

# Kuala Lumpur Climate Action Plan 2050







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Level 9, Menara DBKL 1,  
Jalan Raja Laut,  
50350 Kuala Lumpur, Malaysia.

Tel: 03-2617 9683/9692; Fax: 03-2691 0144  
E-mail: [jprb@dbkl.gov.my](mailto:jprb@dbkl.gov.my)  
Website: [www.dbkl.gov.my](http://www.dbkl.gov.my)

# Mayor of Kuala Lumpur's Foreword



An undeniable truth that is all the more pressing in present times is the fact that cities are a major source of carbon emissions. In the same vein, it is cities that are heavily affected by the consequences of climate change.

Climate change has certainly impacted Kuala Lumpur, we can clearly see it in the increased incidences of flash floods, storms and landslides. With the full comprehension of the urgency required in addressing the present and future consequences of climate change for the sake of our collective future, Kuala Lumpur City Hall (KLCH) has spearheaded the Kuala Lumpur Low Carbon Society Blueprint 2030. This Blueprint identifies comprehensive solutions to battle climate change.

Kuala Lumpur's vision is to become a sustainable and liveable city for all. As custodians of the city, KLCH understands the role it plays in ensuring that the city develops in a sustainable direction. It is also our duty to create a city where the physical, emotional, intellectual and spiritual well-being of all is safeguarded. We achieve this by prioritising the environment, health, cultural heritage as well as safety while at the same time catalysing a vibrant economy and inspiring a model society that respects its environment and its fellow citizens.

Building upon our previous work, we have developed the Kuala Lumpur Climate Action Plan 2050 (KLCAP2050) for the city. The Plan is aligned with our aim of fulfilling the objectives of the Paris Agreement. A good plan, just like

good intentions, is no excuse for bad execution. We will not be able to successfully implement the Plan without the support of citizens. In this respect, KLCH will execute the action points identified in this Plan in an inclusive manner through collective and concerted effort with various agencies, private sector participants and community members in order to achieve our goal of being a long-term carbon neutral and resilient city by 2050.

On behalf of KLCH, I would like to convey my utmost gratitude and appreciation to all stakeholders involved in the preparation of this Plan as well as related preceding plans. Indeed, the invaluable feedback and insight from our multiple engagements with non-governmental organisations, government agencies, professional bodies and institutions of higher learning were crucial in the development of the Kuala Lumpur Climate Action Plan 2050.

**Datuk Seri Haji Mahadi Bin Che Ngah**  
*Mayor of Kuala Lumpur*



# C40 Regional Director's Foreword



Southeast Asia is one of the fastest growing regions in population and urbanisation and is expected to bear the brunt of climate change. In the past years, the region already experienced climate impacts which resulted in flooding and increased urban heat. This was evident from Hanoi to Bangkok, Jakarta to Kuala Lumpur.

Cities are on the frontlines of the global climate crisis and are well positioned to play a leadership role in driving global climate action. Delivering on the objectives of the ground-breaking Paris Agreement requires cities to not only strengthen their ability to manage the impacts of climate change, but to also take bold action to reduce greenhouse gas emissions. Following this, C40's Deadline 2020 programme was launched to translate the ambition of the Paris Agreement into action on the ground through city-level delivery.

Kuala Lumpur signed on to Deadline 2020 in 2017, committing the city to do its part in delivering the Paris Agreement, and kickstarting the development of a highly ambitious climate plan. The plan lays down strategies towards carbon neutrality in 2050 and translating this into a robust emissions reduction target for 2030, while simultaneously looking at adaptation, mitigation, governance and inclusion and equity as key pillars to progress meaningful climate initiatives for a healthier and livable Kuala Lumpur. C40 is thrilled to have supported Kuala Lumpur City Hall (KLCH) on this journey through the Climate Action Planning Programme, from building on previous work to define key targets to identifying gaps,

providing technical assistance, conducting workshops and extensive reviews, resulting in the 15 priority actions outlined in this plan.

This climate action plan builds on the city's existing mitigation focused plans, including the KLCH Carbon Management Plan, and the Kuala Lumpur Low Carbon Society Blueprint 2030. As KLCH continues to develop its Kuala Lumpur's Structure Plan towards 2040, the central inclusive vision of 'A City for All' will guide how the city's climate actions will continue to be developed, implemented and evaluated in the coming years.

In this period where bold climate leadership is crucial, I would like to congratulate Kuala Lumpur for its continued ambition to work towards a resilient and climate-safe future for its communities under the current leadership of Mayor, Datuk Seri Haji Mahadi Che Ngah. C40 looks forward to continuing our collaboration with KLCH as the city takes the next steps towards the implementation of the actions in the *Kuala Lumpur Climate Action Plan 2050*, together with communities and stakeholders.

A handwritten signature in black ink, reading "Milag San Jose-Ballesteros".

**Milag San Jose-Ballesteros**

*Regional Director for East, Southeast Asia  
and Oceania*



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# ABBREVIATIONS

<b>AFOLU</b>	Agriculture, forestry and other land uses
<b>BaU</b>	Business-as-Usual
<b>BEI</b>	Building energy intensity
<b>BIPV</b>	Building-integrated photovoltaics
<b>BRT</b>	Bus rapid transit
<b>C40</b>	C40 Cities Climate Leadership Group
<b>CAP</b>	Climate Action Plan
<b>CO<sub>2</sub></b>	Carbon dioxide
<b>CO<sub>2</sub>e</b>	Carbon dioxide equivalent; t CO <sub>2</sub> e in tonnes
<b>D2020</b>	Deadline 2020
<b>KLCH (DBKL)</b>	Kuala Lumpur City Hall ( <i>Dewan Bandaraya Kuala Lumpur</i> )
<b>DMP</b>	Drought Management Plan
<b>DOSM</b>	Department of Statistics Malaysia
<b>DRP</b>	Drought Response Plan
<b>EECA</b>	Energy Efficiency and Conservation Act
<b>EMS</b>	Energy Monitoring System
<b>EV</b>	Electric vehicle
<b>FMP</b>	Flood Management Plan
<b>FRP</b>	Flood Response Plan
<b>GCoM</b>	Global Covenant of Mayors for Climate and Energy
<b>GDP</b>	Gross domestic product
<b>GHG</b>	Greenhouse gas
<b>GHGE</b>	Greenhouse gas emissions
<b>GPC</b>	Global Protocol for Communities
<b>HMP</b>	Heat Management Plan
<b>HRP</b>	Heat Response Plan
<b>ICA</b>	Inclusive climate action
<b>IPCC</b>	Intergovernmental Panel on Climate Change
<b>IPPU</b>	Industrial processes and product use
<b>KLCAP2050</b>	Kuala Lumpur's Climate Action Plan 2050 (this document)
<b>KLCH</b>	Kuala Lumpur City Hall
<b>KLCHCMP</b>	Kuala Lumpur City Hall's Carbon Management Plan
<b>KLCP2040</b>	(Draft) Kuala Lumpur City Plan 2040
<b>KLLCSBP2030</b>	Kuala Lumpur Low Carbon Society Blueprint 2030
<b>KLSP2040</b>	(Draft) Kuala Lumpur Structure Plan 2040
<b>KPI</b>	Key Performance Indicator

<b>KPKT</b>	Ministry of Local Government and Housing ( <i>Kementerian Perumahan dan Kerajaan Tempatan</i> )
<b>KTM</b>	Malayan Railways Limited ( <i>Keretapi Tanah Melayu</i> )
<b>LA21</b>	Local Agenda 21
<b>LC</b>	Low carbon
<b>LEB</b>	Low Energy Building
<b>LID</b>	Low impact development
<b>LPG</b>	Liquefied petroleum gas
<b>LRT</b>	Light Rail Transit
<b>MESTECC</b>	Ministry of Energy, Science, Technology, Environment and Climate Change
<b>MER</b>	Monitoring, Evaluation and Reporting
<b>MGBC</b>	Malaysian Green Building Council
<b>MEWA (KASA)</b>	Ministry of Environment and Water ( <i>Kementerian Alam Sekitar &amp; Air</i> )
<b>MOT</b>	Ministry of Transport
<b>MRT</b>	Mass Rapid Transit
<b>NEEAP</b>	National Energy Efficiency Action Plan
<b>NGO</b>	Non-governmental organisation
<b>NPP</b>	National Physical Plan
<b>NREPAP</b>	Natural Renewable Energy Policy and Action Plan
<b>NTP</b>	National Transport Policy
<b>NZEB</b>	Near-Zero Emissions Building
<b>OSC</b>	One Stop Centre
<b>PMD</b>	Personal mobility devices
<b>PPP</b>	Public-Private Partnership
<b>PT</b>	Public transport
<b>PR1MA</b>	1Malaysia Housing Programme ( <i>Perumahan Rakyat 1Malaysia</i> )
<b>QCRA</b>	Qualitative Climate Risk Assessment
<b>RE</b>	Renewable energy
<b>RUMAWIP</b>	Federal Territories Affordable Housing Project ( <i>Rumah Mampu Milik Wilayah Persekutuan</i> )
<b>SAP</b>	Station area planning
<b>SDGs</b>	Sustainable Development Goals
<b>SEDA</b>	Sustainable Energy Development Authority
<b>SPKL2040</b>	(Draft) Structure Plan for Kuala Lumpur 2040
<b>TNB</b>	Tenaga Nasional Berhad
<b>TOD</b>	Transit-oriented development
<b>UHI</b>	Urban heat island
<b>UNFCCC</b>	United Nations Framework Convention on Climate Change



# Executive Summary

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## The Need for Kuala Lumpur to Act

The climate crisis is one of the most pressing issues of our time, with global warming generating profound adverse impacts on our planet and its inhabitants. In the face of this crisis, Malaysia remains steadfast in its commitment to combatting climate change by ratifying the Paris Agreement and working towards limiting the earth's temperature increase to under 1.5°C and enhancing the adaptive capacity and resilience against an inevitable changing climate.

In Malaysia, the impacts of climate change affect our everyday lives. This is likely to lead to irreversible social, environmental and economic consequences if no further action is taken. Temperatures in major Malaysian cities have continued to rise over the past decade, which has also led to changes in rainfall patterns, escalating the urgency for bold action. Kuala Lumpur—Malaysia's capital and most populous city—is central to national efforts to mitigating the effects of climate change.

Recognising this, Kuala Lumpur City Hall (KLCH) has been mobilising climate action at the city level on its own as well as collaboratively with other organisations. This includes several local academic institutions such as University Kebangsaan Malaysia and University Teknologi Malaysia, as well as a number of international partners

such as the Tokyo Metropolitan Government, the United Commonwealth of Local Governments and the C40 Cities Climate Leadership Group.

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## Developing the Kuala Lumpur Climate Action Plan 2050

Since the early 2000s, KLCH has embarked on a mission to transform the city of Kuala Lumpur into a sustainable and liveable city, with a more recent focus of becoming 'A City for All'. This can be seen through initiatives such as the Local Agenda 21 Programme as well as the development of the KLCH Carbon Management Plan, the Kuala Lumpur Low Carbon Society Blueprint 2030 and the Draft Kuala Lumpur Structure Plan 2040.

To accelerate action, KLCH has developed this Kuala Lumpur Climate Action Plan 2050, to guide the actions required by the council and its stakeholders in an inclusive manner to achieve the objectives of the Paris Agreement, as highlighted in Figure 1. This expands on KLCH's 2030 targets published in the Kuala Lumpur Low Carbon Society Blueprint 2030, and establishes a clear roadmap to ensure that Kuala Lumpur achieves both carbon neutrality and climate resilience by 2050.

### EMISSIONS NEUTRAL

Develop a pathway to deliver an emissions neutral city by 2050 and set an ambitious interim target for 2030

### GOVERNANCE & COLLABORATION

Detail the governance, powers and the partners to engage in order to accelerate the delivery of the city's mitigation targets and adaptation goals

### RESILIENCE TO CLIMATE HAZARDS

Demonstrate how the city will adapt and improve its resilience to the climate hazards that will intensify over time

### INCLUSIVITY AND BENEFITS

Outline the social, environmental and economic benefits expected from implementing the plan, and ensure the equitable distribution of these benefits



Figure 1: Key Components of the Climate Action Plan

## Towards Carbon Neutrality by 2050

In 2017, Kuala Lumpur recorded an annual carbon footprint of 25 million metric tonnes of carbon emissions. Transportation accounted for the largest share, accounting for 56% of the city's emissions. This was followed by stationary energy (energy consumed in buildings) representing 41% of emissions and waste representing the remaining 3% of emissions. Projections indicate that by 2050, unless we act, emissions will more than double to over 58 million metric tonnes annually compared to 2017.

KLCH has identified the pathways and actions required to achieve an ambitious emissions reduction of 70% in 2030 and 93% in 2050 from the Business-as-Usual Scenario. KLCH has identified that strong partnerships and collaborations with stakeholders are crucial across all key sectors to ensure that these ambitious targets will be achieved.

Figure 2 illustrates the projected carbon emissions reduction for 2030 and 2050 based on actions KLCH will undertake. The reductions based on the Council-Led Scenario rely largely on KLCH initiatives and policies, while the Integrated Approach Scenario represents further potential reductions that require strong collaboration with the Federal Government.

