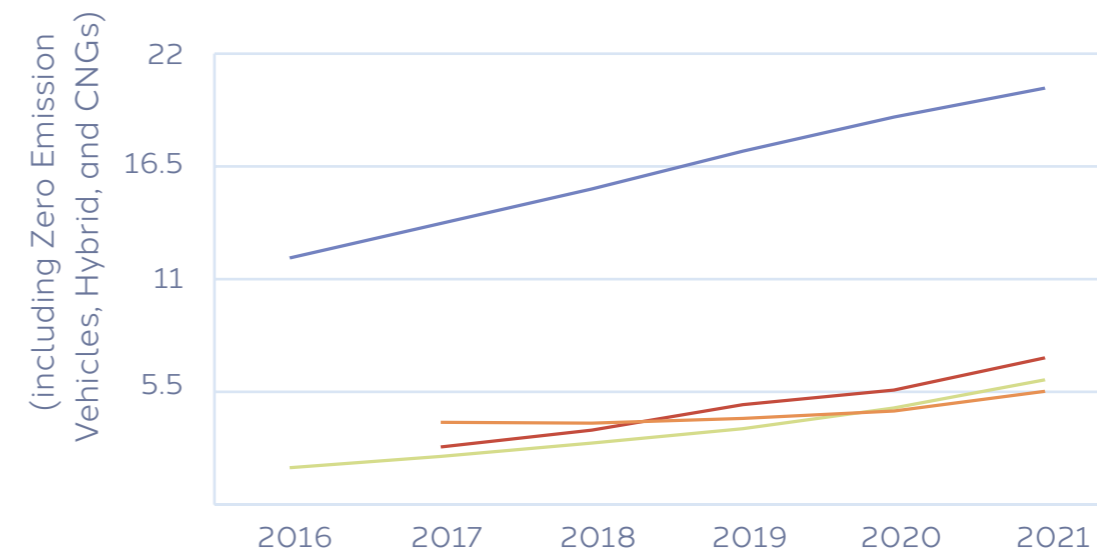
One of the key factors is the deployment of electric vehicle (EV) charging stations. We expect that the number of electric vehicles will increase significantly in the next decade. Even if governments plan hundreds of thousands of charging stations, it may still be insufficient. Therefore, accelerating the deployment of charging stations will be the key. East Asian cities are taking different measures to achieve this. Seoul plans to set up 55,000 charging stations and 15 hydrogen refuelling stations by 2022; Hong Kong plans to set up 150,000 charging stations by 2025; and Tokyo plans to require that new large-scale buildings and subsidised smaller buildings install EV charging stations.

Figure 12. Percentage of Zero Emission Vehicles



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

Figure 13. Percentage of New Energy Vehicles



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

—●— Hong Kong —●— Singapore —●— Seoul —●— Tokyo

Another important indicator is the popularisation of zero-emission vehicles. Tokyo, Seoul and Hong Kong have proposed to stop the new registration of gasoline-fuelled vehicles by 2030 or 2035. Tokyo and Seoul have even proposed that zero-emission vehicles should account for 50% of new car sales by 2030. However, at the G7 summit in 2022, it was reported that Japan's representative asked to dilute the target of zero-emission vehicles, changing it to "significantly increase sales, share and uptake of zero-emission light duty vehicles", which raised questions about Japan's commitment to zero-emission vehicles.

Electric vehicle batteries can also become a source of clean energy in the future. Some studies have pointed out that as long as electric vehicles are connected to the power grid (V2G) and integrated with the power grid (VGI), they can contribute to the energy transition. Technologies in this area are worth researching. East Asian cities should exchange their experiences in investing in relevant technologies and formulating relevant policies.

Table 4. 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)

Conclusion

East Asian cities have made slight progress in energy efficiency and emissions reduction in buildings and transportation. However, with the slowdown of the COVID-19 pandemic, energy consumption is rebounding, and the targets set for building energy efficiency need to be raised. These goals will be difficult to achieve without strong regulatory measures and supportive policies. In terms of transportation, Hong Kong plans to stop the registration of diesel vehicles by 2035, while Seoul has stated that it will limit the use of fuel vehicles in 2050, setting a precedent for legislation to reduce carbon emissions. We need to take the same approach and regulate the design, construction and operation of buildings, as well as all types of vehicles and fleets.

Are we adapting to make Hong Kong a safe and healthy city in the face of global warming?

Hong Kong has already been experiencing the impacts of extreme weather, including its longest heat wave in July 2022. There were 21 very hot days (with daytime temperatures of 33° C or above) and 25 hot nights (with night-time minimum temperatures of 28° C or above), of which 21 were consecutive. These temperatures were record-breaking, according to the Hong Kong Observatory. Vulnerable groups of people – the elderly and children, the disabled, ethnic minorities, outdoor workers and residents of sub-divided flats – are



most affected by extreme weather. Our question on adaptation is particularly relevant with regard to these vulnerable groups.

To answer the adaptation question, we 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 risks; 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 is a summary of our ratings of climate adaptation plans across the six selected Asian cities.

As noted in our 2021 report, these East Asian cities' climate adaptation plans and policies still do not cover all seven climate hazards, nor do they affirm



a core principle of the Paris Agreement, ensuring a 'just transition'. Both Hong Kong and Tokyo signed the C40 Equity Pledge in 2022, a commitment that the government's climate action would be equitable, inclusive, and community-based. It remains to be seen how they will implement the C40 Equity Pledge and the 'just transition' principle.

Only Seoul and Tokyo treat climate change adaptation at the same level as mitigation. Both cities have 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 replete with self-congratulation for past initiatives as well as ongoing efforts, with little evaluation on weaknesses or areas in need of improvement.

Governments in all six cities have focused on the impact of heatwaves and heat-induced illness, and diseases related to heat and precipitation. All cities except Singapore have enacted basic measures to protect the most vulnerable – such as extreme weather warnings, work guidelines and community support services – while Shenzhen and Guangzhou have laws to stop outdoor work in high temperatures. However, in the summer of 2022, both Hong Kong and Tokyo experienced their longest heat waves. Hong Kong's high temperatures in July broke 11 historical records. As of August 10, Tokyo recorded 14 days of extreme heat (daytime temperatures of 35 ° C or above), which also broke past records. Vulnerable groups in cities, including the elderly and children, outdoor workers, persons with disabilities and mental illness, and those living in poor conditions, struggle to cope with longer and hotter days. These cities issued notices of extremely hot weather and warnings of possible heat stroke, but did not clearly address the impact of heatwave-induced diseases. They have no relevant laws to protect the lives and health of those affected by high temperatures.

Table 5. Ratings based on a comparison of climate adaptation plans across the six selected Asian cities

Cities	Adaptation							
	Heatwaves and heat-induced illness	Heat & precipitation related 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, N/A: Data Incomplete)
 (Source: PD, EMSD, HKJCDPRI, ENB (HKSAR), URA, ETHZ (Singapore), SMG (Seoul), TMG (Tokyo), SMPG (Shenzhen), GMPG (Guangzhou))



Sea level rise, sea flooding and coastal erosion

Most of the cities list this as one of their main climate threats, except for Seoul and Guangzhou, which are less exposed to the coastline. In 2022, Hong Kong published a consultancy report on coastal hazards, listing high-risk areas affected by sea level rise and storm surges, and suggesting improvements and suitable mitigation measures. Even so, a study that specifically compares the three cities of Hong Kong, Singapore and New York in their response to sea level rise found that Hong Kong still lags behind Singapore and New York, putting more than 43,000 residential, industrial and commercial buildings and up to 82% of the city's revenue at risk.

Water shortages and drought

All six cities have plans and contingencies, community education programs, preparations for water conservation and rationing, water risk analyses and monitoring, including up-stream supply conditions. On increased fire risks, only Seoul covers this in the city's climate adaptation policies and action plans. It is not covered in other cities' plans.

Reduced biodiversity and damage to ecosystems

Each city has its own biodiversity research, policies and regulations, and incorporates biodiversity into its climate action plans. The linkage between biodiversity policy and climate change appears to be strong. Plans in Tokyo, Seoul and Shenzhen also explore nature-based or ecosystem-based solutions for climate action.

Typhoons, floods and landslides

In 2022, Hong Kong will step up its flood prevention work, improve the storm water drainage system, and allocate additional financial resources to continue related work in the future. Seoul recorded the heaviest rain in at least 80 years in August, with more than 400 mm of rainfall in two days, 30% higher than the average annual rainfall. It caused serious flooding in South Korea's province of Gyeonggi-do, which includes the greater Seoul area, leading to more than a dozen casualties, affecting more than 1,000 people, and flooding many houses. At least one family was drowned in their semi-basement home. This incident brought public attention to the issues of flood control in the Seoul metropolitan area, and the problem of semi-basement homes, leading South Korean officials to announce that semi-basement apartments would be banned within 20 years. This heavy rain exposed Seoul's lack of ability to deal with such emergencies. Some media reported failures in the full and timely disclosure of information. Risk maps were only open to the public in 7 out of 25 districts, making it impossible for social services and citizens to respond in time.



Climate risk insurance

Lastly, climate risk insurance is one of the key issues in mitigating climate risks and impacts. Climate risk insurance can help protect individuals, small businesses or entire countries from permanent damage caused by the impacts of extreme weather events. In the short term, it can reduce the financial effects of natural disasters and, in the longer term, can contribute to preventive disaster risk reduction. South Korea was the first country to enact a storm and flood insurance law, and the Monetary Authority of Singapore issued Guidelines for Environmental Risk Management for Insurers in December 2020, which could serve as an example for regulators in other Asian cities and a base for establishing sector-wide standards across Asia. The insurance industry across Asia has been exploring its multiple roles as risk assessors, risk advisers, risk underwriters and institutional investors, and looking at how climate impacts can be factored into insurance products. A repository of skills training and data, including climate risk assessment tools, launched in June 2022 by the Green and Sustainable Finance Cross-Agency Steering Group set up by the Hong Kong Monetary Authority (HKMA), lays the foundation for the insurance industry to develop related products.

Compared to other cities' plans, Hong Kong's climate action plan lacks key performance indicators, a monitoring and evaluation plan, and a public engagement plan. More importantly, the principle of just transition has not been carried through to the entire climate adaptation plan. In late 2022, CarbonCare InnoLab will publish a Just Transition Report, a compilation of multi-stakeholder dialogues we have conducted since 2018 with various stakeholders from the housing sector, welfare sector, community healthcare sector, outdoor workers' unions, disability organisations, women's groups, urban planners, information technology (IT) sector, environmental groups and scholars, etc. These conversations seek to address the real impacts of global warming on the lives of residents, especially on the most vulnerable groups, and the societal implications of transitioning to a future net-zero economy.