### Carbon Emissions Reductions from Business-as-Usual Scenario

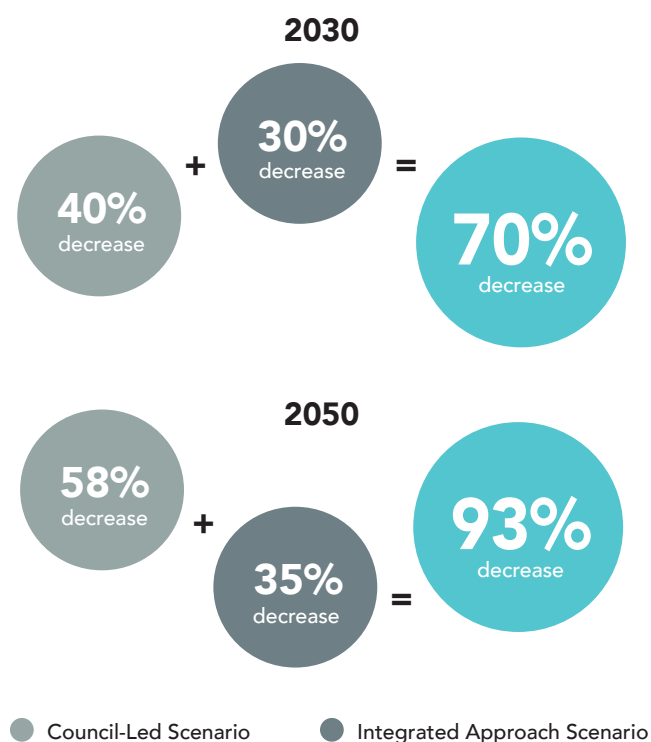


Figure 2: Carbon Emission Reduction Targets for Kuala Lumpur City Hall



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## Towards Increased Resilience Against Climate Hazards by 2050

Despite the city's existing and planned climate mitigation actions, global warming trends highlight that the city of Kuala Lumpur is already witnessing the impacts of climate change.

In Kuala Lumpur, three key climate hazards have been identified as posing the greatest threat to those living and working in the city: heat, flood and drought. The increasing risks and associated impacts from these climate hazards include:

- **Heat Risk:** Increased incidences and severity of heat-related illness, air pollution and energy usage
- **Flood Risk:** Increased incidences and severity of traffic and road accidents, landslides and infrastructure damage
- **Drought Risk:** Increased incidences and severity of economic disruption, drinking water supply and water pollution

Projections show that the annual amount of rainfall is expected to increase by over 30% between 2025 and 2100, yet the length of dry spells is also expected to increase by 18% to 45 days by 2050. These drastic shifts in weather are predicted to have a profound social, environmental and impact on the city, especially its most vulnerable residents.

KLCH has identified three key strategies and goals to combat climate change for the city of Kuala Lumpur:

- Cooler City by decreasing Urban Heat Island
- Better Protection Against Flooding
- Increasing Water Security for Residents

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## Developing Kuala Lumpur's Priority Climate Actions

The Climate Action Plan identifies an initial set of 15 actions across five strategic areas that are prioritised for implementation by KLCH (see Table 1: 15 Priority Climate Actions). The actions have been developed based on reviews of existing policies and programmes as well as consultation with key government agencies. Together, these priority actions provide firm steps towards a carbon neutral and climate resilient future for the city.

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## Planning for Implementation of the Climate Action Plan

The execution of the prioritised climate actions is expected to require a strong public-private partnership mechanisms, including project financing to come from all parties. While infrastructural projects will largely be funded through KLCH's annual budgets as well as Federal budgets, private sector funding and international donors will play a large role in establishing projects and programmes within organisations as well as community-level projects.

KLCH is committed to effectively implement all climate action going forward. Therefore, an interdepartmental task force will be established to collaboratively develop climate actions. By doing this, actions will be able to consider the requirements of different stakeholders while also

identifying opportunities to mainstream climate action in other sector strategies and plans. This good governance will also play a key role in monitoring, evaluation and reporting where specific roles and responsibilities have been identified. Specific departments have been tasked to measure indicators, evaluate progress and report at the action level, with the interdepartmental task force evaluating and reporting at the Climate Action Plan level.

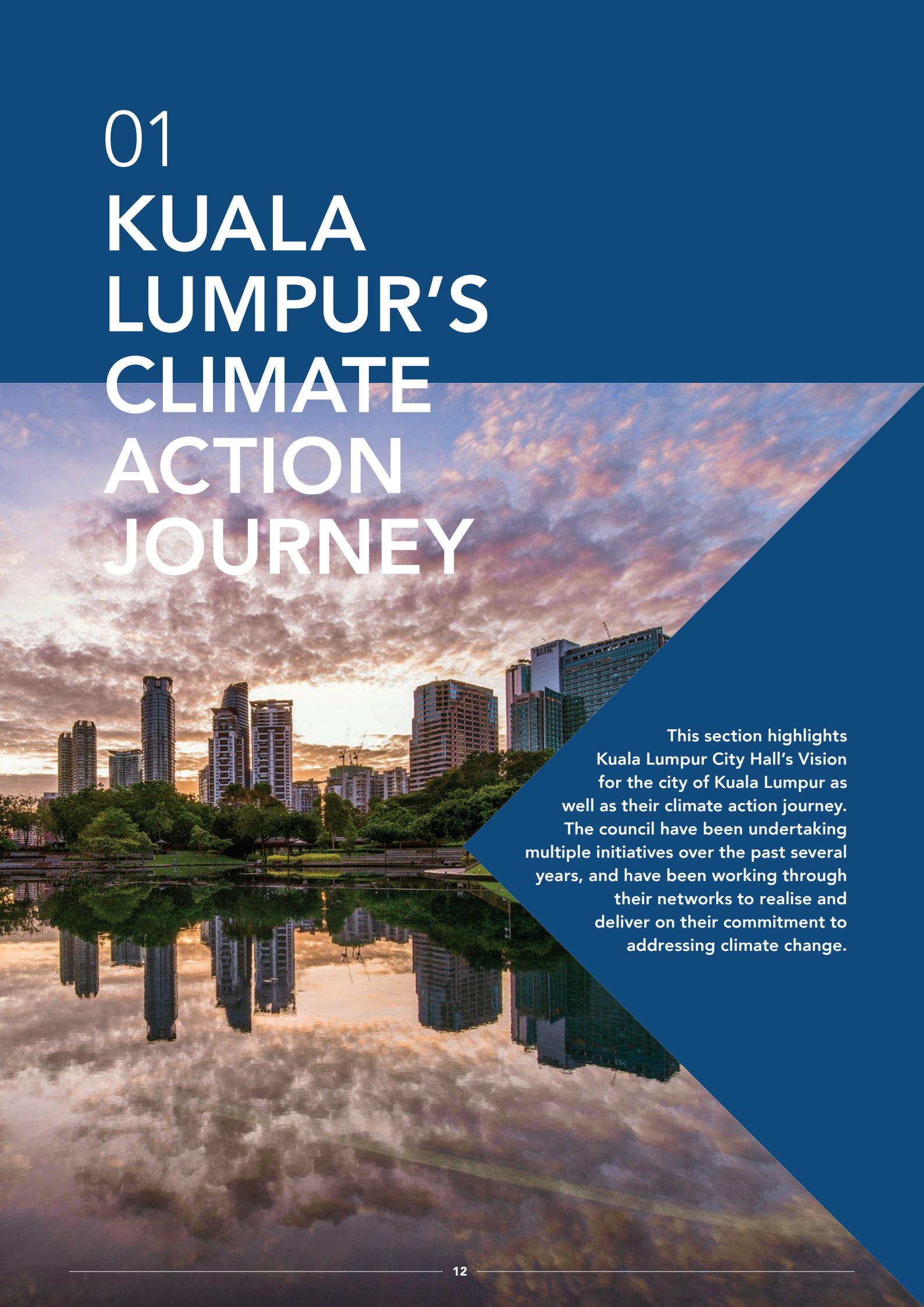
KLCH is determined to ensure the success of this Climate Action Plan and is confident in its implementation approach to make Kuala Lumpur climate resilient and carbon neutral for all by 2050.

**Table 1:** 15 Priority Climate Actions

CLIMATE STRATEGIES	PRIORITISED CLIMATE ACTIONS	OBJECTIVES
<b>Mobility &amp; Infrastructure</b>	Street Design to Prioritise Active Mobility	Introduce pedestrian priority into the road hierarchy to promote active mobility and demote private vehicle usage, to reduce the associated negative impacts from greenhouse gas emissions to air and noise pollution
	Comfortable & Safe Pedestrian Networks	Provide a large network of safe pedestrian routes to increase active mobility and its associated positive impacts such as improved public and mental health
	Accessible Affordable Housing in Priority Area	Increase the availability of affordable housing close to public transport options to encourage public transportation for residents who would benefit the most
	Dedicated Bus Lane Network	Improve and extend existing bus route service to encourage public transportation through increased reliable service
<b>Green Adaptive City</b>	Deploy Low Impact Development	Create nature-based solutions to reduce stormwater runoff as well as urban heat island impacts
	Depave Public Space with the Community	Increase permeable surfaces to support stormwater runoff as well as provide additional community and recreational space
	Protect Parks & Increase Biodiverse Areas	Mitigate the impact of the urban heat island and stormwater runoff by increasing planted areas while protecting sensitive biodiverse areas
<b>Energy Efficient &amp; Climate-Proof Buildings</b>	Building Vegetation Covering	Reduce urban heat island at a building scale, with added benefits of stormwater and pollution management
	Low Carbon Building Checklist Validation	Reduce energy consumption of buildings through technical specifications as well as increase climate resilience through surface treatment
	Building Performance Benchmarking & Rating	Develop maximum allowable Building Energy Intensities to support increased energy efficiency
	Near Zero Emissions Building Roadmap	Develop a roadmap with strategies across the lifecycle of buildings to reduce greenhouse gas emissions
<b>Smart Waste Management</b>	Solid Waste Reduction through a Waste Masterplan	Develop waste reduction, reuse and recycling strategies and infrastructure to reduce greenhouse gas emissions from the waste sector
<b>Disaster Management</b>	Flood Management & Response Plan	Build resilience and preparedness against flood incidents through early warning systems and disaster response plans
	Heat Management & Response Plan	Reduce the impacts of extreme heat by improving the awareness of citizens on heat-related health impacts, monitoring weather locally and modifying existing council assets
	Drought Management & Response Plan	Reduce the impact of extreme drought on citizens by improving their awareness of water efficiency as well as improving city-level water storage



# 01 KUALA LUMPUR'S CLIMATE ACTION JOURNEY



This section highlights Kuala Lumpur City Hall's Vision for the city of Kuala Lumpur as well as their climate action journey. The council have been undertaking multiple initiatives over the past several years, and have been working through their networks to realise and deliver on their commitment to addressing climate change.

# Kuala Lumpur's City Vision



## City Vision

The main vision of Kuala Lumpur City Hall (KLCH) since the start of the 21st century was to transform the city of Kuala Lumpur into a sustainable and liveable city by 2020—a vision that will continue towards 2040 and 2050. KLCH is keen to embrace an innovative and more inclusive approach to governing the city, and this is highlighted through the vision of the draft *Kuala Lumpur's Structure Plan 2040, 'A City for All'*. Through the following sections of this Climate Action Plan (CAP), several other key documents that reaffirm this vision will be referenced, demonstrating the strong commitment and mechanisms KLCH is placing on encouraging and adopting sustainable solutions for the city.

## Commitment to Combatting Climate Change

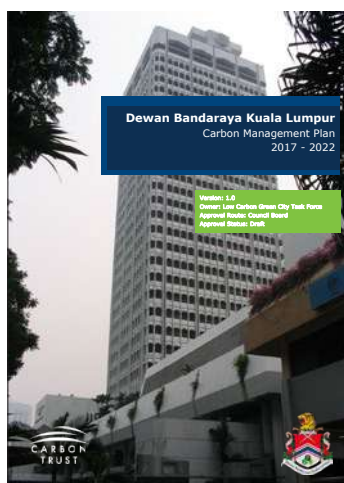
Malaysia's commitment to and ratification of the Paris Agreement<sup>1</sup> of 2015 has been a strong driving factor for policy nationally and at the city level to address climate change and reduce carbon emissions.

Kuala Lumpur, as Malaysia's capital city, is also proud to be a part of the international movement to act against climate change. The city began its journey to combat climate change through community engagement and carbon emissions reduction programmes in the early 2000s, through the formation of its *Local Agenda 21* unit. Subsequent initiatives by the city council include establishing KLCH's *Carbon Management Plan* and the *Kuala Lumpur Low Carbon Society Blueprint 2030*.

KLCH has also joined several international networks and made commitments to reduce carbon emissions from the municipality of Kuala Lumpur. Since 2016, Kuala Lumpur has been a C40 City and in March 2019 KLCH joined the Global Covenant of Mayors (GCoM).

Preceding the development of the Kuala Lumpur Climate Action Plan 2050 (KLCAP2050), there were three main documents that encapsulated the city's key actions relating to climate change. These documents were heavily referenced in the preparation of this CAP:

- KLCH's *Carbon Management Plan* (KLCHCMP)
- Kuala Lumpur Low Carbon Society Blueprint 2030* (KLLCSBP2030)
- Draft *Kuala Lumpur Structure Plan 2040* (KLSP2040)



<sup>1</sup> The Paris Agreement, signed in 2015 within the United Nations Framework Convention on Climate Change (UNFCCC), committed signatories to maintaining global warming to well below 2.0°C above pre-industrial levels and pursuing efforts to limit this increase to 1.5°C.