Conclusion

In the past year, the six cities we researched have made progress in climate adaptation policies and measures, but only Seoul and Tokyo maintain an open and accountable approach. Both cities independently publish relevant strategies, performance indicators, and monitoring and evaluation plans. Other East Asian cities are still lacking in this approach. It is a great irony that some developed cities are left alone when international development agencies are promoting national adaptation plans (NAPs) in developing countries, inviting them to join monitoring and evaluation programmes, and providing capacity building.

Are we developing the right governance and financial systems to tackle climate change?

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 key elements of the cities' climate strategies and action plans. Table 5 captures a summary of ratings of the key aspects of climate governance across the six Asian cities.



All the cities' governments demonstrate a high level of political leadership in climate change strategy, coordinated by their mayors and high-level leadership groups. However, the Environment and Ecology Bureau of the Hong Kong SAR has not announced personnel appointments or committee members for the Climate Change and Carbon Neutrality Office and Advisory Committee it established in October 2021, nor has it been clear on how the two institutions will achieve the purpose of promoting public participation.

Transparency, accountability, monitoring and evaluation

On transparency, accountability, monitoring and evaluation, the cities' governments disclose annual emissions measurements and energy use, except for Shenzhen and Guangzhou. They exhibit different degrees of transparency with regard to their climate policy review processes. 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.

Policies and plans

Concerning policies and plans, it is reassuring that all six cities' governments have set decarbonisation goals and have indicated areas of action to achieve these. The Tokyo Metropolitan Government published an updated zero-emission strategy in February 2022, showing progress in carbon reduction and expanding mandatory renewable energy installation measures, with a view to halving carbon emissions by 2030. The Seoul Metropolitan Government has published a climate work plan for 2022, with a specific budget and goals for the next two years. Guangzhou and Shenzhen have passed their respective 14th Five-Year Plans for environmental protection, while Singapore from time to time updates the climate action measures in its Green Plan 2030. However, in 2022, no city has been able to show how its plans are aligned with global carbon reduction targets and based on a carbon budget, nor has any city shown how to move from a medium-term goal to the eventual goal of carbon neutrality. These cities' governments provide little support to developing countries for climate change, because in China, Japan and South Korea it is the national governments that handle foreign policy and aid programmes. In the case of Singapore, the city-state provides mainly technical support.

Advancing climate finance

On advancing climate finance, all the cities' governments have identified climate mitigation and adaptation as a key policy item in their budgets, and green finance as an opportunity for their financial sectors. Most cities have established institutions to oversee the development of green finance, and have made progress in promoting carbon trading markets. For example, when the Singapore government announced its 2022 Budget, it proposed increasing the carbon tax from 2024 to promote its net zero target; and the Hong Kong Exchanges and Clearing (HKEX) signed a cooperation agreement with the Guangzhou Carbon Emissions Trading Centre in March 2022. In July, the Hong Kong International Carbon Market Committee was established. In June, the Green and Sustainable Finance Cross-agency Steering Group, set up by the Hong Kong Monetary Authority (HKMA), launched skills training and database links. Green taxonomy and reporting guidelines are still under consultation. Following mainland China and Singapore, South Korea had also formulated its own green finance classification and verification standards by the end of 2021. Japan only provides 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) from 2022, 2023 and 2025 respectively. TCFD was established by the Financial Stability Board (FSB) as a result of the 2009 G20 Summit, to develop recommendations for effective climate-related disclosure to promote informed investment, credit, and insurance underwriting decisions.

However, none of the six cities has deterrents on loans for carbon-intensive activities and subsidies for the fossil fuel energy industry. According to a survey, listed companies in East Asian cities still hold a lot of fossil fuel assets. The potential greenhouse gas emissions of listed companies in the four cities of Hong Kong, Tokyo, Shenzhen and Seoul are nearly 100 billion tons of carbon dioxide equivalent, or 30% of the carbon budget to limit global warming by 1.5° C.

International cooperation

On international cooperation, in 2022, both Tokyo and Seoul have been selected as finalists for the C40 Cities Bloomberg Philanthropies Awards, which recognise the best policies, projects or programmes led by mayors that effectively address the climate crisis. Seoul was chosen for its efforts to roll out electric vehicle charging stations, powered by solar panels, which are to be accessible within a five-minute walk of every resident. This has already had a considerable impact, reducing transport emissions by nearly one-quarter and doubling the number of electric vehicles on the road. Meanwhile, Tokyo has strengthened its international cooperation by sharing its expertise with Kuala Lumpur, including its bold and successful steps to reduce emissions from the built environment. Through peer-to-peer discussions and knowledge sharing, the cities worked together to develop Low Carbon Building Standards for facilities in Kuala Lumpur. Renovations are underway on four buildings, based on a five-year plan. An energy-related database for 1,955 facilities in Kuala Lumpur has also been developed, as the basis for implementing Low Carbon Building Standards. Separately, Hong Kong and Tokyo signed the C40 Equity Pledge, committing to climate actions that are equal, inclusive, and community-based. Singapore, Shenzhen and Guangzhou are all C40 members, but the latter two share little meaningful data on the CDP Cities Database.

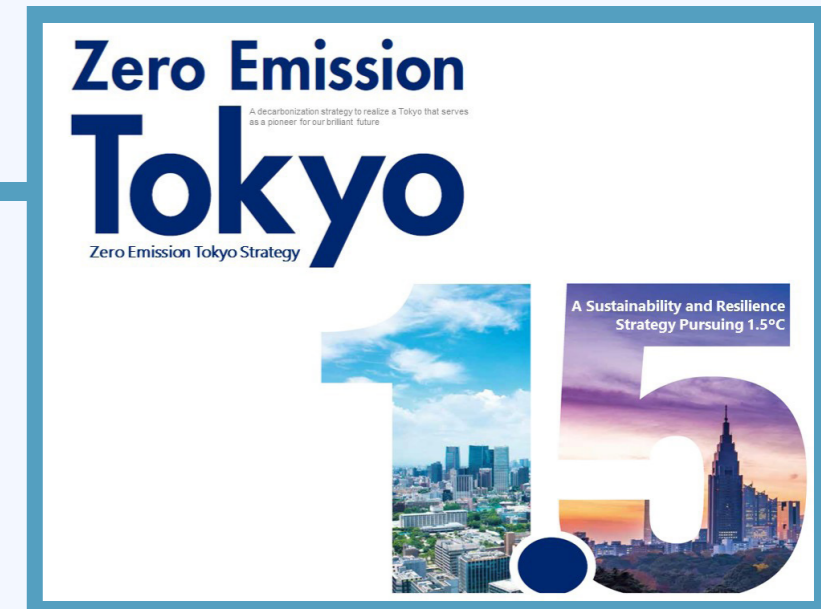


Table 6. Rating based on the comparison of climate governance attributes across the 6 selected Asian cities

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, N/A: Data Incomplete)

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

Conclusion

We have seen positive steps in climate governance taken by several of the cities, including Hong Kong. However, with regard to transparency, accountability, monitoring and evaluation, Hong Kong could learn from Seoul and Tokyo, both of which have demonstrated good practices in public engagement and information disclosure. Further cooperation through well-regulated and clearly defined climate finance systems will also be an opportunity for regional cooperation. For Hong Kong, we call on the Steering Committee on Climate Change and Carbon Neutrality, chaired by the Chief Executive, to actively promote climate finance. We specifically draw its attention to the HK\$240 billion budget pledged in the Hong Kong Climate Action Plan 2050, which should be further refined and elaborated, and the green bonds issued by the SAR government, which require an independent impact assessment. In addition, listed companies in all six cities hold significant fossil fuel assets, which pose significant risks to the climate.



2022

OVERALL CONCLUSION

In Asia, we are seeing alarming evidence of increasing physical impacts of climate change. Record temperatures in Hong Kong and Tokyo, flash flood in Seoul and the flooding in Pakistan are among the examples. Yet greater risks are not being matched by increased scale and urgency of climate adaptation and resilience actions in East Asian cities. For Hong Kong, the rebound in carbon emissions after the COVID-19 pandemic has disrupted progress in carbon reduction. If Hong Kong is simply complacent with its current climate change response, it may not reach its carbon neutrality target.

We need more urgent action and more detailed goals. To remove barriers to carbon neutrality, we need timely implementation of plans and targets; a substantial reduction in carbon emissions in the short term; increases in medium-term reduction targets for 2030 and 2035; updated action plans and milestones; costing and financing plans; and a clear governance structure. Hong Kong also needs a clear scheme to incorporate public participation in monitoring, reporting and verification, to determine the effectiveness of climate adaptation measures. Only then will Hong Kong be able to comply with the IPCC recommendations and the requirements of the Paris Agreement, and have a chance at realizing its current climate action plan and meeting its goals.

ABBREVIATIONS

AIRIA	Automobile Inspection & Registration Information Association, Japan	HKSAR	Hong Kong Special Administrative Region of People's Republic of China
AR5	Fifth Assessment Report of IPCC	ICLEI	International Council for Local Environmental Initiatives (usually known as Local Governments for Sustainability)
AR6	Sixth Assessment Report of IPCC	IEA	International Energy Agency
C40	C40 Cities Climate Leadership Group	IPCC	United Nations Intergovernmental Panel on Climate Change
CBI	Climate Bonds Initiative	KEPCO	Korea Electric Power Corporation
CCIL	Carbon Care InnoLab	LTA	Land Transport Authority, Singapore
CDP	Carbon Disclosure Project	MEE	Ministry of Ecology and Environment, People's Republic of China
CLP	China Light and Power Group (Hong Kong)	MLIT	Ministry of Land, Infrastructure, Transport and Tourism, Japan
CNG	Compressed Natural Gas	MOLIT	Ministry of Land, Infrastructure and Transport, Republic of Korea
COP26	The 26th United Nations Climate Change Conference of the Parties	NCCS	National Climate Change Secretariat, Singapore
COP27	The 27th United Nations Climate Change Conference of the Parties	NDC	National Determined Contributions
COVID-19	Coronavirus Disease of 2019	NPTD	National Population and Talent Division, Singapore
CSD	Census and Statistics Department, HKSAR	OECD	Organisation for Economic Cooperation and Development
ENB	Environment and Ecology Bureau, HKSAR	PBC	People's Bank of China
EF	Energy Foundation, China	PD	Planning Department, HKSAR
EMA	Energy Market Authority, Singapore	PV	Photovoltaic
EMSD	Electrical and Mechanical Service Department, HKSAR	RVD	Rating and Valuation Department, HKSAR
EPD	Environmental Protection Department, HKSAR	SFC	Securities and Futures Commission, HKSAR
ESG	Environmental, Social and Governance	SMG	Seoul Metropolitan Government
ETHZ	Singapore-ETH Centre	SMPG	Shenzhen Municipal People's Government
EV	Electric Vehicle	SR15	IPCC's Special Report on Global Warming of 1.5° C
G7	Group of Seven	SSP	Shared Socio-economic Pathways
G20	Group of Twenty	SZDRC	Development and Reform Commission of Shenzhen Municipality
GDP	Gross Domestic Product	TEPCO	Tokyo Electric Power Corporation
GHG	Greenhouse Gas	TMG	Tokyo Metropolitan Government
GPA	Government Property Agency, HKSAR	UNFCCC	
GMPG	Guangzhou Municipal People's Government	URA	Urban Redevelopment Authority, Singapore
HKE	Hong Kong Electric Investment Group		
HKJCDPRI	Hong Kong Jockey Club Disaster Preparedness and Response Institute		
HKMA	Hong Kong Monetary Authority		

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Annex 1 Data Tables for all the figures and tables in this report

Figure 2.

GHG Emissions from Electricity Sold (Commercial & Residential) (ktCO ₂ -e)						
Year	2016	2017	2018	2019	2020	2021
Commercial & Industrial	17,948	16,914	17,168	17,142	12,566	13,788
Residential	8,526	8,386	8,430	8,520	7,195	7,356
Total	26,474	25,299	25,597	25,662	19,761	21,145

Figure 3.

HK's Electricity Sold for Commercial & Industrial, Residential Sectors (GWh)										
Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Commercial & Industrial	31,590	31,461	31,820	32,143	32,051	32,077	32,542	32,877	31,132	32,532
Residential	11,441	11,095	12,060	11,769	11,978	11,702	11,657	11,926	12,965	13,184
Total	43,031	42,556	43,880	43,912	44,029	43,779	44,199	44,803	44,097	45,716

Figure 4.

Greenhouse Gas Emissions by Sector (2020, in %)						
City\Sector	Electricity Generation (including buildings)	Transport	Waste	Industrial Processes	Agriculture, Forestry, and Land Use	Others
Hong Kong	60.4%	19.7%	8.8%	5.3%	0.1%	5.8%
Singapore (2019)	39.2%	13.8%	0.6%	45.1%	0.0%	1.3%
Seoul (2019)	70.3%	19.1%	6.2%	4.3%	-0.1%	0.2%
Tokyo	65.8%	14.5%	3.0%	5.9%	0.0%	10.8%

*Singapore and Seoul has official data up to 2019, while the rest of the cities have data up to 2020.

Figure 5.

Per Capita Emissions in Four East Asian Cities (in tCO ₂ -e)									
City\Year	2017	2018	2019	2020	2021	2030 (Target)	2035 (Target)	2040 (Target)	2050 (Target)
Hong Kong	5.49	5.46	5.35	4.52	4.75	3.30	2.57	N/A	0
Singapore	9.27	9.27	9.05	9.29	N/A	9.46	N/A	N/A	0
Seoul	4.61	4.68	4.62	4.56	4.67	2.91	N/A	1.49	0
Tokyo	4.70	4.59	4.42	4.26	N/A	2.24	N/A	N/A	0

*Singapore has official data up to 2020, and Tokyo up to 2020. The Singapore data is obtained by the total absolute emission divided by total population (residents and non-residents)

Figure 6.

Electricity Fuel Mix of Six Selected East Asian Cities (2021, in %)						
City\Fuel	Coal	Gas	Oil	Nuclear	Renewables and others	Total
Hong Kong	23.50	48.40	0.30	27.70	0.10	100.00
Singapore	1.05	95.76	0.20	0.00	2.99	100.00
Seoul	35.60	26.40	0.40	29.00	7.80	100.00
Tokyo	20.00	59.00	0.00	0.00	21.00	100.00
Shenzhen	14.62	36.75	0.00	46.86	1.77	100.00
Guangzhou	45.00	41.70	0.00	0.00	13.30	100.00

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

Figure 7.

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	0.408
South Korea	0.492	0.541	0.553	0.503	0.451
Tokyo	0.479	0.470	0.464	0.441	0.441
China (Southern)	0.868	0.837	0.809	0.804	N/A

*South Korean 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 level of independence despite their connections with neighbouring regions.

Figure 8.

Renewable Energy Status and Pledges (in %)									
City\Year	2016	2017	2018	2019	2020	2021	2025 (Target)	2030 (Target)	2035 (Target)
Hong Kong	0.10%	0.20%	0.20%	0.26%	0.38%	0.35%	N/A	N/A	10.00%
Singapore	0.72%	0.87%	1.17%	2.16%	2.31%	2.84%	10.88%	13.99%	N/A
Tokyo	12.11%	14.10%	15.30%	17.30%	19.24%	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	N/A
Guangzhou	6.00%	N/A	N/A	N/A	14.20%	N/A	18.70%	N/A	N/A

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

Figure 9.

Building Energy Efficiency (Commercial, TJ/10,000 sq. m.)									
City\Year	2016	2017	2018	2019	2020	2021	2030 (Target)	2035 (Target)	2050 (Target)
Hong Kong	51.2	50.4	50.3	49.9	44.9	46.6	N/A	31.8	19.5
Singapore	47.7	45.9	44.4	44.4	42.2	N/A	N/A	N/A	N/A
Seoul	N/A	N/A	8.0	7.6	6.8	6.9	N/A	N/A	N/A
Tokyo	N/A	15.8	16.1	15.5	14.3	N/A	10.8	N/A	N/A

Figure 10.

Building Energy Efficiency (Residential, TJ/10,000 sq. m.)									
City\Year	2016	2017	2018	2019	2020	2021	2030 (Target)	2035 (Target)	2050 (Target)
Hong Kong	5.61	5.46	5.48	5.42	5.71	5.77	N/A	3.25	2.69
Singapore	2.40	2.13	2.10	1.93	2.08	N/A	N/A	N/A	N/A
Seoul	N/A	N/A	5.85	5.51	5.57	5.55	N/A	N/A	N/A
Tokyo	3.70	3.93	3.73	3.75	N/A	N/A	2.43	N/A	N/A

Figure 11.

Percentage of Zero Emission Vehicles (EV and Hydrogen-powered Vehicles)						
City\Year	2016	2017	2018	2019	2020	2021
Hong Kong	N/A	1.31	1.32	1.58	2.03	3.03
Singapore	N/A	0.04	0.08	0.14	0.15	0.39
Seoul	0.05	0.15	0.31	0.5	0.79	1.35
Tokyo	0.12	0.15	0.18	0.22	0.28	0.33

Figure 12.

Percentage of New Energy Vehicles (Including Zero Emission Vehicles, Hybrid, and CNGs)						
City\Year	2016	2017	2018	2019	2020	2021
Hong Kong	N/A	4.03	3.99	4.22	4.58	5.54
Singapore	N/A	2.83	3.65	4.89	5.60	7.17
Seoul	1.82	2.37	3.02	3.72	4.73	6.10
Tokyo	12.03	13.71	15.39	17.23	18.89	20.30

Table 4.

Tables below 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	Y	Y	Y	Y	Y	Y
Singapore	Y	Y	Y	N	Y	Y	Y
Seoul	Y	N/A	Y	Y	Y	Y	Y
Tokyo	Y	Y	Y	Y	Y	Y	Y
Shenzhen	Y	Y	Y	Y	Y	Y	Y
Guangzhou	Y	Y	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	1.4%	Y
Singapore	Y	Y	Y	Y	Y	N/A	Y
Seoul	Y	Y	Y	Y	Y	1.1%	Y
Tokyo	Y	Y	Y	Y	Y	1.9%	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	National
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	National
Guangzhou	National	N	N	Y	N	Y	Y	National

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	Y	Y	Y	N	N
Tokyo	Y	Guidelines only	Y	Y	N	N
Shenzhen	Y	Y	N	Y	N	N
Guangzhou	Y	Y	N	N/A	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)	SDG Voluntary Local Review	C40 Water Safe Cities (Flooding)	C40 Water Safe Cities (Drought)
Hong Kong	Very High	-	-	-	-	93	75	N	Low	Low-Medium
Singapore	Very High	High	-	Low-Medium	Low	92	70	N	Low	N/A
Seoul	Very High	Medium-High	-	Medium	High	83	73	Partial	Medium	N/A
Tokyo	Very High	-	-	-	High	88	81	Y	Low-Medium	Low
Shenzhen	Medium	-	Medium	-	-	-	-	N	Medium-High	N/A
Guangzhou	Medium	-	Medium	-	Medium	-	-	N	Medium-High	Low-Medium

Other Ratings and Ranking on Climate Action Performance (2)

City	Planet Ranking 2022 (Arcadis)	Cities A List 2021 (CDP)	2020 Cities Climate Hazards (CDP-ICLEI)	2020 Cities Adaptation Actions (CDP-ICLEI)	2021 Cities Climate Change Impacts on Health and Health Systems(CDP-ICLEI)	Emission Reduction Target Scenario (CDP-ICLEI)	Resilient Cities (Grosvenor)	CWR APACCT 20 Index	Pedestrian friendly city planning (Score)
Hong Kong	56	A	Medium	8	Y	1.5° C	Medium	Low	78.9
Singapore	69	-	Medium	7	-	2.0° C	Medium	High	63.9
Seoul	43	A	High	1	Y	1.5° C	Low-Medium	Medium	66.6
Tokyo	7	A	Medium-High	10	Y	1.5° C	Medium	Low	72.4
Shenzhen	61	-	-	1	-	-	-	Medium	-
Guangzhou	77	-	-	-	-	-	Low	Medium	-

References

Please note that all the web links below were last accessed on 5 October 2022.

Introduction and Context Analysis

Carbon Brief. "COP26: Key outcomes agreed at the UN climate talks in Glasgow," 15 November 2021. <https://www.carbonbrief.org/cop26-key-outcomes-agreed-at-the-un-climate-talks-in-glasgow>

Carbon Brief. "In-depth Q&A: The IPCC's sixth assessment report on climate science," 9 August 2021. <https://www.carbonbrief.org/in-depth-qa-the-ipccs-sixth-assessment-report-on-climate-science>

CarbonCare InnoLab, "Paris Watch Hong Kong Climate Action Report 2020," https://www.ccinnolab.org/uploads/media/pairswatch/CCIL_ParisWatch_HK_Climate_Action_Report_2020.pdf

CarbonCare InnoLab, "Paris Watch Hong Kong Climate Action Report 2021," https://www.ccinnolab.org/uploads/media/pairswatch/CCIL_ParisWatch_HK_Climate_Action_Report_2021_Eng.pdf

Climate Action Tracker. "Warming Projections Global Update", 9 November 2021. <https://climateactiontracker.org/press/Glasgows-one-degree-2030-credibility-gap-net-zeros-lip-service-to-climate-action/>

Denchak, M., "Paris Agreement: Everything You Need to Know," NRDC. <https://www.nrdc.org/stories/paris-climate-agreement-everything-you-need-know>; "Emissions Gap Report 2020," UNEP. <https://www.unep.org/emissions-gap-report-2020>

Dvorak, M.T., Armour, K.C., Frierson, D.M.W. et al. Estimating the timing of geophysical commitment to 1.5 and 2.0° C of global warming. *Nature Climate Change*. 12, 547–552, 2022. <https://doi.org/10.1038/s41558-022-01372-y>