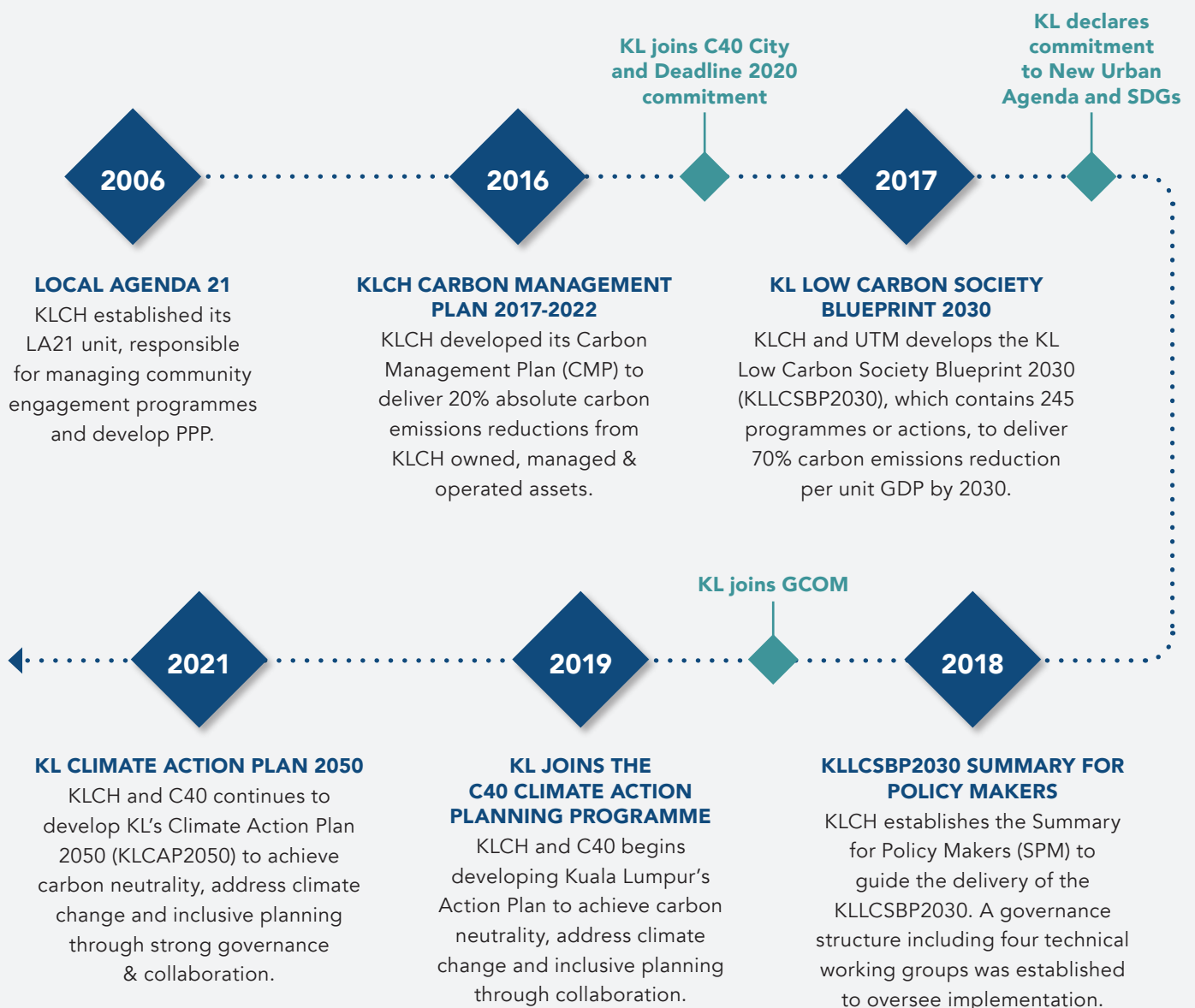
The KLLCSBP2030, containing 245 programmes or actions, proposes a low carbon approach to city planning and development for Kuala Lumpur. It identified an interim goal of 70% reduction in carbon emissions intensity per unit GDP by the year 2030, using a base year of 2010.

In addition to the three key documents, since the early 2000s KLCH has been implementing initiatives relating to sustainability, climate change and also inclusive engagement through the adoption of Local Agenda 21 (LA21), the New Urban Agenda (NUA) and the Sustainable Development Goals (SDGs). KLCH is also a member of regional and international networks that promote collaboration and knowledge sharing in these areas.

These include (but are not limited to):

- CityNet
- C40 Cities Climate Leadership Group (C40)
- Global Covenant of Mayors (GCoM)
- United Cities and Local Governments (UCLG)

The development of the Kuala Lumpur Climate Action Plan 2050 (KLCAP2050) is a continuum to the preceding work that KLCH has developed and will continue to develop, even beyond the implementation of the KLCAP2050 programme. KLCH is determined to continue to lead, inspire and implement ambitious rapid climate change action in and for the city of Kuala Lumpur.



**Figure 3:** KLCH's Journey in Sustainability and Climate Change Initiatives

## Developing Kuala Lumpur's Climate Action Plan

The development of the KLCAP2050 was undertaken to address and fulfil four main components:



**Figure 4:** Key Components of the Climate Action Plan

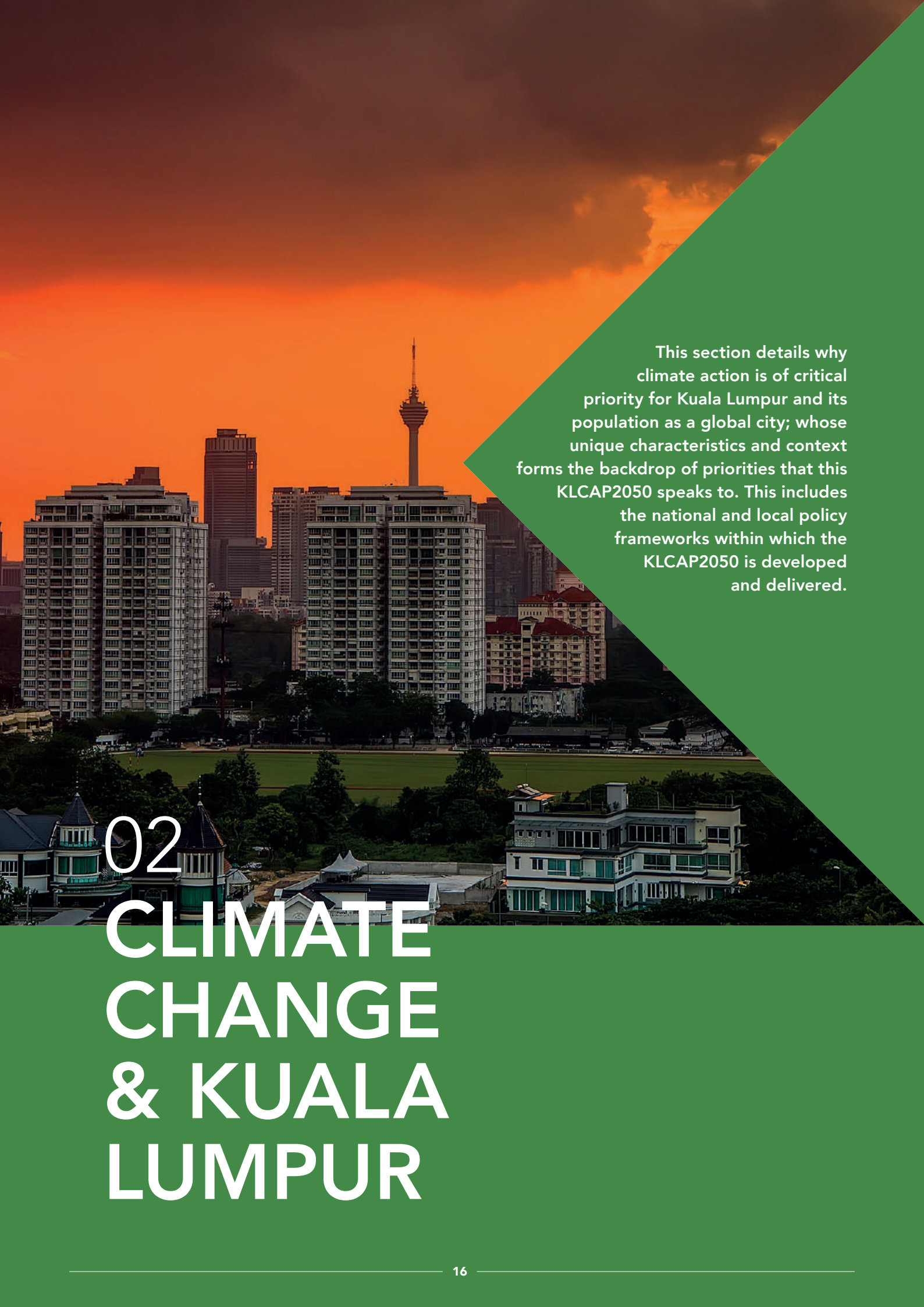
Building upon the KLLCSBP2030, the focus of which was on climate change mitigation, i.e. reducing the city's carbon emissions, KLCAP2050 has been developed with the following objectives:

- Establish Kuala Lumpur's pathway to achieve carbon neutrality by 2050
- Develop strategies for Kuala Lumpur to increase its resilience against climate hazards by 2050
- Incorporate an inclusive approach to climate action planning and implementation
- Establish a governance structure that will drive and maintain collaboration with all stakeholders across the city in order to deliver climate action targets

The KLCAP2050 has been developed with support from the C40 Climate Action Planning Programme, funded by the Department of Business, Energy and Industrial Strategy of the United Kingdom Government.

**“The KLLCSBP2030, containing 245 programmes or actions, proposes a low carbon approach to city planning and development for Kuala Lumpur.”**



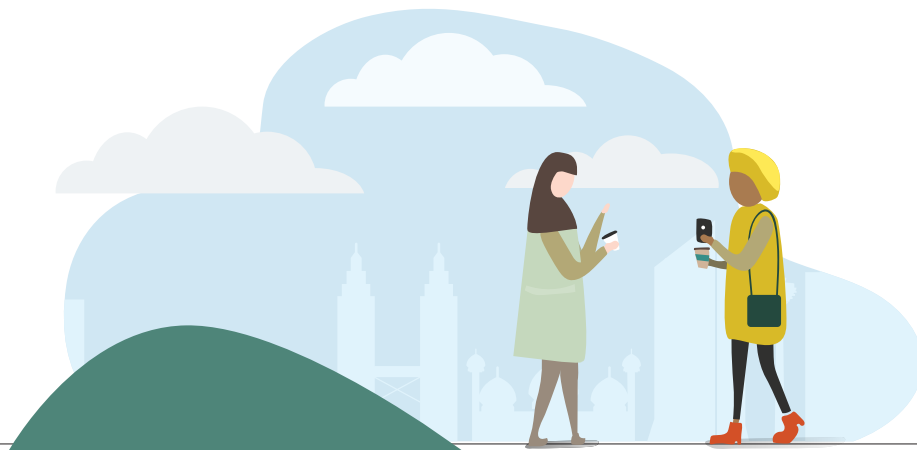


This section details why climate action is of critical priority for Kuala Lumpur and its population as a global city; whose unique characteristics and context forms the backdrop of priorities that this KLCAP2050 speaks to. This includes the national and local policy frameworks within which the KLCAP2050 is developed and delivered.

# 02 CLIMATE CHANGE & KUALA LUMPUR

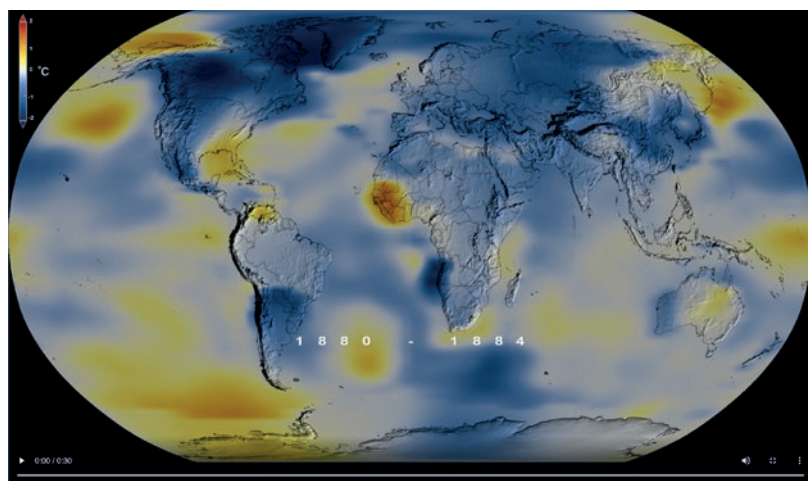


# The Earth is Warming



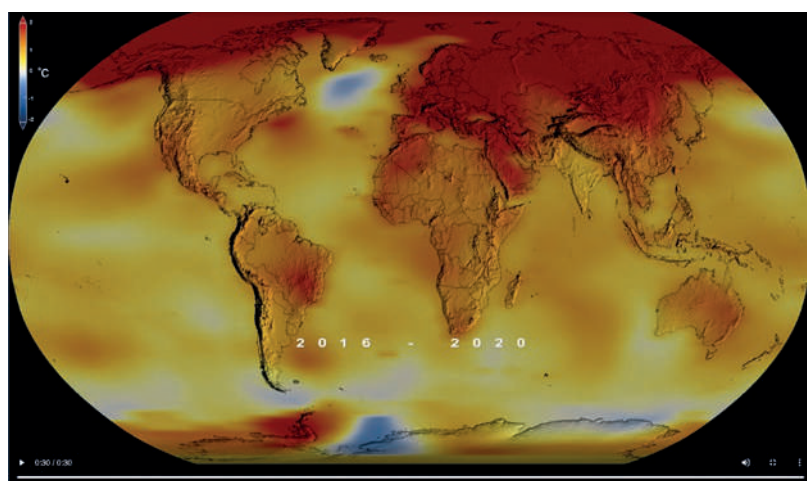
## The Window for Taking Action is Disappearing

Climate change and its impacts are already being felt around the world. Global temperatures, driven by increasing levels of atmospheric greenhouse gases such as carbon dioxide (CO<sub>2</sub>), have risen to alarming levels. With the temperature shift already exceeding a 1°C rise compared to pre-industrial times, our planet is at risk of irreversible and catastrophic effects, exacerbating trends we are already witnessing such as increased extreme weather events.



**+1°C / 2017**

The world has already warmed by 1.0°C above pre-industrial levels due to human activities and is experiencing related impacts.