EU Observer, "Europe turns back to coal as Russia cuts gas supplies," 22 June 2022. <https://euobserver.com/green-economy/155276>

G7 Germany, "G7 Leaders' Communique," G7 Germany, 28 June 2022. <https://www.governo.it/sites/governo.it/files/2022-06-28-abschlusserklaerung-eng-web-data.pdf>

G7 Germany, "G7 Statement on Climate Club," G7 Germany, 28 June 2022. <https://www.g7germany.de/resource/blob/974430/2057926/2a7cd9f10213a481924492942dd660a1/2022-06-28-g7-climate-club-data.pdf>

Inter-governmental Panel on Climate Change (IPCC). "AR6 Climate Change 2021," <https://www.ipcc.ch/report/ar6/>

International Energy Agency (IEA). "CO2 Emissions," in *Global Energy Review 2021*, IEA, 2021. <https://www.iea.org/reports/global-energy-review-2021/co2-emissions>

IEA. "COP26 climate pledges could help limit global warming to 1.8° C, but implementing them will be the key," IEA, 4 November 2021. <https://www.iea.org/commentaries/cop26-climate-pledges-could-help-limit-global-warming-to-1-8-c-but-implementing-them-will-be-the-key>

IEA, "Net Zero by 2050: A Roadmap for the Global Energy Sector," IEA, May 2021. <https://www.iea.org/reports/net-zero-by-2050>

Jiang, Y. and Gao Baiyu, "China's Five Year Plan for energy: One eye on security today, one on a low-carbon future," *China Dialogue*, 23 June 2022. <https://chinadialogue.net/en/climate/chinas-five-year-plan-for-energy-one-eye-on-security-today-one-on-a-low-carbon-future/>

Lam, S. et al., "COP26: How the world will measure progress on the Paris climate agreement and keep countries accountable," *The Conversation*. <https://theconversation.com/cop26-how-the-world-will-measure-progress-on-the-paris-climate-agreement-and-keep-countries-accountable-160325>

Ministry of Environment and Ecology (MEE), "National Climate Adaptation Strategy," MEE, 7 June 2022. https://www.mee.gov.cn/xxgk2018/xxgk/xxgk03/202206/t20220613_985261.html

Naran, B. et al., "Global Landscape of Climate Finance 2021," *Climate Policy Initiative*. <https://www.climatepolicyinitiative.org/publication/global-landscape-of-climate-finance-2021/>

National Development and Reform Commission (NRDC), "14th Five Year Plan for a Modern Energy System," NRDC, 22 March 2022. (in Chinese) https://www.ndrc.gov.cn/xxgk/zcfb/ghwb/202203/t20220322_1320016.html?code=&state=123

Reuters, "Five Eyes alliance urged to forge ties with Greenland to secure minerals," 4 March 2021. <https://www.reuters.com/business/energy/five-eyes-alliance-urged-forge-ties-with-greenland-secure-minerals-2021-03-04/>

Science Based Targets Initiative (SBTI), "Buildings," SBTi, 2022. <https://sciencebasedtargets.org/sectors/buildings>

Science Based Targets Initiative (SBTI), "Transport," SBTi, 2022. <https://sciencebasedtargets.org/sectors/transport>

Shared Socioeconomic Pathways (SSPs) are scenarios of projected socioeconomic global changes up to year 2100. They are used to derive greenhouse gas emissions scenarios with different climate policies.

The Economist, "Weaning Europe off Russian energy will mean making changes," 26 March 2022. <https://www.economist.com/europe/2022/03/26/weaning-europe-off-russian-energy-will-mean-making-changes>

The Hill, "Biden administration announces mineral supply chain push," 22 February 2022. <https://thehill.com/policy/energy-environment/595247-biden-administration-announces-mineral-supply-chain-push>

United Nations Climate Change News. "The Adaptation Committee Considers Methods to Review the Global Goal on Adaptation," 18 May 2021. <https://unfccc.int/news/the-adaptation-committee-considers-methods-to-review-the-global-goal-on-adaptation>

United Nations Framework Convention on Climate Change (UNFCCC). "Paris Agreement," 2015. https://unfccc.int/sites/default/files/english_paris_agreement.pdf

Yamazaki, M., and Kate Abnett, "Exclusive: Japan pushes to remove zero-emission vehicle target from G7 statement, draft shows," *Reuters*, 27 June 2022. <https://www.reuters.com/business/environment/exclusive-japan-pushes-remove-zero-emission-vehicle-target-g7-statement-draft-2022-06-27/>

1. Is Hong Kong on track?

CLP Group Holdings Ltd., "2021 Climate-related Disclosures Report." https://www.clpgroup.com/content/dam/clp-group/channels/sustainability/document/sustainability-report/2021/CLP_Climate_Related_Disclosures_Report_2021_en.pdf.coredownload.pdf

Global Carbon Project. "Global Carbon Budget," 4 November 2021. <https://www.globalcarbonproject.org/carbonbudget/>

Hausfather, Z., "Global CO2 emissions have been flat for a decade, new data reveals," *Carbon Brief*, 4 November 2021. <https://www.carbonbrief.org/global-co2-emissions-have-been-flat-for-a-decade-new-data-reveals/>

HKSAR Environment Bureau. “Greenhouse Gas Emissions and Carbon Intensity in Hong Kong,” 2021. <https://www.climate.gov.hk/files/pdf/Greenhouse%20Gas%20Emissions%20and%20Carbon%20Intensity%20in%20Hong%20Kong.pdf>

HKSAR Environment Bureau. “Greenhouse Gas Emissions in Hong Kong by Sector,” 2021. <https://www.climate.gov.hk/files/pdf/Greenhouse%20Gas%20Emissions%20in%20Hong%20Kong%20by%20Sector.pdf>

HKSAR Environment Bureau. “Hong Kong Climate Change Report 2015,” <https://www.enb.gov.hk/sites/default/files/pdf/ClimateChangeEng.pdf>

HKSAR Environment Bureau. “Hong Kong’s Climate Action Plan 2030+,” 2017. <https://www.enb.gov.hk/sites/default/files/pdf/ClimateActionPlanEng.pdf>

HKSAR Environment Bureau. “Hong Kong’s Climate Action Plan 2050,” 2021. <https://www.climate.gov.hk/>

HKSAR Census and Statistics Department. “Gross Domestic Product (Yearly) 2020 Edition,” 24 February 2021. https://www.censtatd.gov.hk/en/data/stat_report/product/B1030002/att/B10300022020AN2OE0100.pdf

HKSAR Census and Statistics Department. “Hong Kong Population Projections 2020-2069,” 9 September 2020. https://www.censtatd.gov.hk/en/data/stat_report/product/B1120015/att/B1120015082020XXXXB01.xlsx

Hong Kong Electric Investments, “Sustainability Report 2021”

International Energy Agency (IEA), “Global CO₂ emissions rebounded to their highest level in history in 2021,” 8 March 2022. <https://www.iea.org/news/global-co2-emissions-rebounded-to-their-highest-level-in-history-in-2021>

Korea Electric Power Company (KEPCO), “Statistics of Electric Power in Korea,” 2021.

Lam, S. et al., “COP26: How the world will measure progress on the Paris climate agreement and keep countries accountable,” The Conversation. <https://theconversation.com/cop26-how-the-world-will-measure-progress-on-the-paris-climate-agreement-and-keep-countries-accountable-160325>

Our World in Data. “Annual share of global CO₂ emissions,” <https://ourworldindata.org/grapher/annual-share-of-co2-emissions?tab=chart&country=HKG>

Seoul Metropolitan Government. “Seoul resident population (by division) statistics,” Open Data Plaza, 5 August 2021. (In Korean) <https://data.seoul.gov.kr/dataList/419/S/2/datasetView.do>

Seoul Metropolitan Government. “Seoul’s greenhouse gas inventory for 2017-2019,” April 2021 (In Korean). <https://news.seoul.go.kr/env/environment/green-house-inventory>

Singapore Department of Statistics. “Indicators on Population,” September 2021. <https://tablebuilder.singstat.gov.sg/table/TS/M810001>

Singapore National Climate Change Secretariat. “Carbon Tax,” 2022. <https://www.nccs.gov.sg/singapores-climate-action/carbon-tax/>

Singapore National Climate Change Secretariat. “Charting Singapore’s Low-Carbon and Climate Resilient Future,” 2020. <https://www.nccs.gov.sg/docs/default-source/publications/nccsleds.pdf>

Singapore National Climate Change Secretariat. “Singapore’s Emissions Profile,” 2021. <https://www.nccs.gov.sg/singapores-climate-action/singapore-emissions-profile/>

Tokyo Bureau of Environment. “Greenhouse gas emissions in Tokyo,” 25 July 2022. (In Japanese) https://www.kankyo.metro.tokyo.lg.jp/climate/zenpan/emissions_tokyo.html

Tokyo Statistics Division. “Table 1 Municipalities, Monthly Population Estimates (Correction) (Total),” 2021. (In Japanese) <https://www.toukei.metro.tokyo.lg.jp/jsuikei/js-index2.htm>

2. Are we transitioning to a low carbon economy by developing renewable energy?

Argus Media. “South Korea approves coal phase-out by 2050,” 27 October 2021. <https://www.argusmedia.com/en/news/2267757-south-korea-approves-coal-phaseout-by-2050>

C40 Group. “15 Mayors to Power Green and Just Cities by Expanding Renewable Electricity, Addressing Energy Inequalities,” 22 September 2021. https://www.c40.org/press_releases/renewable-energy-declaration

CDP-ICLEI. “2020 Cities Percentage Energy Mix,” <https://data.cdp.net/Renewable-Energy/2020-Cities-Percentage-Energy-Mix/ss3g-7c4g/data>

China’s Ministry of Ecology and Environment. “Baseline grid emission factors of China’s regional power grid,” <https://www.mee.gov.cn/ywgz/ydqhbh/wsqtz/index.shtml>

Climate and Environment Head Office of Seoul Metropolitan Government, “2022 Main Work Plan,” February 2022. (In Korean) <https://news.seoul.go.kr/gov/archives/536797>

CLP Group Holdings Ltd. “2021 Annual Report,” https://www.clpgroup.com/content/dam/clp-group/channels/investor/document/3-3-financial-reports/2021/e_2021Annual%20Report.pdf.coredownload.pdf

CLP Group Holdings Ltd. “2021 Sustainability Report,” <https://sustainability.clpgroup.com/en/2021/>

EUR-Lex. “Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives,” 22 November 2008. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02008L0098-20180705>

European Commission. “A new Circular Economy Action Plan for a cleaner and more competitive Europe,” 11 March 2020. <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1583933814386&uri=COM:2020:98:FIN>

European Parliament. “European Parliament resolution of 10 February 2021 on the New Circular Economy Action Plan,” 10 February 2021. https://www.europarl.europa.eu/doceo/document/TA-9-2021-0040_EN.html

Foster, S., “Japan’s nuclear revival in a race against time,” Asia Times, 30 August 2022. <https://asiatimes.com/2022/08/japans-nuclear-revival-in-a-race-against-time/>

Guangzhou Municipal Development and Reform Commission. “Letter from the Guangzhou Municipal Development and Reform Commission on the Proposal No. 20212307 of the Sixth Meeting of the 15th Municipal People’s Congress,” 11 May 2021. (In Chinese) http://fgw.gz.gov.cn/rdzt/rddbzyhxta/rddbzy/content/post_7274486.html

Guangzhou Municipal People’s Government. “Notice of the General Office of the Guangzhou Municipal People’s Government on Issuing the Thirteenth Five-Year Plan for Energy Development of Guangzhou (2016-2020),” 17 November 2017. (In Chinese) http://www.gz.gov.cn/zwgk/fggw/sfbgtwj/content/post_4759268.html

HKSAR Electrical and Mechanical Services Department. “Hong Kong Energy End-use Data,” https://www.emsd.gov.hk/en/energy_efficiency/energy_end_use_data_and_consumption_indicators/hong_kong_energy_end_use_data/data/index.html

HKSAR Environment Bureau. “Waste Blueprint for Hong Kong 2035,” February 2021. https://www.enb.gov.hk/sites/default/files/pdf/waste_blueprint_2035_eng.pdf

HKSAR Information Services Department, “Feed-in tariff rates adjusted,” 26 April 2022. https://www.news.gov.hk/chi/2022/04/20220426/20220426_171047_297.html

HKSAR Information Services Department, “LCQ6: Feed-in Tariff Scheme,” 15 June 2022. <https://www.info.gov.hk/gia/general/202206/15/P2022061500369.htm>

HK Electric Investments. “Annual Report 2021,” <https://www.hkelectric.com/en/investor-relations/financial-reports/annual-report-2021>

HK Electric Investments, "Net-Zero Electricity Generation - HK Electric Offshore Wind Farm Planned for 2027 Commissioning," 6 May 2022.

HK Electric Investments. "Sustainability Report 2021," <https://www.hkelectric.com/en/sustainability/sustainability-reports/year-2021>

Journalism for the Energy Transition. "Waste to Energy – Controversial power generation by incineration," 26 May 2021. <https://www.cleanenergywire.org/factsheets/waste-energy-controversial-power-generation-incineration>

Korea Electric Power Corporation (KEPCO). "Korea Electric Power Statistics," (In Korean) https://home.kepco.co.kr/kepco/KO/ntcob/list.do?menuCd=FNO5030103&boardCd=BRD_000099

Korea Electric Power Corporation (KEPCO). "Sustainability Report 2020," https://home.kepco.co.kr/kepco/EN/D/C/KEDCPP004.do?boardCd=BRD_000014&menuCd=ENO40106

Lee, H., "Korea Pares Back Renewables as It Taps Nuclear for Climate Goal," Bloomberg, 30 August 2022. <https://www.bloomberg.com/news/articles/2022-08-30/korea-pares-back-renewables-as-it-taps-nuclear-for-climate-goal>

Nanfang Ribao (newspaper). "Guangzhou coal consumption has reached its peak," 2 April 2021. (In Chinese) http://www.gz.gov.cn/ysgz/xwdt/ysdt/content/mpost_7201612.html

Polytechnic University of Hong Kong. "Potentials of generating clean solar energy in Hong Kong," <https://www.polyu.edu.hk/cpa/excel/en/201703/viewpoint/v1/index.html>

Shenzhen Municipal Development and Reform Commission. "The 13th Five-Year Plan for Shenzhen's Energy Development," 12 January 2017. (In Chinese) http://www.szns.gov.cn/xxgk/qzfxgkml/ghjh/fzgh/content/post_3731466.html

Singapore Energy Market Authority. "Singapore Energy Statistics: Energy Transformation," <https://www.ema.gov.sg/singapore-energy-statistics/ChO2/index2>

Singapore National Climate Change Secretariat, "Singapore to phase out unabated coal power by 2050," 4 November 2021. <https://www.nccs.gov.sg/media/press-release/sg-phase-out-unabated-coal>

Tokyo Bureau of Environment. "Renewable energy usage in Tokyo," 13 May 2021. https://www.kankyo.metro.tokyo.lg.jp/climate/renewable_energy/200100a20180214152237412.html

Tokyo Bureau of Environment. "Zero Emission Tokyo Strategy 2020 Update & Report," 18 June 2021. https://www.kankyo.metro.tokyo.lg.jp/en/about_us/zero_emission_tokyo/strategy_2020update.html

Tokyo Electric Power Company Holdings. "CO2 emissions / emission intensity and electricity sales," (In Japanese). <https://www.tepco.co.jp/corporateinfo/illustrated/environment/emissions-co2-j.html>

3. Are we using energy more efficiently in Hong Kong?

Automobile Inspection & Registration Information Association (AIRIA, Japan). "Number of low-emission fuel vehicles owned by vehicle type," (In Japanese) <https://www.airia.or.jp/publish/statistics/trend.html>

CLP Group Holdings Ltd. "2021 Annual Report," https://www.clpgroup.com/content/dam/clp-group/channels/investor/document/3-3-financial-reports/2021/e_2021Annual%20Report.pdf.coredownload.pdf

CLP Group Holdings Ltd., "Hong Kong Offshore Wind Farm Project - Project Background". <https://env.clphk.com/en/project-background.html>

GoGoLabs. "Number of charging stations installed by prefecture," 2021. (In Japanese) <https://ev.gogo.gs/report/evchargers/>

Group of Seven, "G7 Leaders' Communique," 28 June 2022. <https://reliefweb.int/report/world/g7-leaders-communique-elmau-28-june-2022>

HK Electric Investments, "Annual Report 2021." <https://www.hkelectric.com/en/investor-relations/financial-reports/annual-report-2021>

HKSAR Census and Statistics Department, "2016 Population By-census," <https://www.censtatd.gov.hk/en/scode459.html>

HKSAR Electrical and Mechanical Services Department (EMSD), "Buildings Energy Efficiency Ordinance (Cap. 610)," 31 December 2020. https://www.emsd.gov.hk/beeo/en/mibec_beeo_WhatsNews.html

HKSAR Government. "Charging facilities for electric vehicles," 28 April 2021. <https://www.info.gov.hk/gia/general/202104/28/P2021042800340.htm>

HKSAR Government. "Hong Kong Roadmap on Popularisation of Electric Vehicles," https://www.evhomecharging.gov.hk/downloads/ev_booklet_en.pdf

HKSAR Government. "Year-end population for 2020," <https://www.info.gov.hk/gia/general/202102/18/P2021021800322.htm?fontSize=1>

HKSAR Government Property Agency. "Annual Reports," <https://www.gpa.gov.hk/english/press/press.html>

HKSAR Planning Department. "Hong Kong 2030+: Towards a Planning Vision and Strategy Transcending 2030," HKSAR Government. https://www.pland.gov.hk/pland_en/p_study/comp_s/hk2030plus/TC/document/2030+_booklet.pdf

HKSAR Rating and Valuation Department. "Hong Kong Property Review 2021," 30 April 2021. <https://www.rvd.gov.hk/en/publications/hkpr.html>

HKSAR Transport Department. "Registration and Licensing of Vehicles by Fuel Type," in "Monthly Traffic and Transport Digest," https://www.td.gov.hk/en/transport_in_hong_kong/transport_figures/monthly_traffic_and_transport_digest/index.html

Land Transport Authority (LTA, Singapore). "Electric Vehicles," https://www.lta.gov.sg/content/ltagov/en/industry_innovations/technologies/electric_vehicles.html

Land Transport Authority (LTA, Singapore). "Motor Vehicle Population by Type of Fuel Used," https://www.lta.gov.sg/content/dam/ltagov/who_we_are/statistics_and_publications/statistics/pdf/MO9-Vehs_by_Fuel_Type.pdf

Ministry of Land, Infrastructure and Transport (MOLIT, South Korea). "Detailed Use Building Energy Consumption Statistics," (In Korean) <https://www.greentoegether.go.kr/sta/sta010102.do>

Ministry of Land, Infrastructure and Transport (MOLIT, South Korea). "Motor Vehicle Registration by City/Province," 28 April 2021. https://kosis.kr/statHtml/statHtml.do?orgId=116&tblId=DT_MLTM_5498&language=en&conn_path=I3

Ministry of Land, Infrastructure, Transport and Tourism (MLIT, Japan). "Number of vehicles owned by the Kanto Transport Bureau," (In Japanese) <https://www.tb.mlit.go.jp/kanto/page2/toukei.html>

Seoul Green Car Infrastructure Team. "Application for a site for installing electric vehicle chargers in Seoul," 26 July 2021. <https://news.seoul.go.kr/env/archives/513023>

Singapore Building and Construction Authority. "Green Building Masterplans," <https://www1.bca.gov.sg/buildsg/sustainability/green-building-masterplans>

Singapore Government. "Available and Vacant Commercial Properties," 23 January 2019. https://data.gov.sg/dataset/available-and-vacant-commercial-and-industrial-properties?resource_id=3d6d31ad-3cad-46a9-be7f-debc98fad580

Singapore Energy Market Authority. "Statistics - Total Final Energy Consumption," https://www.ema.gov.sg/statistic.aspx?sta_sid=20141211NBOOXgSCZO

Singapore Urban Redevelopment Authority. "Available and Vacant Office and Retail Space," https://www.ura.gov.sg/-/media/Corporate/Property/Commercial-Properties-2021Q2/Comm_Available_Vacant_2021Q2.pdf?la=en

Tokyo Open Data Catalogue Site. "3-2 Number of houses and floor area by area, type, structure (2015-19)," <https://catalog.data.metro.tokyo.lg.jp/dataset/t000003d1900000020/resource/8026503b-ff8a-4d64-bde3-d0b6c0d9f318>

Tokyo Statistics Division. “Length and Area of Roads by District and Category,” in Tokyo Statistical Yearbook 2019, <https://www.toukei.metro.tokyo.lg.jp/tnenkan/2019/tn19q3e004.htm>

Yamazaki, M., Abnett, K., “Exclusive: Japan pushes to remove zero-emission vehicle target from G7 statement, draft shows,” Reuters, 27 June 2022. <https://www.reuters.com/business/environment/exclusive-japan-pushes-remove-zero-emission-vehicle-target-g7-statement-draft-2022-06-27/>

4. Are we adapting to make Hong Kong a safe and healthy city in the face of global heating?

Bai, L. et al., “Climate change and mosquito-borne diseases in China”, *Globalization and Health*, 2013, 9:10. <http://www.globalizationandhealth.com/content/9/1/10>

C40, “Equity Pledge,” <https://www.c40.org/declarations/equity-pledge/>

Chan, E.Y.Y. et al., “A study of intra-city variation of temperature-related mortality and socioeconomic status among the Chinese population in Hong Kong.” *Journal of Epidemiology Community Health*. 2012;66(4):322-327. doi:10.1136/jech.2008.085167