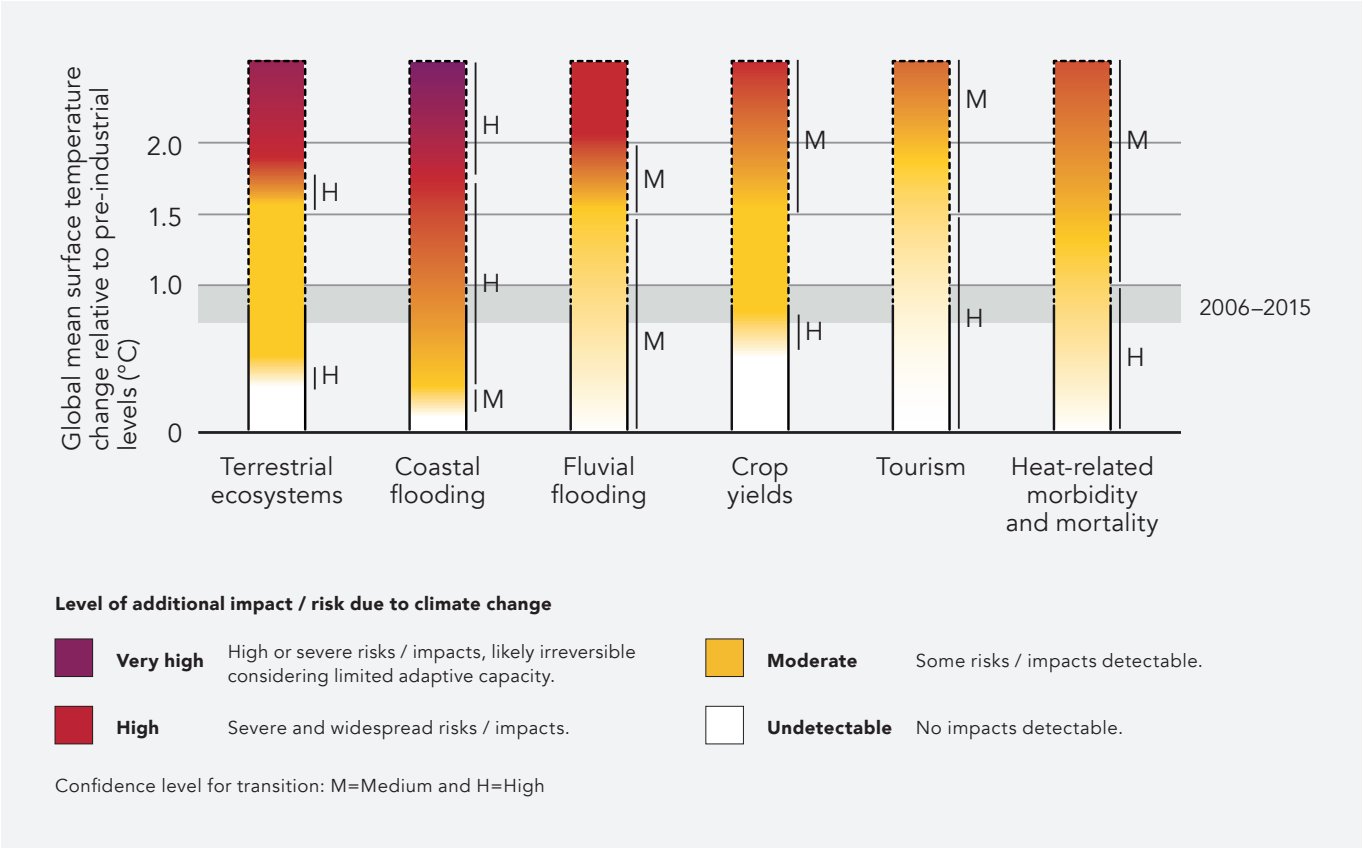
**+1.5°C / 2030–2052**

At the current rate of warming of 0.2°C per decade, global warming will reach 1.5°C between 2030 and 2052.

**Figure 5:** Observed and Projected Global Temperature Change Throughout the Years. Global Temperature in 1884 vs 2019<sup>1</sup>

<sup>1</sup> 2020, NASA Scientific Visualization

In 2013, 98% of the 66 major cities surveyed recognised that hazards from climate change will become more serious and more frequent as the climate changes and global temperatures increase<sup>2</sup>. The potential impacts on people, infrastructure, environments, and local and national economies will become more profound, as illustrated below.



**Figure 6:** Impacts and Risks for Selected Natural, Managed and Human Systems at Different Levels of Global Warming<sup>3</sup>

Though climate change and climate action have moved up the political agenda, much more can and must be done in the face of the impending risks and impacts of climate change. Countries and their regulators must cooperate to accelerate climate action and prevent the global temperature rise exceeding 1.5°C. The 2015 Paris Agreement marked a historic step in global coordination on climate change mitigation and adaptation; agreements and commitments such as this, embodied at the international level must propel governments, businesses, communities and individuals to take action.

Collaborative actions in cities, utilising a ‘bottom up’ approach, are beginning to gain traction around the world as cities increasingly understand the contribution to global warming they are making due to their greenhouse gas (GHG) emissions, as well as the role they can play in taking action and decreasing these emissions.

As the impacts of climate change are increasingly experienced, KLCH, as the local government for the Kuala Lumpur municipality, recognises this and is committed to taking the lead with initiatives that will provide effective solutions for the city and the population it serves.

<sup>2</sup> 2015, C40 and Arup, Climate Action in Megacities report

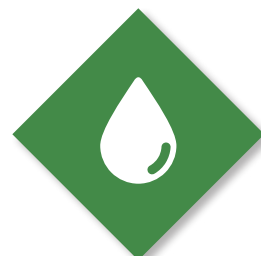
<sup>3</sup> 2018, Amir Bazaz et al, What the IPCC Special Report in Global Warming of 1.5°C Means For Cities (figure reproduced and adapted from original)

## The Impacts of Climate Change

With global warming increasing, so too will its impact on populations across the globe. Cities, with their large and densely packed populations, are particularly vulnerable to climate change and they lack natural ecosystems that can help alleviate impacts. Key impacts of climate change are summarised below.



**Human illness and death** are expected to increase due to exacerbated UHI<sup>4</sup>, amplification of heat waves, extreme weather volatility, floods, droughts, coastal inundation, and an increase in vector-borne diseases such as dengue. Likewise, migration from marginalised agriculture-dependent communities could increase as temperatures rise and water stress increases<sup>5</sup>.



Globally, **water shortages** occur more often as temperatures increase. While there will be considerable variation by region, the overall global population suffering water scarcity if temperatures rise by 2.0°C is projected to be double that at 1.5°C. Drought frequency and intensity will increase in many regions of the world<sup>6</sup>.



**Food insecurity and malnutrition** are expected to increase in already stressed regions—including those within, for example, Southeast Asia, Southern Africa, and South America—due to projected impacts of temperature increases and climate change on crop nutrition content as well as yield, as well as on livestock. Vital fisheries and aquaculture face increasing risks from ocean warming, acidification, and climate impacts in deltas and coastal zones<sup>7</sup>.



**Natural habitats degrade** substantially at higher global temperatures, with expected irreversible impacts on some species and ecosystems. For example, the number of insect species projected to lose their habitat is tripled at 2.0°C global temperature increase compared with 1.5°C, while the number of plant species projected to lose their habitat is doubled. Ecosystem loss has repercussions for regional and global food security, forests, and water systems<sup>8</sup>.

<sup>4</sup> The urban heat island (UHI) effect is caused by concrete, stone and road surfaces absorbing large amounts of heat energy from sun

<sup>5</sup> 2018, Amir Bazaz et al, What the IPCC Special Report in Global Warming of 1.5°C Means For Cities

<sup>6</sup> Ibid

<sup>7</sup> Ibid

<sup>8</sup> Ibid





As climate change occurs, it must be noted that various natural and human systems will feel the impacts of global warming at different temperature levels. While not usually contained within city boundaries, agricultural land, rainforests, mangroves or coastal areas; cities and their residents rely heavily on managed and natural ecosystems for necessities including water, food, trade, economic development and even protection. Climate impacts across many sectors and systems will be felt not only by those directly facing the impacts, but also by urban populations around the world. Like most cities, this is the case for Kuala Lumpur.

Catastrophic impacts of climate change are becoming increasingly clear, emphasising the incredible urgency with which we need to act if the ambitions contained within the Paris Agreement are to be met. The Intergovernmental Panel on Climate Change (IPCC)'s *Special Report on Global Warming of 1.5°C*<sup>9</sup> shows that based on current trends of consumption and infrastructure development, within five years the world will have 'locked-in' sufficient future carbon emissions to exceed the +1.5°C rise in global temperatures. A third of these emissions will be determined by cities, making them pivotal in the solution.

<sup>9</sup> Ibid; and 2015, C40 Cities & Arup, *Deadline 2020—How Cities Will Get the Job Done*



# Kuala Lumpur's City Context

Kuala Lumpur is the capital and the largest city in Malaysia. Together with the 10 surrounding municipalities, it forms the National Conurbation, also known as the Greater Kuala Lumpur region.

It is a tropical city located just above the Equator, and like its surrounding Southeast Asian neighbours, Kuala Lumpur is no stranger to extreme weather events, with a historical record of major flood events<sup>10</sup>. Trends have shown that major cities in Malaysia, including Kuala Lumpur, have recorded higher temperatures in 2019 compared to the decade prior<sup>11</sup>.

As a city with extensive infrastructure and a high level of development, Kuala Lumpur has, to some extent, managed to alleviate the impacts of climate change through well planned innovative infrastructural solutions over the past couple of decades. As the impacts of climate change worsen, so too will the frequency and severity of extreme weather, in turn delivering adverse environmental, social and economic impacts on the city. This has been evident even over the past year.

## Physical & Environmental Context

Kuala Lumpur is home to almost 2 million people and is very densely developed, with 76% of its land comprising built-up area<sup>12</sup>. Natural features of the city's landscape include rivers, managed parkland, and sloping hill areas, a large portion of which has been engineered for safety purposes based on development practices of preceding decades. Some of the characteristics of the city and its environment could potentially mean that impacts of climate change are felt more strongly by its inhabitants.



### URBANISATION

- Accelerated urban growth took place from the late 1980s, resulting in the skyscraper-dominated skyline and urban sprawl of today.
- Kuala Lumpur has lost much of its vegetated land area to urban development.



### WATERBODY

- The city of Kuala Lumpur begins at the confluence of the Klang and Gombak Rivers.
- Kuala Lumpur has multiple rivers running through it, with several flood-prone areas.
- Lower hierarchy streams and waterways have been 'culverted' and integrated into the stormwater management system.



### GEOGRAPHY & CLIMATE

- Located towards the central west coast of Peninsular Malaysia, enclaved within the State of Selangor and Klang Valley.
- Tropical rainforest climate with 27.5°C annual average temperature and abundant rainfall throughout the year.



### POLLUTION

- High level of vehicle ownership: nearly every Malaysian household owns a car<sup>13</sup>.
- Worsening traffic congestion<sup>14</sup>, with 163 hours (2017) increasing to 170 hours (2019) lost per year.
- Air quality averages at moderate band of 60–70 API<sup>15</sup>.
- Water pollution caused water cuts six times across Greater Kuala Lumpur in 2020<sup>16</sup>.

<sup>10</sup> 2019, Kuala Lumpur City Hall, Kuala Lumpur Structure Plan 2040

<sup>11</sup> 2019, Clarissa Chung and Jo Timbuong, More hotter days now compared to 10 years ago

<sup>12</sup> 2019, Kuala Lumpur City Hall, Kuala Lumpur Structure Plan 2040, page 18

<sup>13</sup> 2019, Malaysia Economic Monitor, <http://documents1.worldbank.org/curated/en/616631575645435287/pdf/Malaysia-Economic-Monitor-Making-Ends-Meet.pdf>

<sup>14</sup> 2020, NST Leader: Traffic-choked in KL, <https://www.nst.com.my/opinion/leaders/2020/03/573509/nst-leader-traffic-choked-kl>

<sup>15</sup> 2020, Air Pollutant Index Malaysia, [http://apims.doe.gov.my/public\\_v2/api\\_table.html](http://apims.doe.gov.my/public_v2/api_table.html)

<sup>16</sup> 2020, 2020: The Year Of Klang Valley Water Cuts <https://www.therakyatpost.com/2020/12/29/2020-the-year-of-klang-valley-water-cuts/>



## Social & Economic Context

The city of Kuala Lumpur is a large contributor to Malaysia's gross domestic product (GDP)<sup>17</sup>, providing an estimated 15.6% of national GDP in 2017<sup>18</sup>. Kuala Lumpur's GDP per capita is the highest in the country and its inhabitants have the highest average household income in the nation<sup>19</sup>.

Despite this, several key issues have a significant impact on much of the population that reside in and serve the city, including housing affordability and quality of life in the city, urban sprawl and the increasing population in areas surrounding the city, but not within the city itself. These relate to increased vehicle usage, traffic congestion and air pollution in Kuala Lumpur, as well as increasing economic inequality<sup>20</sup> in recent years.

Climate action in Kuala Lumpur will take place with consideration of the social and economic context of the city. The KLCAP2050, needs to recognise and assess the various aspects of this context to understand how climate action interventions will be influenced, enabled

or constrained by social and economic factors. KLCH will strive to align its climate actions in a manner that will yield wider benefits for the city and its residents, in particular, those that are vulnerable.

With this in mind, KLCH assessed the current performance of the city across several domains loosely based on C40's ICA Planning Toolkit. KLCH's indicative assessment of the current status for each indicator is shown across the following pages. These indicators serve as benchmarks and focus points as KLCH moves forward with tackling carbon emissions and addressing adverse impacts of climate change, helping to ensure that climate action taken in the city is sensitive to the needs of all in the city, in particular, the needs of the most marginalised and vulnerable in society.













<sup>17</sup> 2018, Department of Statistics Malaysia, [https://www.dosm.gov.my/v1/index.php?r=column/cthemebycat&cat=449&bul\\_id=l25euxqxbwdbaeovowxu5atfqwupndz09&menu\\_id=te5Scruzblh4ztzmodzibmk2awrrqt09](https://www.dosm.gov.my/v1/index.php?r=column/cthemebycat&cat=449&bul_id=l25euxqxbwdbaeovowxu5atfqwupndz09&menu_id=te5Scruzblh4ztzmodzibmk2awrrqt09)

<sup>18</sup> 2018, Department of Statistics Malaysia, Gross Domestic Product Fourth Quarter 2017, [https://www.dosm.gov.my/v1/index.php?r=column/cthemebycat&cat=100&bul\\_id=emUyMzI4eEINK0hZQzRyaEgyZGhZz09&menu\\_id=TE5CRUZCblh4ZTZMODZlbnk2aWRRTQT09](https://www.dosm.gov.my/v1/index.php?r=column/cthemebycat&cat=100&bul_id=emUyMzI4eEINK0hZQzRyaEgyZGhZz09&menu_id=TE5CRUZCblh4ZTZMODZlbnk2aWRRTQT09)

<sup>19</sup> 2020, Department of Statistics Malaysia, Household Income & Basic Amenities Survey Report 2019, [https://www.dosm.gov.my/v1/index.php?r=column/cthemebycat&cat=120&bul\\_id=TU00TmRhQ1N5UxHVWN0T2VjbXJYZz09&menu\\_id=amVoWU54UTl0a21NWmdhMjFMMWcyZz09](https://www.dosm.gov.my/v1/index.php?r=column/cthemebycat&cat=120&bul_id=TU00TmRhQ1N5UxHVWN0T2VjbXJYZz09&menu_id=amVoWU54UTl0a21NWmdhMjFMMWcyZz09)

<sup>20</sup> Ibid. According to the Household Income and Basic Amenities Survey Report, the Gini coefficient (an indicator of income inequality), based on gross income in urban areas, increased from 0.389 in 2016 to 0.398 in 2019.



DOMAINS	EXPLANATION	INDICATORS (Indicative assessment)
<b>Health &amp; Wellbeing</b> 	<ul style="list-style-type: none"> <li>Health and medical care is good: hospitals are well equipped with excellent facilities, well trained medical professionals and affordable services.</li> <li>The rate of non-communicable diseases, such as diabetes, is high<sup>21</sup> at double the rate of rural population, due to physical inactivity, which is linked to less walkable urban environments and high vehicle dependence.</li> </ul> <p><b>Threats:</b></p> <ul style="list-style-type: none"> <li>Urban design that prioritise motorised vehicles can increase traffic and pollution, resulting in increased stress, obesity and cardiovascular disease rates<sup>22</sup>.</li> </ul>	 Physical Health Mental Health Work-Life Balance  Healthcare Peace & Security
<b>Economic Prosperity</b> 	<ul style="list-style-type: none"> <li>Kuala Lumpur has a high employment rate compared to other Malaysian states, due to greater opportunities for formal jobs in urbanised areas.</li> <li>Less labour intensive and higher value knowledge-based jobs through sustained growth in service sectors.</li> <li>At the national level, in October 2020, due to the Covid-19 pandemic, the unemployment rate in Malaysia grew to approximately 4.7 percent (from 3.8 percent) according to the Department of Statistics Malaysia<sup>23</sup>.</li> <li>The country aims to create 200,000 green jobs by 2023<sup>24</sup>.</li> </ul> <p><b>Threats:</b></p> <ul style="list-style-type: none"> <li>Reliance on exports—volatile market (e.g. gas and diesel prices ever-changing)<sup>25</sup>.</li> </ul>	 Economic Innovation Income & Poverty Prosperity  Employment
<b>Education &amp; Skills</b> 	<ul style="list-style-type: none"> <li>At least 75% of the population completed lower secondary school, as compared to 72.6% in 2015<sup>26</sup>.</li> <li>According to UNESCO, nationally Malaysia has an adult literacy rate of 93.12%. Male literacy rate is 95.43%, slightly lower for females at 90.75%<sup>27</sup>.</li> </ul> <p><b>Threats:</b></p> <ul style="list-style-type: none"> <li>Without clear and supportive policies, the green job targets are at risk.</li> <li>Corruption limiting basic rights<sup>28</sup>.</li> </ul>	 Financial Literacy Training & Green Jobs Education Quality  Education Attainment
 Good  Moderate  Poor		

<sup>21</sup> 2020, Normaz Wana Ismail, Sudha Sivasdas, Malaysian Journal of Medicine and Health Sciences, [https://medic.upm.edu.my/upload/dokumen/2020041912590601\\_MJMHS\\_0312.pdf](https://medic.upm.edu.my/upload/dokumen/2020041912590601_MJMHS_0312.pdf)

<sup>22</sup> 2018, Kowaleski-Jones, Lori et al, Walkable neighborhoods and obesity: Evaluating effects with a propensity score approach, SSM—Public Health Elsevier, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6086390/>

<sup>23</sup> 2020, Department of Statistics Malaysia, Unemployment rate







<sup>24</sup> 2018, Komal Nanthani, Entrepreneur Asia Pacific, Malaysia Aims to Create 200,000 Green Jobs by 2023 in ASEAN

<sup>25</sup> 2020, C40 & Kuala Lumpur City Hall, Inclusive Climate Action (ICA) Summary Report

<sup>26</sup> Ibid

<sup>27</sup> Ibid

<sup>28</sup> Ibid

DOMAINS	EXPLANATION	INDICATORS (Indicative assessment)
<b>Civil Society</b> 	<ul style="list-style-type: none"> <li>Kuala Lumpur had an estimated 1,500 to 2,000 homeless population in 2016<sup>29</sup>, while KLCH identified approximately 1,000 homeless persons in 2018<sup>30</sup>.</li> <li>Food service providers, for example, Kechara Soup Kitchen, PERTIWI Soup Kitchen, Dapur Jalanan Kuala Lumpur, among various other groups, help the homeless and urban poor.</li> <li>Covid has highlighted that the urban underprivileged are at high risk, with many opting to reside in council-provided shelters during lockdowns due to inability to work (daily wage workers).</li> <li>The city has a large migrant workforce in both formal and informal employment consisting of legal, illegal as well as refugee status.</li> </ul> <p><b>Threats:</b></p> <ul style="list-style-type: none"> <li>While NGOs are heavily involved in leading climate-related action, the majority of civil society lack involvement in climate-related discussion or activities<sup>31</sup>.</li> </ul>	 Non-Governmental Organisations (NGOS) Neighbourhood and Community Involvement   Technology & Communication
<b>Essential Public Services</b> 	<ul style="list-style-type: none"> <li>Access to electricity (% of population) in Malaysia was reported at 100% in 2018, according to the World Bank<sup>32</sup>.</li> <li>In Kuala Lumpur public transport usage is particularly high; modal share stands at 20–25%<sup>33</sup> and average daily ridership of rail and bus services in 2017 was at 1.206 million, increasing from 1.16 million in 2016<sup>34</sup>.</li> <li>Affordable housing schemes are available in the country—including in the greater Kuala Lumpur urban area—such as the 1Malaysia Housing Programme or Perumahan Rakyat 1Malaysia (PR1MA), Federal Territories Affordable Housing Project (RUMAWIP) and MyHome (private affordable ownership housing scheme).</li> </ul> <p><b>Threats:</b></p> <ul style="list-style-type: none"> <li>Profit-oriented unaffordable and irresponsible development.</li> <li>Middle-class individuals and families being left out of affordable housing access<sup>35</sup>.</li> </ul>	 Housing Solid Waste Transportation   Energy Water & Sanitation Wastewater

 Good
  Moderate
  Poor

<sup>29</sup> Homeless Population Details: <http://www.wongchen.com/wp-content/uploads/2014/03/KayLi-The-Homeless-in-Malaysia-1-1.pdf>

<sup>30</sup> KLCH Walkabout between 2am to 4am in several homeless 'hotspot' areas (not entire city)





<sup>31</sup> 2015, Pew Research Centre, Global Concerns about Climate Change Survey

<sup>32</sup> 2021, The World Bank, Sustainable Energy for All (SEforALL)

<sup>33</sup> 2018, Nur Ayuni Binti Mohammad Zin, Ministry of Transport, Malaysia, Urban Transport System in Greater Kuala Lumpur

<sup>34</sup> 2017, Malaysia National Transformation Plan Annual Report 2017

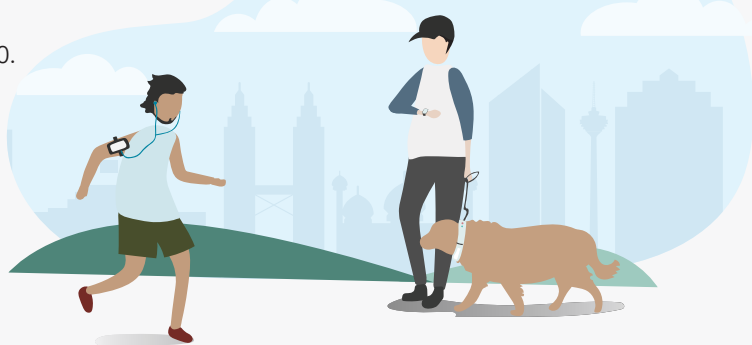
<sup>35</sup> 2020, C40 & Kuala Lumpur City Hall, Inclusive Climate Action (ICA) Summary Report

DOMAINS	EXPLANATION	INDICATORS (Indicative assessment)
<b>Institutions &amp; Governance</b> 	<ul style="list-style-type: none"> <li>Malaysia's good governance index has been steadily improving over the years, with improvements in: political stability and absence of violence or terrorism; voice and accountability; effectiveness; rule of law and control of corruption<sup>36</sup>.</li> <li>Corruption incidence and perception still exists, with 71% of Malaysians surveyed by <i>Transparency International</i> finding government corruption a concern<sup>37</sup>.</li> </ul> <p><b>Threats:</b></p> <ul style="list-style-type: none"> <li>Political corruption threatening livelihoods<sup>38</sup>.</li> </ul>	 <ul style="list-style-type: none"> <li>Voter Participation &amp; Presentation</li> <li>Anti-Corruption</li> <li>Good Governance Mechanisms</li> <li>Crime &amp; Justice</li> </ul>
<b>Political Climate</b> 	<ul style="list-style-type: none"> <li>KLCH understands the need to lead overcoming urban issues relating to environmental challenges, poverty, governance and improving resident's quality of life.</li> <li>Political leaders are involved in community outreach initiatives and seeking to generate goodwill, togetherness and unity over the long term.</li> </ul> <p><b>Threats:</b></p> <ul style="list-style-type: none"> <li>Unstable political situations may disrupt on going initiatives and their direction or follow-through<sup>39</sup>.</li> <li>Stalled federal-level progress and direction on climate change-related policies and targets.</li> </ul>	 <ul style="list-style-type: none"> <li>Unclear Long-Term Climate-Related Goals &amp; Targets</li> </ul>

 Good
  Moderate
  Poor

As highlighted, understanding the context in which Kuala Lumpur exists and operates as a city—its infrastructure, the fabric of social and economic systems, the city's policies and institutions for governance—is crucial to the development of a robust, credible and appropriate Climate Action Plan. The insights drawn from these self-assessments help provide an understanding of the current context and broader considerations to ensure that the climate action eventually implemented is aligned with the wider effort to address inequalities and protect vulnerable and marginalised communities in the city. Beyond this, it is also important to take into consideration expectations of future trends as the city grows and changes over the lifespan of this plan, to 2050.

**“KLCH aim to ensure that the climate action implemented is aligned with the wider effort to address inequalities and protect vulnerable and marginalised communities in the city.”**



<sup>36</sup> 2021, The World Bank, Worldwide Governance Indicators

<sup>37</sup> 2020, Arjuna Chandran Shankar, The Edge Markets, 71% of Malaysians view Government corruption as a big problem, says TI-M

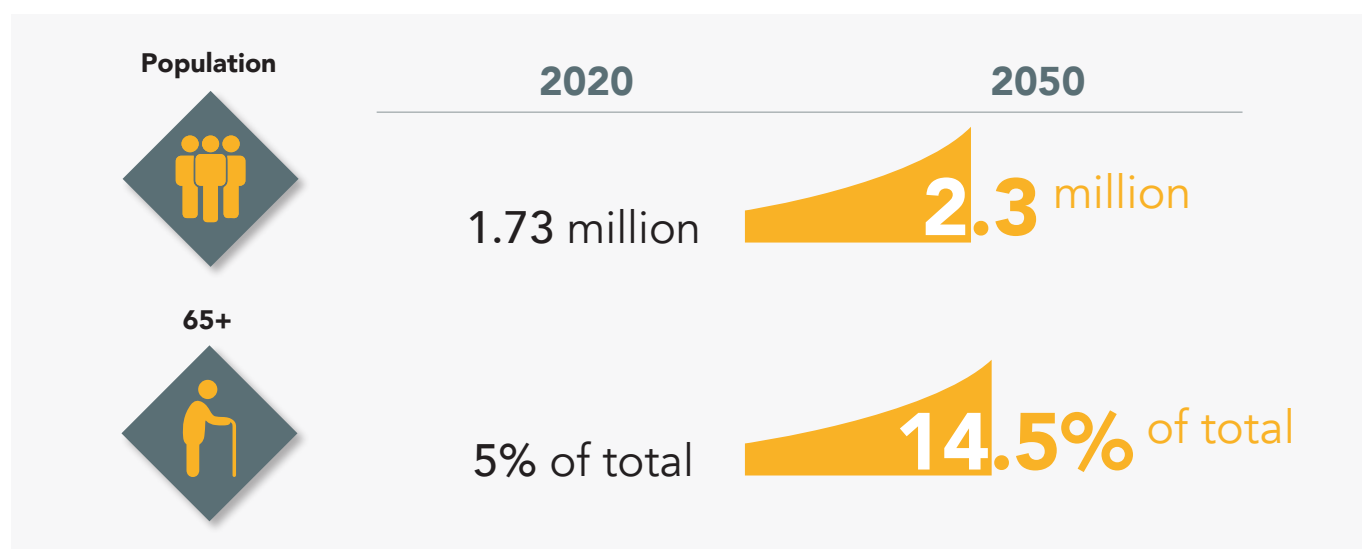
<sup>38</sup> 2020, C40 & Kuala Lumpur City Hall, Inclusive Climate Action (ICA) Summary Report

<sup>39</sup> 2020, Ariel Tan, Today Online, All eyes on how new Muhyiddin government handles three issues in Malaysia, <https://www.todayonline.com/commentary/all-eyes-how-new-muhyiddin-government-handles-three-issues-malaysia>



# Forward-Looking Trends For Kuala Lumpur

Projecting future scenarios for Kuala Lumpur, as with any city, is an uncertain exercise, yet it is very important to provide the context for climate action in the city over the next 30 years. Based on historical patterns, current indications and existing plans, KLCH has noted some key trends that are likely to have a significant influence on the progress of its climate action journey.