Chan, E.Y.Y. et al., “Policy Implication of Health Impacts of Climate Change in Hong Kong,” The Hong Kong Jockey Club Disaster Preparedness and Response Institute, 26 April 2017. <https://www.hkjcdpri.org.hk/policy-brief-policy-implication-health-impacts-climate-change-hong-kong-0>

Chan, F.K.S. et al., “Towards resilient flood risk management for Asian coastal cities: Lessons learned from Hong Kong and Singapore,” *Journal of Cleaner Production*, 2018, 187, 576-589. <https://doi.org/10.1016/j.jclepro.2018.03.217>

Chan, W. et al., “Hot, Thirsty, Sweaty & Wet: HK’s Future Down the Drain?” *China Water Risk*, 19 August 2019. <https://www.chinawaterrisk.org/resources/analysis-reviews/hot-thirsty-sweaty-wet-hks-future-down-the-drain/>

Chen, C. et al., “Influence of meteorological factors on arbo-infectious diseases in Guangzhou,” *Journal of Disease Surveillance*, 2016, 31(12): 984-988. (in Chinese) http://www.jbjc.org/JBJC/html/article_8779.htm

Cho, H. et al., “Exploring Physical Environments, Demographic and Socioeconomic Characteristics of Urban Heat Island Effect Areas in Seoul, Korea,” *Journal of the Korean Regional Science Association*, 2019, 35, 4, pp. 61-73. (In Korean) <http://doi.org/10.22669/krasa.2019.35.4.061>

Dayoo News. “The total investment is 1.348 billion yuan! Guangzhou's first integrated energy project settled in the Financial City,” 16 January 2021. (in Chinese) https://news.dayoo.com/gzrbyc/202101/16/158752_53756955.htm

DeWit, A. et al., “Building Holistic Resilience: Tokyo’s 2050 Strategy,” *The Asia-Pacific Journal (Japan Focus)*, 2020, 18, 7, No.3. <https://apjif.org/2020/7/DeWit.html>

Eveland, J., “Ways to beat the heat,” *Skyline (Urban Redevelopment Authority)*, No.10. <https://www.ura.gov.sg/Corporate/Resources/Publications/Skyline/Skyline-Issue10/Beat-the-heat>

LSE Grantham Research Institute on Climate Change and the Environment, “Climate Change Laws of the World - Storm and Flood Insurance Act,” <https://www.climate-laws.org/geographies/south-korea/laws/storm-and-flood-insurance-act>

Guangzhou Meteorological Service. “Guangzhou Urban Heat Island Monitoring Bulletin,” (in Chinese) <http://www.tqyb.com.cn/gz/climaticprediction/islandmonitoring/>

Guangzhou Municipal People’s Government. “Emergency plan for water supply emergencies in Guangzhou,” 9 July 2014. (in Chinese) http://www.gz.gov.cn/zwgk/fggw/sfbgtwj/conent/post_4758090.html

Guangzhou Municipal People’s Government. “Guangzhou Forest Fire Emergency Plan,” 18 May 2018. (in Chinese) http://www.gz.gov.cn/zwgk/fggw/sfbgtwj/content/post_4758865.html

Guangdong Provincial People’s Government. “Comprehensive Development Plan for the Coastal Economic Zone of Guangdong Province (2017-2030),” 5 December 2017. (In Chinese) http://www.gd.gov.cn/gkmlpt/content/O/146/post_146463.html#7

Guangdong Provincial People’s Government. “Measures for Labour Protection in Hot Weather of Guangdong Province,” 30 December 2011. http://www.gd.gov.cn/gkmlpt/content/O/140/post_140318.html#6

Hashizume, M., “Public health impacts of climate change and adaptation measures in Japan,” *Journal of National Institute of Public Health*, 2020, 69, 5. (In Japanese) <https://www.niph.go.jp/journal/data/69-5/202069050002.pdf>

Hong Kong Monetary Authority, “Cross-Agency Steering Group announces launch of information and data repositories and other progress in advancing Hong Kong’s green and sustainable finance development,” 21 June 2022. <https://www.hkma.gov.hk/eng/news-and-media/press-releases/2022/06/20220621-5/>

HKSAR Civil Engineering and Development Department, “Study of Coastal Hazards under Climate Change and Extreme Weather and Formulation of Improvement Measures - Feasibility Study,” April 2022. <https://www.cedd.gov.hk/eng/our-projects/project-reports/index-id-24.html>

HKSAR Electrical and Mechanical Services Department (EMSD). “District Cooling System at Kai Tak Development,” https://www.emsd.gov.hk/en/energy_efficiency/district_cooling_system_at_kai_tak_development/index.html

HKSAR Legislative Council. “Measures to tackle urban heat,” April 2021. <https://www.legco.gov.hk/research-publications/english/essentials-2021ise04-measures-to-tackle-urban-heat.htm>

HKSAR Planning Department. “Urban Climatic Map and Standards for Wind Environment - Feasibility Study,” https://www.pland.gov.hk/pland_en/p_study/prog_s/ucmapweb/ucmap_project/content/reports/final_report.pdf, <https://www.enb.gov.hk/sites/default/files/susdev/html/en/council/SSCPaper02-12Att2e.pdf>

Hong Kong Insurance Authority. “Insurance veterans explore risks and opportunities arising from global climate change,” 19 January 2021. https://www.ia.org.hk/en/infocenter/press_releases/20210119.html

Hong Kong Observatory. “Number of Very Hot days observed at the Hong Kong Observatory since 1884, exclude 1940-1946,” https://www.hko.gov.hk/en/cis/statistic/vhotday_statistic.htm

Human Resources and Social Security Department of Guangdong Province, “Policy Interpretation of “Notice of Human Resources and Social Security Department of Guangdong Province, Health Commission of Guangdong Province, Emergency Management Department of Guangdong Province, State Administration of Taxation, Taxation Bureau of Guangdong Province, Guangdong Federation of Trade Unions on Adjusting the Standard of High Temperature Allowance in Our Province,” 2 June 2021. (in Chinese) http://hrss.gd.gov.cn/zcfg/zcjd/content/post_3302867.html

Leung, R., Dawn McGregor, “3 Ways to Deal with The Deep Uncertainty of Sea Level Rise,” *China Water Risk*, 27 July 2021. <https://www.chinawaterrisk.org/resources/analysis-reviews/3-ways-to-deal-with-the-deep-uncertainty-of-sea-level-rise/>

Lim, V., “As temperatures rise, outdoor workers, elderly and children are most at risk: Experts,” *Channel News Asia*, 13 August 2021. <https://www.channelnewsasia.com/singapore/temperature-heat-illnesses-climate-change-elderly-children-workers-2105706>

Lim, W. et al., “A Resilient Singapore,” Centre for Liveable Cities, Singapore. <https://www.clc.gov.sg/research-publications/publications/books/view/a-resilient-singapore>

Liu, S. et al., “The Mortality Risk and Socioeconomic Vulnerability Associated with High and Low Temperature in Hong Kong,” *International Journal of Environmental Research and Public Health*, 2020, 17, 7326. <https://doi.org/10.3390/ijerph17197326>

Low, C.T. and Debra Tan, "Hong Kong Rising Seas Adaptation Is Way Behind New York & Singapore," *China Water Risk*, 23 August 2022. <https://www.chinawaterrisk.org/resources/analysis-reviews/hong-kong-rising-seas-adaptation-is-way-behind-new-york-singapore/>

Ministry of Land, Infrastructure, Transport and Tourism (MLIT, Japan). "An example of restricting building uses and structures in an area for the purpose of ensuring safety from disasters by designating a disaster risk area (Article 39 of the Building Standards Act)," (in Japanese) <https://www.mlit.go.jp/common/001042836.pdf>

Mirando, D. et al., "No-Sense Climate Strategies: From DSD to HSBC," *China Water Risk*, 20 September 2019. <https://www.chinawaterrisk.org/resources/analysis-reviews/no-sense-climate-strategies-from-dsd-to-hsbc/>

Monetary Authority of Singapore. "Guidelines on Environmental Risk Management for Insurers," 8 December 2020. <https://www.mas.gov.sg/regulation/guidelines/guidelines-on-environmental-risk-management-for-insurers>

NAP Global Network, "Monitoring, Evaluation, and Learning," <https://napglobalnetwork.org/themes/monitoring-evaluation/>

Organisation for Economic Cooperation and Development (OECD). "Water management in Korea: from goals to action," <https://www.oecd.org/about/impact/water-management-in-korea.htm>

Othman, L., "World's biggest underground district cooling network now at Marina Bay," *today news (Singapore)*, 3 March 2016. <https://www.todayonline.com/singapore/plant-underground-district-cooling-network-marina-bay-commissioned>

Oxfam Hong Kong, "Impacts of Extreme Weather on Subdivided Flat Residents," November 2021. (in Chinese) https://www.oxfam.org.hk/f/news_and_publication/71897/summary%20SDU_CC%20report_with%20cover.pdf

Park, E.-H., "Climate Change Trends in the Han River Area - A Seoul's Water Supply System Study," *Journal of Climate Change Research*, 10, 3 (September 2019), pp. 199-211. (In Korean) <https://doi.org/10.15531/KSCCR.2019.10.3.199>

Shenzhen Municipal Human Resources and Social Security Bureau. "Notice on the publication of our province's high temperature allowance standards," 10 January 2017. (in Chinese) http://hrss.sz.gov.cn/ztfw/gwjt/zcfg/content/post_7395648.html

Seoul Metropolitan Government. "Comprehensive Climate Change Response Plan (2017-2021): '19 Detailed Action Plan Implementation Performance Inspection Result Report," July 2020. (In Korean)

Seoul Metropolitan Government. "Comprehensive Climate Change Response Plan (2017-2021): '20 Implementation Results and '21 Implementation Plan Report," April 2021. (In Korean)

Seoul Metropolitan Government. "Resilient Seoul: A Strategy for Urban Resilience 2019," 23 September 2019. https://resilientcitiesnetwork.org/downloadable_resources/Network/Seoul-Resilience-Strategy-English.pdf

Seoul Metropolitan Government. "What is the urban heat island phenomenon in Seoul?" 27 August 2009. (In Korean) <https://opengov.seoul.go.kr/civilappeal/2897211>

Shenzhen Bureau of Environment. "Shenzhen City's '14th Five-Year Plan" for Ecological Environment Protection (Draft for Solicitation of Comments)," 19 March 2021. (in Chinese) <http://meeb.sz.gov.cn/hdjlpt/yjzj/answer/10882>

Shenzhen Centre for Disease Control. "Shenzhen High Temperature Heat Wave Health Risk Index," (in Chinese) <http://www.szcdc.net/rdzt/rlzs/>

Shenzhen Emergency Management Bureau. "Shenzhen Forest Fire Emergency Plan (2020 version)," 20 July 2020 (in Chinese). http://www.sz.gov.cn/cn/xxgk/zfxxgj/yjgl/yjya_81608/sjjj/content/post_7914732.html