## INFORMAL POPULATION

Kuala Lumpur has a significant informal population, including temporary and special status (refugee) residents, as well as a population residing illegally within the city area. The informal population is by nature difficult to quantify, making it hard for the projection and planning of services and amenities. It is also difficult to assess the impact of intensifying climate hazards on these communities.

**“The population data used in this document are based on Kuala Lumpur’s permanent residents. The reality is that Kuala Lumpur, as any major city, has other groups that can be considered ‘temporary’ population”**

The growth of Kuala Lumpur’s population has slowed down compared to the early 2000s, in large part due to alternative and more affordable property beyond the boundary of the municipality. The population data used in this document are based on Kuala Lumpur’s permanent residents. The reality is that Kuala Lumpur, as any major city, has other groups that can be considered ‘temporary’ population, such as:

- Day population: the daily influx of citizens from other parts of the Klang Valley, for work, business or leisure
- Migrant population: while legal migrants are accounted for, it is difficult to estimate illegal and undocumented residents or workers
- Refugee population: due to issues of legality, a sizeable proportion of the refugee population remains hidden
- Other informal populations: homeless and temporarily stranded citizens

Moving forward, KLCH aims to track day population more accurately through the use of surveys, as well as 2020 and future census data. Furthermore, coordination with agencies that manage community welfare and labour could result in a more accurate understanding of the city’s long- and short-term temporary population.

## Transportation

The total number of train stations within the municipality is expected to increase by 50% to 128 stations by 2040<sup>40</sup> upon completion of all LRT and MRT lines. These additional stations and the supporting feeder bus routes will boost public transportation uptake, helping Kuala Lumpur move closer to achieving a shared mode of transport target of 70% for public transportation by 2040.

The uptake of electric vehicles is expected to occur as the technology develops and affordability and popularity increases. Although the up-front cost of electric cars is currently too high to expect a large uptake without supporting tax breaks or incentives initiated by the federal government, ownership and use of smaller personal mobility devices (PMDs) such as e-scooters has been on the rise in Kuala Lumpur over recent years. Despite the potential for increased usage of the PMDs, inter-agency coordination and legal enforcement matters will need to be resolved<sup>41</sup>, with simultaneous mobilisation by KLCH to address safety considerations, such as increasing the bicycle lane network and legislation to support shared use of it by PMD users.

## Technology

The region boasts a tech-savvy population and has experienced high levels of adoption of new technologies and online platforms<sup>42</sup>. As a rapidly developing nation, Malaysia has become increasingly reliant on information and communication technology, with mobile telecommunications services and fixed broadband subscriptions becoming integral as means for information, communication and business continuity. This growth is exemplified by the increase in individuals using the

internet to 80% in 2019 from 56% in 2010<sup>43</sup>. With this increasing connectivity, there is potential for KLCH to more easily share information and raise awareness among its citizens on the issue of climate change, hazards and the actions required to be implemented.

The ongoing technological transformation of Malaysia—including Kuala Lumpur—will also encompass a future energy ecosystem that can deliver balance between environmental sustainability, secure and reliable energy supply, and optimal economic development<sup>44</sup> in order to lower carbon emissions for the nation.

Improved energy efficiency based on technological advancements as well as upcoming legislation such as the Energy Efficiency and Conservation Act (EECA) will set higher targets than the existing 8% energy consumption reduction target by 2020, set by the National Energy Efficiency Action Plan (NEEAP)<sup>45</sup>. This is a key step in the longer-term transition towards a low-carbon economy, in line with national and global ambitions<sup>46</sup>.

## Environment

As a result of rapid urban development, Kuala Lumpur has lost valuable undeveloped vegetated land area over the past three decades. In addition to the decreased permeable green area, Kuala Lumpur has also lost trees and shrubs inhabiting these areas as it steadily urbanised to the city it is today. Should urbanisation continue and no rectification made, these 'green lungs' will continue to diminish even more, with implications on air pollution and amplification of the impacts of climate change.<sup>47</sup>

<sup>40</sup> 2019, Kuala Lumpur City Hall, Kuala Lumpur Structure Plan 2040

<sup>41</sup> Bavani M, The Star Online, DBKL not ready to dismiss use of e-scooters, <https://www.thestar.com.my/metro/metro-news/2021/01/04/dbkl-not-ready-to-dismiss-use-of-e-scooters>

<sup>42</sup> 2021, Google and Temasek, E-conomy SEA 2020

<sup>43</sup> 2021, The World Bank, World Development Indicators, Fixed Broadband and mobile cellular subscriptions

<sup>44</sup> 2019, The Star Online, Energy efficiency for the future, <https://www.thestar.com.my/news/nation/2019/04/03/energy-efficiency-for-the-future/>

<sup>45</sup> 2019, Mark Rao, The Malaysian Reserve, Malaysia's arduous journey to a sustainable and secure energy future

<sup>46</sup> 2019, The Star Online, Energy efficiency for the future, <https://www.thestar.com.my/news/nation/2019/04/03/energy-efficiency-for-the-future/>

<sup>47</sup> 2017, Pamela Victor, The Asean Post, Kuala Lumpur's green lung struggles to 'stay alive', <https://theaseanpost.com/article/kuala-lumpurs-green-lung-struggles-stay-alive>



# Placing Climate Action Within the Existing Planning Framework

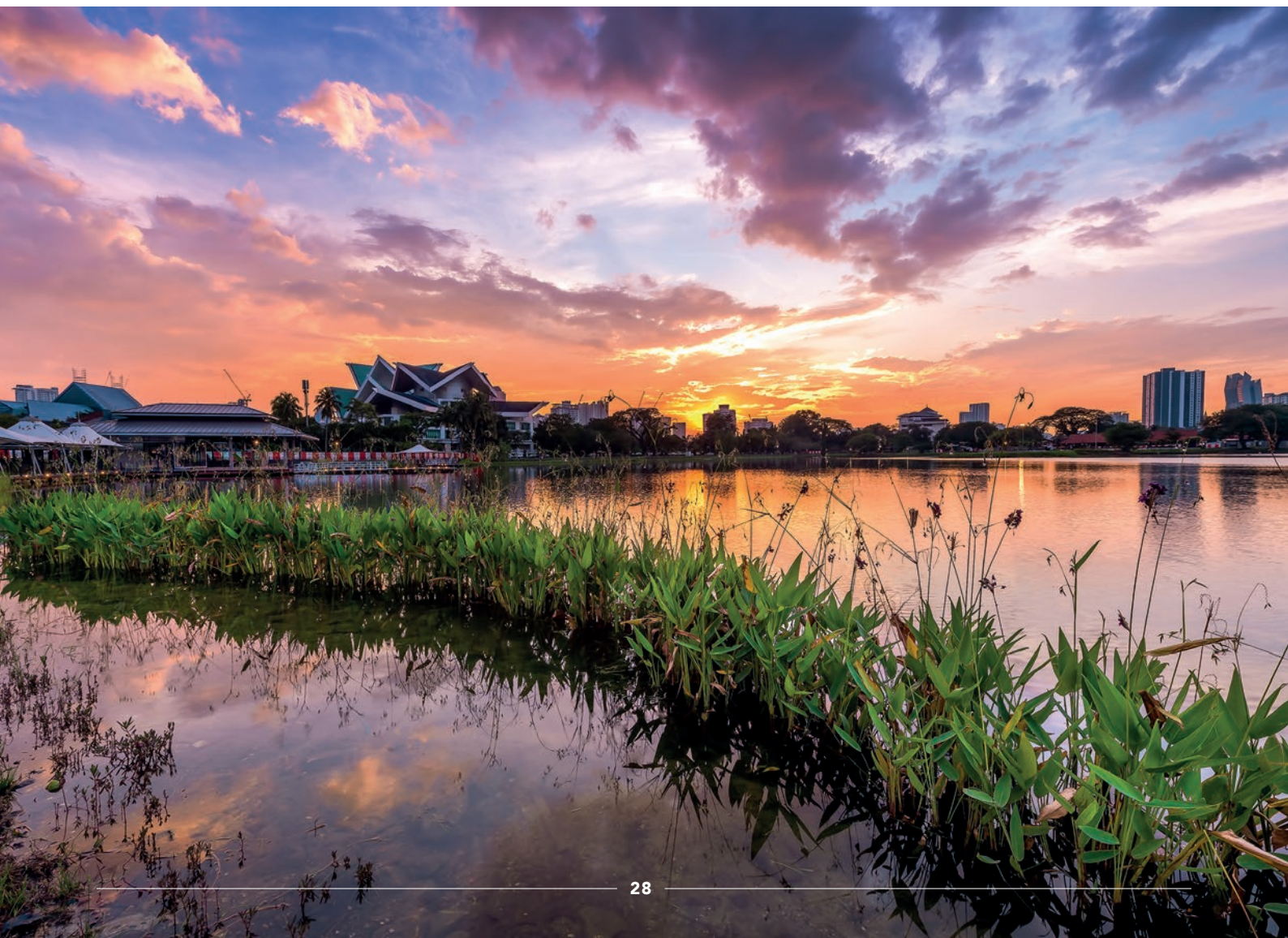
As the capital of Malaysia, Kuala Lumpur garners attention from its residents, fellow Malaysians, and the international community. The city is governed by a planning framework which seeks to ensure that it remains globally competitive, attractive and sustainable, while providing the mechanism for KLCH to address required challenges as the custodians of the city.

KLCH is aware of the impacts that the changing climate is having on the city and understands the importance of undertaking climate action in the city. The council has been working on climate action over past decades through the national planning framework within which KLCH operates.

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## The Governing Planning Framework for Kuala Lumpur

KLCH's efforts in sustainable development and climate action have been heavily influenced by federal-level ambitions and legislation. Local authorities in Malaysia operate within a national planning framework which guides the development of local plans and policy documents, from which the development of the KLCAP2050 has stemmed.





## **Alignment to National Climate-Related Policy**

Malaysia has several key national policies, plans and guidelines that relate to climate change mitigation that was referenced in the development of the KLCAP2050. Chronologically, climate-related policy alignment began with the National Policy on the Environment, with several subsequent sectoral policies:

- (1)** The National Policy on the Environment aims to promote environmentally sound and sustainable development in managing and conserving the environment, for continuation of the economic, social and cultural progress of Malaysia and enhancement of the quality of life of its people<sup>48</sup>.
- (2)** The National Renewable Energy Policy and Action Plan is a policy and plan identifying the needs and rationale for a convergence of policies for energy, industrial growth, environmental and information dissemination and proposes a new and forward-looking Renewable Energy (RE) Policy<sup>49</sup>.
- (3)** The National Transport Policy 2019-2030 serves as the roadmap for developing an efficient, comprehensive, secure and sustainable transport sector aimed at enhancing Malaysia's economic competitiveness and supporting the wellbeing of its people<sup>50</sup>.
- (4)** The National Policy on Climate Change provides the framework to mobilise and guide government agencies, industry and communities, as well as other stakeholders, in addressing the challenges of climate change in a holistic manner<sup>51</sup>.
- (5)** The National Energy Efficiency Action Plan provides the strategy for a coordinated and cost-effective implementation of energy efficiency measures in several sectors, leading to reduced energy consumption and economic savings for the consumers and the nation<sup>52</sup>.
- (6)** The Green Technology Master Plan Malaysia recognises the importance of green technologies to achieve progress and to accelerate the national economy and promote sustainable development to combat climate change<sup>53</sup>.

Further to these existing national policies that feature climate action, Malaysia also anticipates two further key pieces of legislation that will provide positive directives to local authorities, business and the community to address both climate change mitigation and adaptation<sup>54</sup>. These forthcoming Acts are:

- (1)** The Energy Efficiency and Conservation Act (EECA), developed by the Ministry of Environment and Water (MEWA). The EECA is a formulation of the legal framework for energy efficiency, energy conservation and regulating energy demand<sup>55</sup>.
- (2)** The Climate Change Act, also advanced by MEWA, seeks to complete and announce a national climate change plan that promises new initiatives in climate change adaptation and mitigation<sup>56</sup>.

The Malaysian Government is also currently developing their National Adaptation Plan, which has not yet been made available at time of publication. For this Climate Action Plan, references related to national climate change adaptation policy were largely obtained from Malaysia's Third National Communication and Second Biennial Report to the United Nations Framework Convention on Climate Change (UNFCCC)<sup>57</sup>.