Shenzhen Meteorological Bureau. "Shenzhen Municipal Heat Island Monitoring Communiqué in 2020," (in Chinese) <http://weather.sz.gov.cn/qixiangfuwu/qihoufuwu/qihouguanceyupinggu/chengshiredaojiance/index.html>

Shenzhen Municipal People's Government. "Shenzhen green space system planning revision (2014-2030)," October 2016. (in Chinese) <http://www.sz.gov.cn/szst2010/wgkzl/jcgk/jcygk/zdzcjc/201610/PO20161020612657061291.pdf>

Shenzhen Municipal Planning and Land Resources Commission. "Key Points and Review Rules of Shenzhen Sponge City Planning," March 2017. (in Chinese) <http://www.sz.gov.cn/cn/xxgk/zfxxgj/tzgg/201703/PO20170314410812720232.pdf>

Shenzhen Tequ Bao (newspaper). "Qianhai's world-class "large air-conditioning" 24-hour centralized cooling," 18 March 2021. (in Chinese) http://www.sz.gov.cn/cn/xxgk/zfxxgj/zwdt/content/post_8634373.html

Shenzhen University Lab for Optimising Design of Built Environment. "Research and Application of Urban Climate Map UCM," (in Chinese) <https://lod.szu.edu.cn/kyfx1/jchjpyhsj2/csqtUCMyjyyy.htm>

Shenzhen Water Bureau. "Emergency plan for water sources and water supply emergencies in Shenzhen," (in Chinese) <http://swj.sz.gov.cn/attachment/O/351/351877/2922023.pdf>

Shenzhen Water Bureau. "Flood Control Tide Planning and River Regulation Planning in Shenzhen City (2014 ~ 2020)," November 2018. (in Chinese) <http://swj.sz.gov.cn/ztlz/ndmsss/yldzl/xgzc/201811/PO20181120374047047833.pdf>

Singapore Civil Defence Force. "Clause 3.3 Fire Resistance of Elements of Structure," <https://www.scdf.gov.sg/firecode/table-of-content/chapter-3-structural-fire-precuations/clause-3.3>

Singapore-ETH Centre. "Outdoor Thermal Comfort and Cognitive Performance of Older Adults in Singapore: A field quasi-experiment," 20 August 2020. <https://doi.org/10.3929/ethz-b-000432015>

Singapore-ETH Centre. "Urban Heat Vulnerability Analysis for Singapore D 2.4 - Vulnerability Map," 30 June 2020. <https://doi.org/10.3929/ethz-b-000419689>

Singapore Ministry of Environment and Water Resources. "Climate Action Plan: Take Action Today, For A Sustainable Future," 2016. <https://www.nccs.gov.sg/media/publications/climate-plan-take-action-today-for-a-sustainable-future>

Singapore National Climate Change Secretariat. "Impact of Climate Change and Adaptation Measures," <https://www.nccs.gov.sg/faqs/impact-of-climate-change-and-adaptation-measures/>

Singapore National Water Agency. "Our Water, Our Future," June 2016. <https://www.pub.gov.sg/Documents/PUBOurWaterOurFuture.pdf>

Taylor, M. et al., "How Singapore is putting a stop to water running out," *Global Centre on Adaptation*, 17 January 2020. <https://gca.org/how-singapore-is-putting-a-stop-to-water-running-out/>

Tokyo Bureau of Construction. "Flood Hazard Map," (In Japanese) https://www.kensetsu.metro.tokyo.lg.jp/jigyo/river/chusho_seibi/index/menu03.html

Tokyo Bureau of Environment. "Heat Island Measures," 9 February 2018. (In Japanese) https://www.kankyo.metro.tokyo.lg.jp/kids/climate/heat_island_countermeasure.html

Tokyo Bureau of Environment. "Tokyo Climate Change Adaptation Plan," 30 March 2021. (In Japanese) https://www.kankyo.metro.tokyo.lg.jp/policy_others/zeroemission_tokyo/adaptation/plan.html

Tokyo Bureau of Urban Development. "About new fire prevention regulations (outline of system)," 10 May 2021. (in Japanese) https://www.toshiseibi.metro.tokyo.lg.jp/kenchiku/kijun/anzen_bouka.htm

Tokyo Bureau of Urban Development. "Popularization of district heating and cooling facilities," (in Japanese) <https://www.toshiseibi.metro.tokyo.lg.jp/kenchiku/reidan/index.html>

Tokyo Metropolitan Disaster Prevention Council. “Tokyo area disaster prevention plan,” 2021. https://www.bousai.metro.tokyo.lg.jp/_res/projects/default_project/_page/_001/012/274/2.pdf

Transparent Seoul. Seoul Climate Environment Energy Map Production,” 2016. (in Korean) <https://opengov.seoul.go.kr/research/7799089>

Tsuji, Y., “Climate Change Action and Adaptation in Tokyo,” Washington Journal of Environmental Law and Policy, 2020, 11, 1. <https://digitalcommons.law.uw.edu/wjelp/vol11/iss1/4>

United Nations University Institute for Environment and Human Security. “7 things you need to know about climate risk insurance,” 9 May 2017. <https://ehs.unu.edu/news/news/7-things-you-need-to-know-about-climate-risk-insurance-2.html>

Von Eiff, D., “Sustainable Infrastructure: Towards A Diversified HK Water Supply,” China Water Risk, 19 March 2020. <https://www.chinawaterrisk.org/opinions/sustainable-infrastructure-towards-a-diversified-hk-water-supply/>

Wang, R.Y. et al., “Hong Kong’s water security: a governance perspective, International Journal of Water Resources Development, 2021, 37:1, 48-66, DOI: 10.1080/07900627.2019.1688647

Wong, M., “Allocating additional resources to enhance flood prevention capacity,” Development Bureau. https://www.devb.gov.hk/en/home/Blog_Archives3/index_id_487.html

Wong, M., “Prevention better than cure: flood prevention,” Development Bureau. https://www.devb.gov.hk/tc/home/my_blog/index_id_1496.html

Xu, H.-Y. et al., “Weather Impact on Heat-Related Illness in a Tropical City State, Singapore,” Atmospheric and Climate Sciences, 2018, 8, 97-110. <https://doi.org/10.4236/acs.2018.81007>

Yang, J., et al. “Projecting heat-related excess mortality under climate change scenarios in China,” Nature Communications 12, 1039 (2021). <https://doi.org/10.1038/s41467-021-21305-1>

Zhao, C., “Managing Risks in Transboundary Water Supply: Hong Kong vs Singapore,” China Water Risk, 19 March 2020. <https://www.chinawaterrisk.org/opinions/managing-risks-in-transboundary-water-supply-hong-kong-vs-singapore/>

Zhao, W., et al., “Environmental climate spatial pattern of Guangzhou City based on urban climatic map,” Progress in Geography, 2019, 38(3): 452-464. <https://doi.org/10.18306/dlxjz.2019.03.014>

5. Are we developing the right governance and financial systems to tackle climate change?

21st Century Economic Herald. “Four major green financial incentives will be issued. Macro-prudential policies focus on preventing climate risks,” 21 April 2021. (in Chinese) <https://finance.sina.com.cn/tech/2021-04-21/doc-ikmyaawc0846777.shtml>

Arcadis. “Citizen Centric Cities - The Sustainable Cities Index,” 2018. https://www.arcadis.com/campaigns/citizencentriccities/images/%7B1d5ae7e2-a348-4b6e-b1d7-6d94fa7d7567%7Dsustainable_cities_index_2018_arcadis.pdf

Asian Development Bank. “Mobilizing Green Finance through K-taxonomy,” 28 June 2021. <https://development.asia/insight/mobilizing-green-finance-through-k-taxonomy>

C40, “Equity Pledge,” C40, 2022. <https://www.c40.org/declarations/equity-pledge/>

C40, “C40 Cities Bloomberg Philanthropies Awards,” C40, 2022. <https://www.c40.org/awards-2022/>

Carbon Disclosure Project (CDP). “Cities A List 2021,” <https://www.cdp.net/en/cities/cities-scores>

Carbon Tracker, “Unburnable Carbon: Ten Years On,” 23 June 2022. <https://carbontracker.org/reports/unburnable-carbon-ten-years-on/>

CDP-ICLEI. “2020 Cities Climate Hazards,” <https://data.cdp.net/Climate-Hazards/2020-Cities-Climate-Hazards/y567-7tyw/data>

CDP-ICLEI. “2021 Cities Emissions Reduction Targets,” <https://data.cdp.net/Mitigation-Actions/2021-Cities-Emissions-Reduction-Targets/vevx-e5s3/data>

Chanjaroen, C., “Singapore Exchange Plans Mandatory Climate-Related Disclosures,” Bloomberg Green, 26 August 2021. <https://www.bloomberg.com/news/articles/2021-08-26/singapore-exchange-plans-mandatory-climate-related-disclosures>

Bloomberg, “Task Force on Climate-related Financial Disclosures - Overview,” March 2021. https://assets.bbhub.io/company/sites/60/2020/10/TCFD_Booklet_FNL_Digital_March-2020.pdf

Chen, Y. et al., “Shenzhen National Low-Carbon City Pilot and Research Report on Climate Change Planning,” National Centre for Climate Change Strategy and International Cooperation, 2020. (in Chinese) <http://www.ncsc.org.cn/yjcg/dybg/202108/PO20210824350110511415.pdf>

China Water Risk. “CWR APACCT 20 Index,” <https://www.chinawaterrisk.org/resources/analysis-reviews/surviving-rising-seas-20-apac-cities-whos-ahead-whos-behind/>

Climate and Environment Head Office of Seoul Metropolitan Government, “2022 Main Work Plan,” February 2022. (In Korean) <https://news.seoul.go.kr/gov/archives/536797>

Climate Bonds Initiative and Syntao. “Research on the Incentive Mechanism of Chinese Local Government Green Bonds,” 11 April 2017. (in Chinese) <https://www.climatebonds.net/files/reports/chinalocalgovt-01-11april17-ch-a3.pdf>

Climate Transparency. “Climate Transparency Report,” 2021. <https://www.climate-transparency.org/g20-climate-performance/g20report2021>

Economist Intelligence Unit. “Safe Cities Index 2021,” <https://safecities.economist.com/safe-cities-2021-whitepaper/>

Energy Foundation (China). “Research on Promotion Mechanism of Urban Climate Investment and Financing,” 30 April 2021. (In Chinese) <https://www.efchina.org/Attachments/Report/report-lceg-20210430/%E5%9F%8E%E5%B8%82%E6%B0%94%E5%80%99%E6%8A%95%E8%9E%8D%E8%B5%84%E6%8E%A8%E5%B9%BF%E6%9C%BA%E5%88%B6%E7%A0%94%E7%A9%B6.pdf>