**“Malaysia also anticipates two further key pieces of legislation that will provide positive directives to local authorities, business and the community to address both climate change mitigation and adaptation.”**

<sup>48</sup> 2002, Malaysian Government, Department of Environment, Ministry of Environment and Water, National Policy on the Environment, <https://www.doe.gov.my/portalv1/en/tentang-jas/pengenalan/dasar-alam-sekitar>

<sup>49</sup> 2009, Malaysian Government, Minister of Energy, Green Technology and Water, <https://policy.asiapacificenergy.org/sites/default/files/NREPAP.pdf>

<sup>50</sup> 2021, Malaysian Government MyGovernment, Government Policies—List of Malaysia Government Policies, <https://www.malaysia.gov.my/portal/category/298>

<sup>51</sup> Ibid

<sup>52</sup> Ibid

<sup>53</sup> Ibid

<sup>54</sup> 2021, United Nations Framework Convention on Climate Change, Malaysia Third National Communication and Second Biennial Update Report to the UNFCCC

<sup>55</sup> Ministry of Energy, Science, Technology, Environment and Climate Change, Energy Efficiency and Conservation Act (EECA), <http://upc.mpc.gov.my/csp/sys/bi/%25cspapp.bi.work.nc.custom.regulation.cls?regId=38&ext=1>

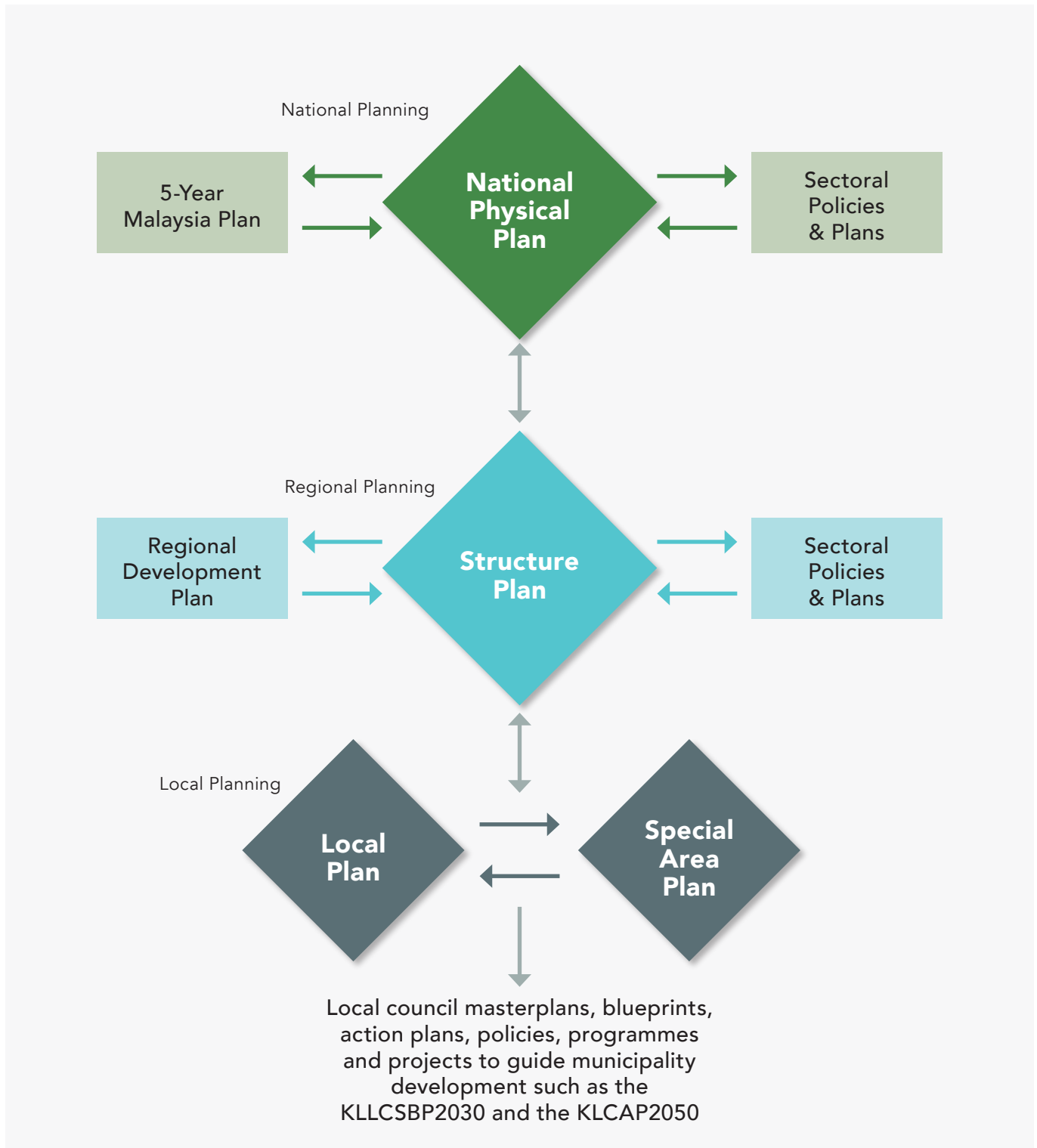
<sup>56</sup> 2018, The Straits Times, Malaysia to draft Climate Change Act, formulate national adaptation and mitigation plan,

<https://www.straitstimes.com/asia/se-asia/malaysia-to-draft-climate-change-act-formulate-national-adaptation-and-mitigation-plan>

<sup>57</sup> 2021, United Nations Framework Convention on Climate Change, Malaysia Third National Communication and Second Biennial Update Report to the UNFCCC

## Integrating the Climate Agenda into KLCH's Planning Framework

KLCH has the opportunity and challenge to integrate and coordinate national and local policies as well as initiatives that influence action to mitigate climate change and help the city better adapt to the inevitable impacts of the changing climate. This includes revisiting existing initiatives at the city level to ensure they are oriented towards the climate action and ambition-levels required for and by the city of Kuala Lumpur. This section outlines the mechanism for KLCH to adopt policies and integrate the climate agenda into the various relevant city plans for Kuala Lumpur.



**Figure 7:** Hierarchy of Documents Used for the Climate Action Plan<sup>58</sup>

<sup>58</sup> 2020, Kamran Jafarpour Ghalehtemouri, The spatial turn in the National Physical Plan (NPP) Malaysia in compare to Germany for better criteria identification on climate change and environmental hazards issues Climate Change

KLCH is required by law to prepare three plans that will guide policy and control development for the municipality of Kuala Lumpur: (i) the Structure Plan, (ii) the Local Plan and (iii) the Strategic Plan. These are developed to guide the city's spatial development over two decades. It is therefore very important that KLCH incorporates its climate-related strategies and targets into these three documents:

- (i)** The Kuala Lumpur Structure Plan 2040 (Draft KLSP2040) provides long-term policy direction for the city of Kuala Lumpur
- (ii)** The Kuala Lumpur Local Plan 2040 (Draft KLCP2040) controls zoning, density and land use in Kuala Lumpur
- (iii)** The KLCH Strategic Plan 2021-2031 is based on the Kuala Lumpur vision, mission, shared values and goals guiding the formation of action plans

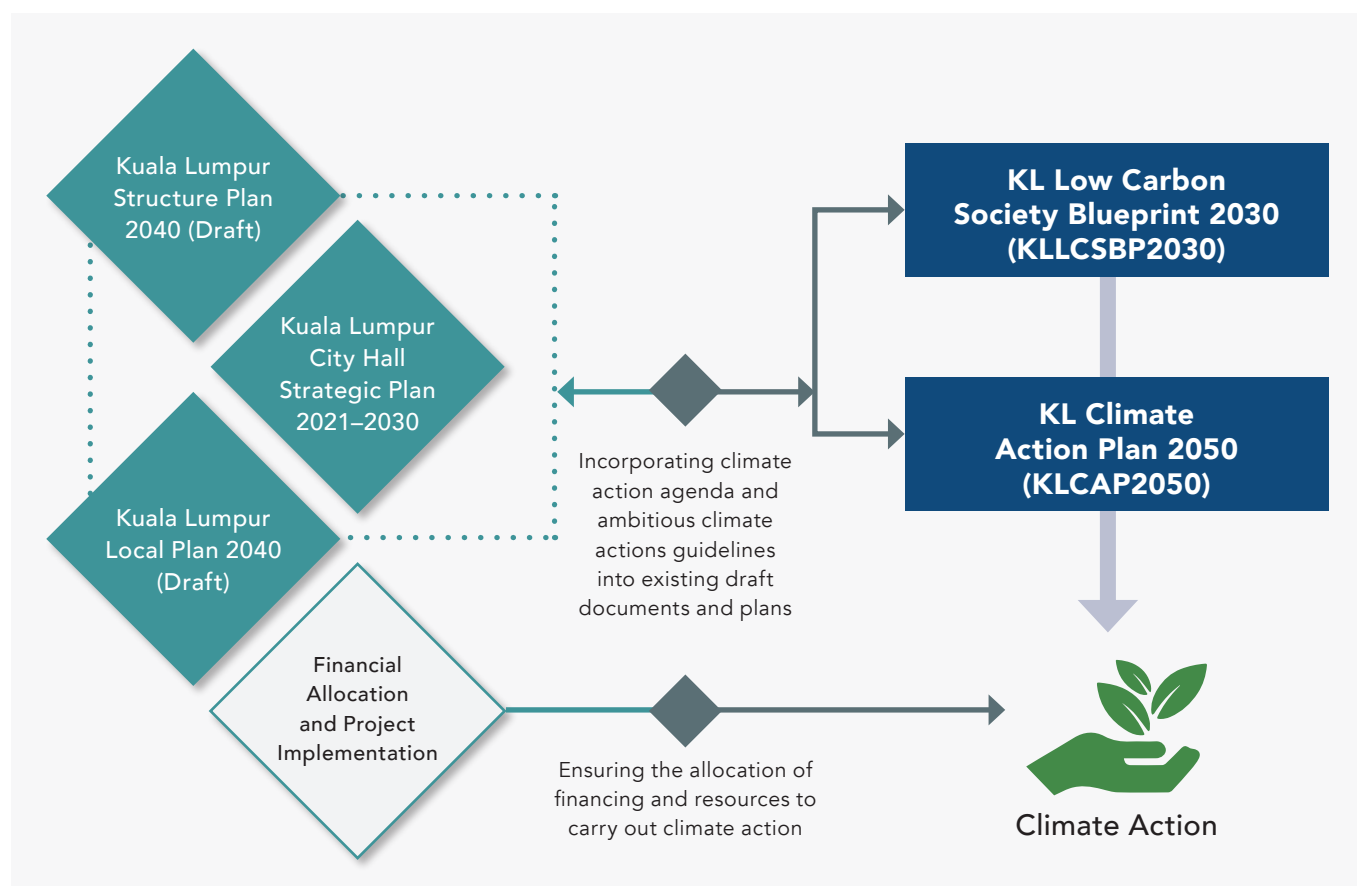
At the time of preparation of the KLCAP2050, both the KLSP2040 and KLCP2040 were in draft form and will need to be gazetted by the Federal Territory Minister. It is crucial that the local development committed in these two strategy documents capture and integrate the strategic and spatial-related issues for climate action in the city, along with the supporting policies that will ensure that Kuala Lumpur's long-term development is planned to prevent, rather than exacerbate climate change.

KLCH has indeed integrated the climate-related agenda into the draft KLSP2040, which identifies the key strategies

and plans that will be developed and implemented by the city over a 10-year period. The KLSP2040 identifies sectoral blueprints, studies, plans and policies that will need to be developed and utilised to guide KLCH's activities over the decade. Incorporated within the KLSP2040 are strategies and policies identified within the KLLCSBP2030. In addition, climate actions have also been incorporated into the guiding doctrine for the city council, the KLCH Strategic Plan 2021–2030, where the implementation of action plans is structured by priority and based on short-term, medium-term and long-term. This should also be carried forward when KLCH updates the document for 2031–2040 and beyond.

The Climate Action Plan (KLCAP2050) will build upon and integrate existing plans set out in previous and current KLCH documents, including the identification of climate actions contained within these documents for both 'quick win' projects and long-term transformative actions. This integrated approach aims to ensure that climate-related goals and targets set by the city are at the heart of the city's strategic planning framework and can be achieved in the medium (by 2030) and long term (by 2050).

*For further details on Governance and Mainstreaming of the Climate Action Plan, please refer to Chapter 5.*



**Figure 8:** Documents to Incorporate Climate Action or Stricter Climate Action Guidelines



# 03 TOWARDS A LOW CARBON & RESILIENT CITY

A nighttime photograph of the Kuala Lumpur skyline, featuring the Petronas Twin Towers as the central focus. The towers are brightly lit with white and yellow lights, and their reflection is visible in the water at the base. Other skyscrapers and city lights are visible in the background, creating a vibrant urban scene. The image is partially covered by a teal-colored geometric overlay on the right side.

Taking action begins with a thorough understanding of the present circumstances. KLCH began its KLCAP2050 journey by establishing the greenhouse gas (GHG) emissions profile and the climate hazard profile for the city. Subsequent technical studies determined strategies for carbon emissions reductions and key climate risks to be addressed; these formed the basis of the mitigation and adaptation targets to be achieved by 2030 and 2050.

# Carbon Emissions in Kuala Lumpur

In the development of the KLCAP2050, an updated GHG Emissions Inventory for base year 2017 was developed for Kuala Lumpur, in order to understand the progress of the city in relation to its carbon reduction plans. This updated inventory was compliant with the Global Protocol for Communities (GPC) method for measuring and reporting municipal GHG emissions. Subsequently, updated modelling for emissions reduction scenarios was developed for 2030 and 2050 using C40's Pathways modelling tool; the results from this are detailed in this chapter.

For the preparation of the KLLCSBP2030, published in 2017, a GHG emissions profile was established using 2010 as the base year, as well as emissions trajectories for 2020 and 2030. These calculations were made using the Asia-Pacific Integrated Model (AIM) and were used as the basis for determining the KLLCSBP2030 targets to reduce Kuala Lumpur's GHG emissions intensity per unit of GDP by 70%.