Estimates Committee of Parliament of Singapore. “Fourteenth Parliament of Singapore- First Session - Report of the Estimates Committee (pt.108),” 23 August 2021. <https://sprs.parl.gov.sg/selectcommittee/selectcommittee/download?id=434&type=report>

Finance Services Commission (South Korea). “Green Finance,” 7 June 2021. <https://www.fsc.go.kr/eng/po060101>

Global Facility for Disaster Reduction and Recovery (GFDRR). “Unbreakable Resilience Indicator,” <https://unbreakable.gfdrr.org/policytool>

Grosvenor. “Resilient cities: A Grosvenor research report,” 2014. <https://www.alnap.org/system/files/content/resource/files/main/resilient-cities-a-grosvenor-research-report-2014.pdf>

Guangdong Energy Bureau. “Guangdong Province’s implementation plan for resolutely curbing the blind development of the “two highs” project,” 26 September 2021. (In Chinese) http://drc.gd.gov.cn/top/content/post_3552696.html

HKSAR Government. “Building a Liveable City,” in the Chief Executive’s 2021 Policy Address, 6 October 2021. <https://www.policyaddress.gov.hk/2021/eng/p95.html>

HKSAR Government. “Estimates,” in the 2021-22 Budget. 24 February 2021. <https://www.budget.gov.hk/2021/eng/estimates.html>

HKSAR Environment Bureau. "Hong Kong's Climate Action Plan 2050," 2021. <https://www.climateready.gov.hk/>

Hong Kong Exchanges and Clearing Limited (HKEX), "HKEX Launches Hong Kong International Carbon Market Council, Unveils Carbon Market Plans," 5 July 2022. https://www.hkex.com.hk/News/News-Release/2022/220705news?sc_lang=en

Hong Kong Monetary Authority. "Cross-Agency Steering Group announces next steps to advance Hong Kong's green and sustainable finance strategy," 15 July 2021. <https://www.hkma.gov.hk/eng/news-and-media/press-releases/2021/07/20210715-4/>

International Financial Law Review (IFLR). "The challenges of standardising green bonds in Japan," 30 June 2021. <https://www.iflr.com/article/b1sgmsw9jhch7v/the-challenges-of-standardising-green-bonds-in-japan>

Jiji Press. "Climate risk disclosure considers obligatory action: Encouraging corporate response - Financial Services Agency," 3 September 2021. (In Japanese) <https://www.jiji.com/jc/article?k=2021090200764&g=eco>

KHARN (South Korea). "Seoul City to approve climate action plan for the first time in East Asia," 20 June 2021. (In Korean) <http://www.kharn.kr/mobile/article.html?no=16492>

Kookmin Ilbo (newspaper). "Green Seoul Citizens' Committee for Environmental Governance, the first in the country to lead 'Climate Environment Leading City Seoul,'" 26 November 2020. (In Korean) <http://news.kmib.co.kr/article/view.asp?arcid=0015259558&code=61111311>

Lloyd's City Risk Index - Asia Pacific 2018. <https://cityriskindex.lloyds.com/regional-reports/>

Loh, C., "Why are Hong Kong's vital low-carbon policies missing from the budget?" South China Morning Post, 2 March 2021. <https://www.scmp.com/comment/opinion/article/3123439/why-are-hong-kongs-vital-low-carbon-policies-missing-budget>

Mokhtar, F., "Singapore Has a S\$100 Billion Plan to Survive in a Far Hotter World Than Experts Predicted," Bloomberg Green, 26 February 2020. <https://www.bloomberg.com/news/features/2020-02-25/singapore-has-a-100-billion-plan-for-adapting-to-climate-change>

Ng, E., "Climate change: Hong Kong orders managers of at least US\$1 billion in assets to disclose their investees' emissions data," South China Morning Post, 29 September 2021. <https://www.scmp.com/business/banking-finance/article/3150427/climate-change-hong-kong-orders-managers-least-us1-billion>

Nikkei Asia, "Japan to require 4,000 companies to disclose climate risks," 5 October 2021. <https://asia.nikkei.com/Spotlight/Environment/Climate-Change/Japan-to-require-4-000-companies-to-disclose-climate-risks>

Nikkei Asia. "SGX joins Hong Kong exchange in moving to tighten climate rules," 26 August 2021. <https://asia.nikkei.com/Business/Companies/SGX-joins-Hong-Kong-exchange-in-moving-to-tighten-climate-rules>

Organisation for Economic Cooperation and Development (OECD). "Update on recent progress in reform of inefficient fossil-fuel subsidies that encourage wasteful consumption 2021," 23 July 2021. <https://www.oecd.org/g20/topics/climate-sustainability-and-energy/OECD-IEA-G20-Fossil-Fuel-Subsidies-Reform-Update-2021.pdf>

Park, J.-w., "Environmentally-friendly 'green finance' advances Korea's carbon neutrality," Dong-A Ilbo (newspaper), 17 December 2021. (In Korean) <https://www.donga.com/news/Economy/article/all/20211216/110814676/1>

Park, K.-g., "[Open World] 'Green Budget' must be the cutting edge of climate change management," Seoul Newspaper, 16 July 2021. (In Korean) <https://www.seoul.co.kr/news/newsView.php?id=20210716030004>

People's Bank of China. "List of projects supported by green bonds (2021 version)," (In Chinese) <http://www.pbc.gov.cn/goutongjiaoliu/113456/113469/4236341/2021042115215612655.pdf>

Republic of Korea Ministry of Environment, "Korean Green Taxonomy Guidelines (K-Taxonomy)," 30 December 2021. (In Korean)

Rockefeller Foundation. "100 Resilient Cities," <https://www.rockefellerfoundation.org/100-resilient-cities/>

Shi, Y. et al., "Shenzhen Special Economic Zone's Green Finance Regulations was formally implemented to promote mandatory environmental information disclosure," Sina Finance, 8 March 2021. (In Chinese) <http://finance.sina.com.cn/zl/china/2021-03-08/zl-ikknscsh9181247.shtml>

Shenzhen Science and Technology Innovation Committee. "Shenzhen's 13th Five-Year Plan for Climate Change," 6 July 2017. (In Chinese) http://www.szns.gov.cn/xxgk/qzfxgkml/ghjh/fzgh/content/post_3731395.html

Singapore Exchange, "SGX RegCo charts the way forward on mandatory climate reporting, wants board diversity disclosures," 26 August 2021. <https://www.sgx.com/media-centre/20210826-sgx-regco-charts-way-forward-mandatory-climate-reporting-wants-board>

Seoul Metropolitan Government, "1 million low-carbon buildings and 400,000 electric vehicles by 2026," 20 January 2022. (In Korean) <https://mediahub.seoul.go.kr/archives/2003639>

Seoul Metropolitan Government. "2019 Climate Change White Paper," 5 March 2021. (In Korean) <https://news.seoul.go.kr/env/archives/510331>

Seoul Metropolitan Government. "2021 Budget," 6 September 2021. (In Korean) <https://news.seoul.go.kr/gov/archives/522208>

Seoul Metropolitan Government. "2050 Seoul Climate Action Plan," 14 July 2021. (In Korean) https://news.seoul.go.kr/env/environment/climate-energy/weather_info#view/343817

Singapore Government. "Singapore Green Plan 2030." <https://www.greenplan.gov.sg/>

Singapore Ministry of Environment and Water Resources. "Climate Action Plan: Take Action Today, For A Sustainable Future," 2016. <https://www.nccs.gov.sg/media/publications/climate-plan-take-action-today-for-a-sustainable-future>

Singapore National Climate Change Secretariat. "Carbon Tax," 2022. <https://www.nccs.gov.sg/singapores-climate-action/carbon-tax/>

Singapore National Climate Change Secretariat. "Charting Singapore's Low-Carbon and Climate Resilient Future," 2020. <https://www.nccs.gov.sg/docs/default-source/publications/nccsleds.pdf>

Son, J.-h., "Shareholder engagement key driver for Asia's green finance growth: experts," The Korea Herald, 1 June 2021. <http://www.koreaherald.com/view.php?ud=20210601000772>

Tan, A. "Budget 2022: Singapore's carbon tax could increase to \$80 per tonne of emissions by 2030," The Strait Times (Singapore), 18 February 2022. <https://www.straitstimes.com/singapore/budget-2022-singapores-carbon-tax-could-increase-to-80-per-tonne-of-emissions-by-2030-in-accelerated-net-zero-emissions-bid>

Tan, A., "Budget debate: Singapore must tackle climate change while balancing trade-offs, says Teo Chee Hean," The Strait Times (Singapore), 4 March 2021. <https://www.straitstimes.com/singapore/singapore-must-tackle-climate-change-while-balancing-trade-offs-in-manpower-land-and>

Tan, A., "Singapore Budget 2020: New coastal and flood protection fund to protect Singapore against rising sea level," The Strait Times (Singapore), 18 February 2020. <https://www.straitstimes.com/singapore/singapore-budget-2020-new-coastal-and-flood-protection-fund-to-protect-singapore-against>

Tokyo Bureau of Environment. "Tokyo Climate Change Adaptation Policy," December 2019. <https://www.kankyo.metro.tokyo.lg.jp/files/Full.ver-adaptation-policy.pdf>

Tokyo Bureau of Environment. "Zero Emission Tokyo Strategy 2020 Update & Report," 18 June 2021. https://www.kankyo.metro.tokyo.lg.jp/en/about_us/zero_emission_tokyo/strategy_2020update.html

Tokyo Office of the Governor for Policy Planning. "Tokyo Green Finance Initiative (TGFI) - Proposals for Developing Green Finance," <https://www.seisakukikaku.metro.tokyo.lg.jp/en/pgs/2021/08/images/e94bbd86c7dfe12da1a6c232a8fb898c.pdf>

Tokyo Metropolitan Government. “Budget 2021.” (In Japanese) <https://www.zaimu.metro.tokyo.lg.jp/zaisei/yosan/r3.html>

Tokyo Metropolitan Government, “Fast Forward to Carbon Half 2030,” February 2022. (In Japanese) https://www.kankyo.metro.tokyo.lg.jp/policy_others/zeroemission_tokyo/zeroemission2021.html

Transparent Seoul. “Green Seoul Citizens' Committee,” (In Korean) <https://opengov.seoul.go.kr/proceeding/mtgcls/1730>

United Nations Development Programme (UNDP). “Human Development Index,” <http://hdr.undp.org/en/content/latest-human-development-index-ranking>

United Nations Framework on Climate Change Convention (UNFCCC) Secretariat, “Singapore’s update of its first nationally determined contribution and accompanying information,” <https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Singapore%20First/Singapore%20INDC.pdf>

World Bank. “Worldwide Governance Indicators,” <http://info.worldbank.org/governance/wgi/>

Zhong Lun Law Firm. “A New Dimension of Enterprise Development-A Comprehensive View of ESG Policies and Regulations Outside the Territory,” 24 August 2021 (In Chinese). <http://www.zhonglun.com/Content/2021/08-24/1459442497.html>