While comparisons are made in this report between the KLLCSBP2030 and KLCAP2050, the following summary of the contexts of inventory and scenario developments in each document should be kept in mind:

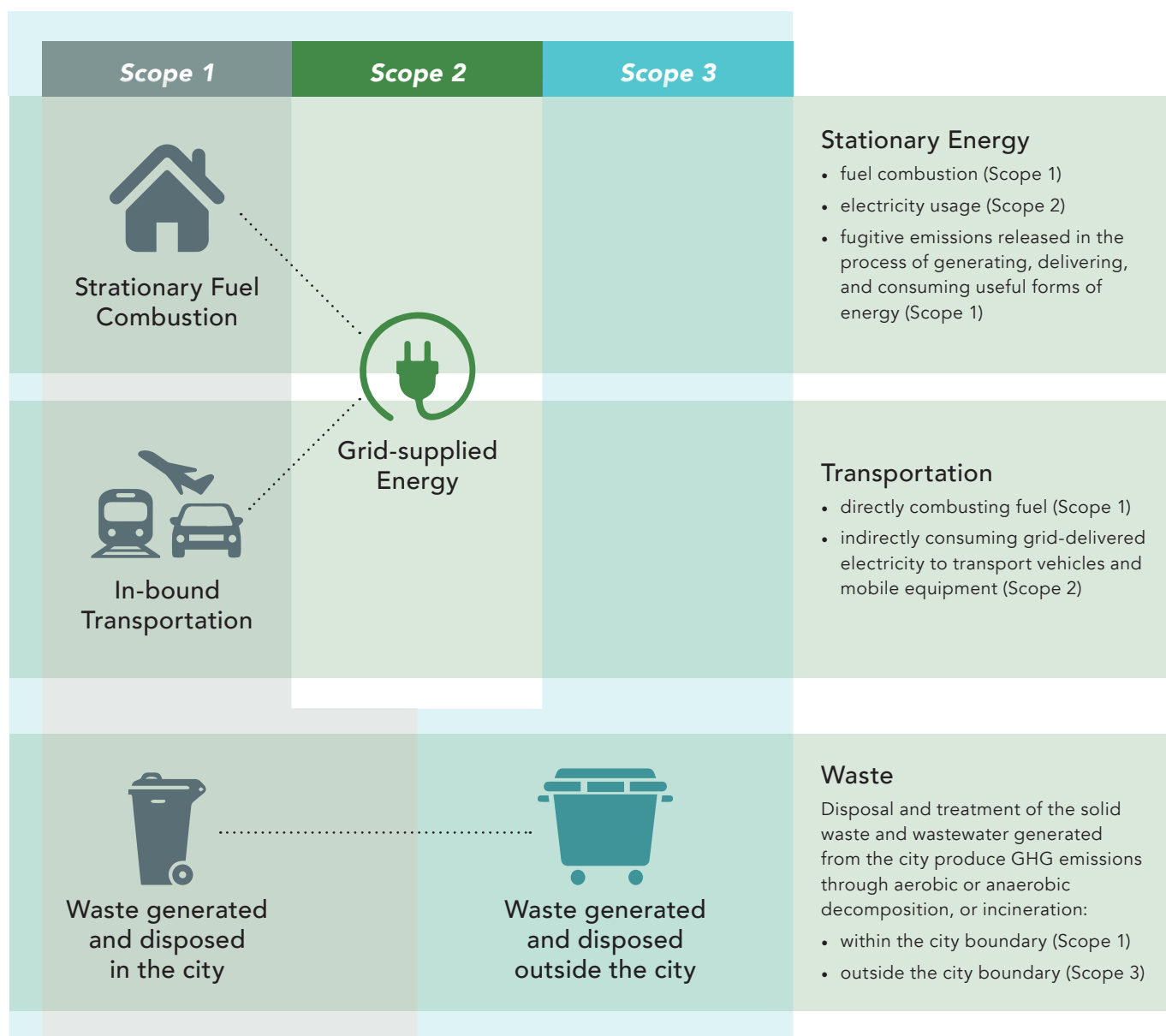
**Table 2:** Difference Between KLLCSBP2030 and KLCAP2050 GHG Emissions Inventory

DIFFERENCES	KLLCSBP2030	KLCAP2050
Inventory base year	2010	2017
Scenario modelling horizon years	2020 & 2030	2030 & 2050
Methodology	Asia-Pacific Integrated Model (AIM)	Global Protocol for Communities (GPC) and Pathways Tool (C40)
Calculations	Emphasis on estimating emissions in specific sectors to understand priority sectoral actions	Emphasis on estimating emissions across all applicable GPC Basic level sectors, to understand priority sectors and actions
Specificity of data available	Mostly scaled-down national level data	Prioritised Kuala Lumpur-specific data where available and scaled-down national level data as well

For the KLCAP2050, we are utilising the updated 2017 GHG Emissions Inventory to form our base year, due to its compliance to GPC.

## Carbon Emissions Profile of Kuala Lumpur

KLCH used the GPC method to measure and report municipal greenhouse emissions in 2017 to established a base year profile. The BASIC<sup>1</sup> level within the GPC methodology estimates the following sources of emissions:







**Figure 9:** Sources of Emissions Included in the 2017 Inventory for Kuala Lumpur

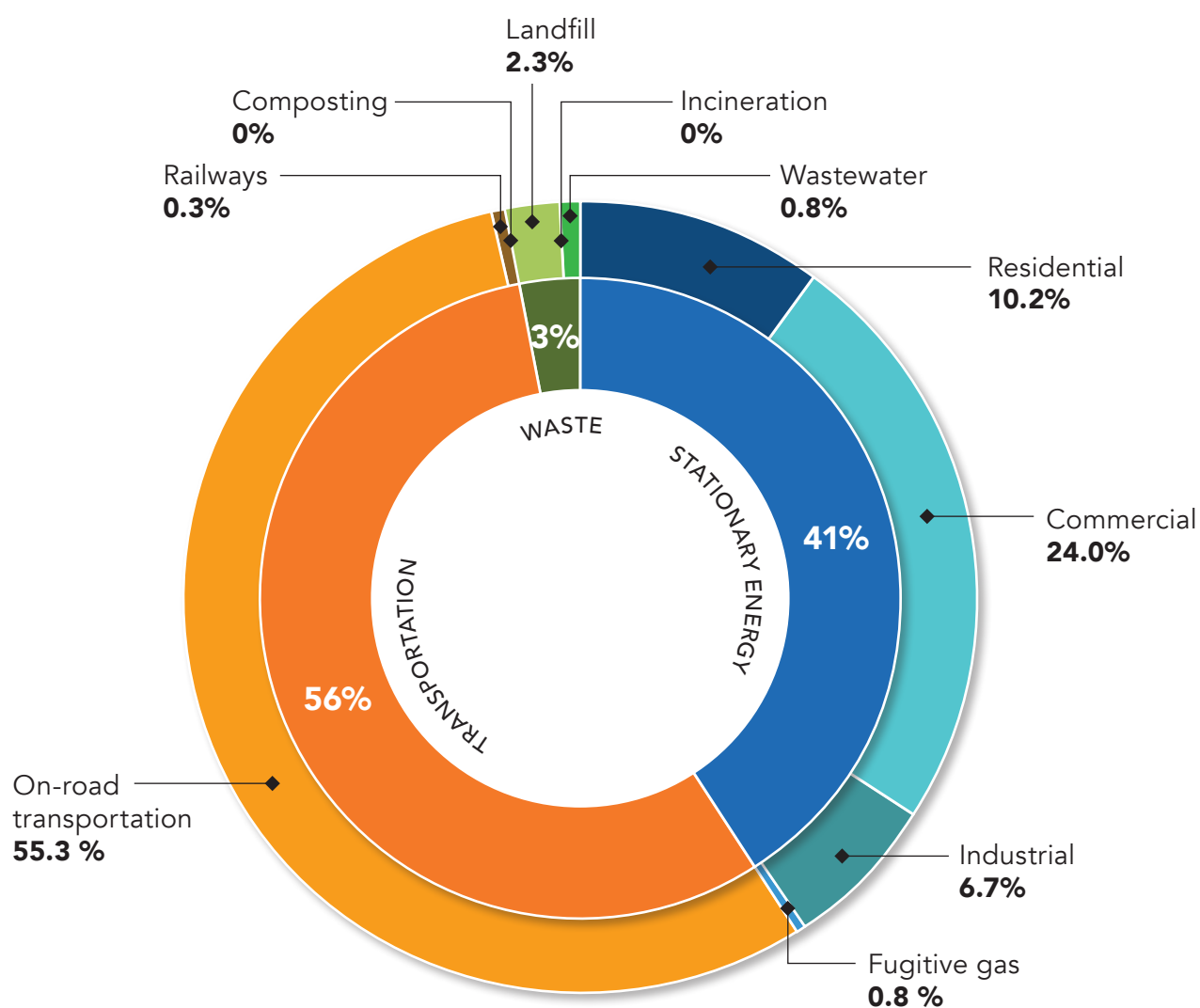
Kuala Lumpur recorded emissions of 25,094,052 tonnes of CO<sub>2</sub>e in 2017, or 14.0 tonnes of CO<sub>2</sub>e per capita<sup>2</sup>. Overall, the transportation sector generates the largest share of emissions in the Kuala Lumpur inventory, accounting for 56% of total emissions. Within the transportation sector, on-road transportation is the dominant source of emissions (99.4%), with the remainder deriving from electricity consumption by rail transport (0.6%). Stationary energy and the waste sector are responsible for 41.3% and 3.1% of total emissions respectively.

<sup>1</sup> Under the Global Protocol for Communities (GPC), cities have the option of two reporting levels: BASIC or BASIC+. BASIC+ involves more complex data collection and calculation processes, and includes emissions from scope 1 agriculture, forestry & other land uses (AFOLU) and industrial processes & product use (IPPU), and scope 3 transboundary transportation. Based on data availability and capability, KLCH and C40 decided to establish the 2017 baseline for Kuala Lumpur following BASIC level, while aiming to be BASIC+ compliant in the future.

<sup>2</sup> The population for Federal Territory of Kuala Lumpur in 2017 was estimated to be 1,793,000, according to the Department of Statistics.

**Table 3:** Overview of Kuala Lumpur's 2017 GHG Emissions Inventory

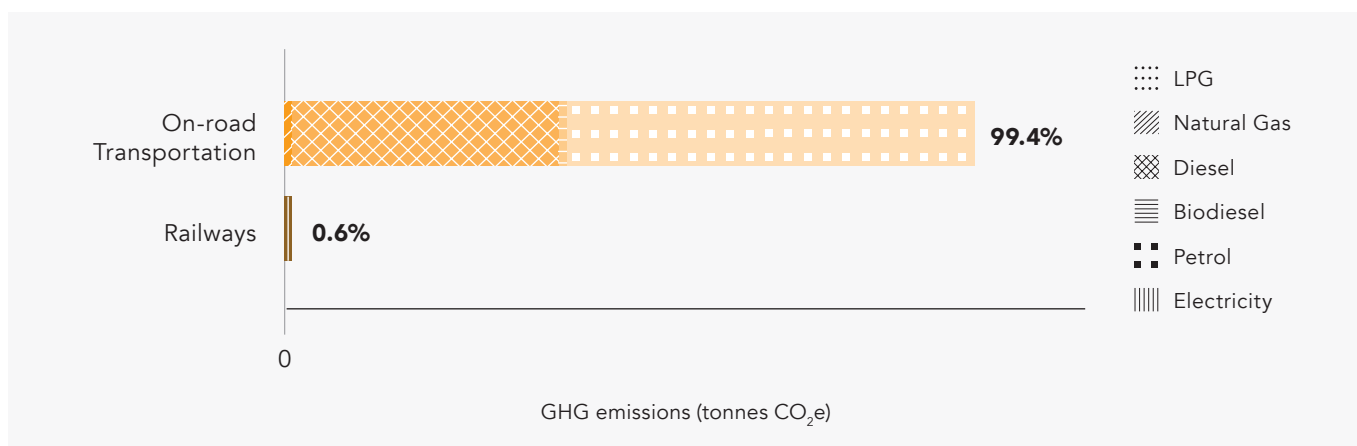
t CO <sub>2</sub> e	BASIC	SCOPE 1	SCOPE 2	SCOPE 3
	<b>Stationary</b>	1,472,306	8,882,383	
	<b>Transport</b>	13,875,481	86,673	
	<b>Waste</b>	201,104		576,105
	<b>TOTAL</b>	<b>25,094,052</b>		



**Figure 10:** Emissions by Sector and Sub-Sector Estimated in Kuala Lumpur BASIC GPC Inventory for 2017



## Transportation



**Figure 11:** Transportation Emissions by Sub-Sector and by Fuel Type

On-road transportation contributed 99.4% (13,875,481 tonnes CO<sub>2</sub>e) of total emissions in the transport sector, comprising emissions from the combustion of petrol, diesel, biodiesel and natural gas by vehicles (private vehicles, taxis, motorcycles, buses and trucks) within the city boundary. The remaining 0.6% (86,673 tonnes CO<sub>2</sub>e) of sectoral emissions are attributable to electrified rail systems found in the city such as the Mass Rapid Transit (MRT), Light Rail Transit (LRT), Express Rail Link (ERL), Keretapi Tanah Melayu (KTM) and Monorail. Due to the low take-up rate of electric vehicles at the time of this inventory, emissions related to electricity consumption by on-road transport are negligible.



### HOW WERE THESE EMISSIONS MEASURED?

The emissions generated from on-road transportation were calculated based on scaled-down fuel consumption estimates from national fuel sales data. Disaggregated data on fuel sales specifically within the geographic jurisdiction of Kuala Lumpur was not available, therefore national fuel sales data were used, with extrapolation based on the number of registered vehicles within the Federal Territories as a proportion of the national total. This method may have upwardly skewed the estimation of carbon emissions from transportation due to the high number of vehicles registered in Kuala Lumpur relative to the number of residents; this in turn could relate to the large number of businesses registered in the city and no legislation existing on vehicle registration.

For more accurate inventory assessments in the future, other methodologies that could be considered include data collection from operators of road-usage charges (tolls), which would provide a holistic estimate of the number of active vehicles on the roads in Kuala Lumpur, with inclusion of commuter cars that enter and exit the city. Another approach would be collection of vehicle usage data if and when the city administers a usage-based vehicle taxation mechanism, which could provide a clearer rendition of vehicles emitting within the city jurisdictions.

## Stationary Energy

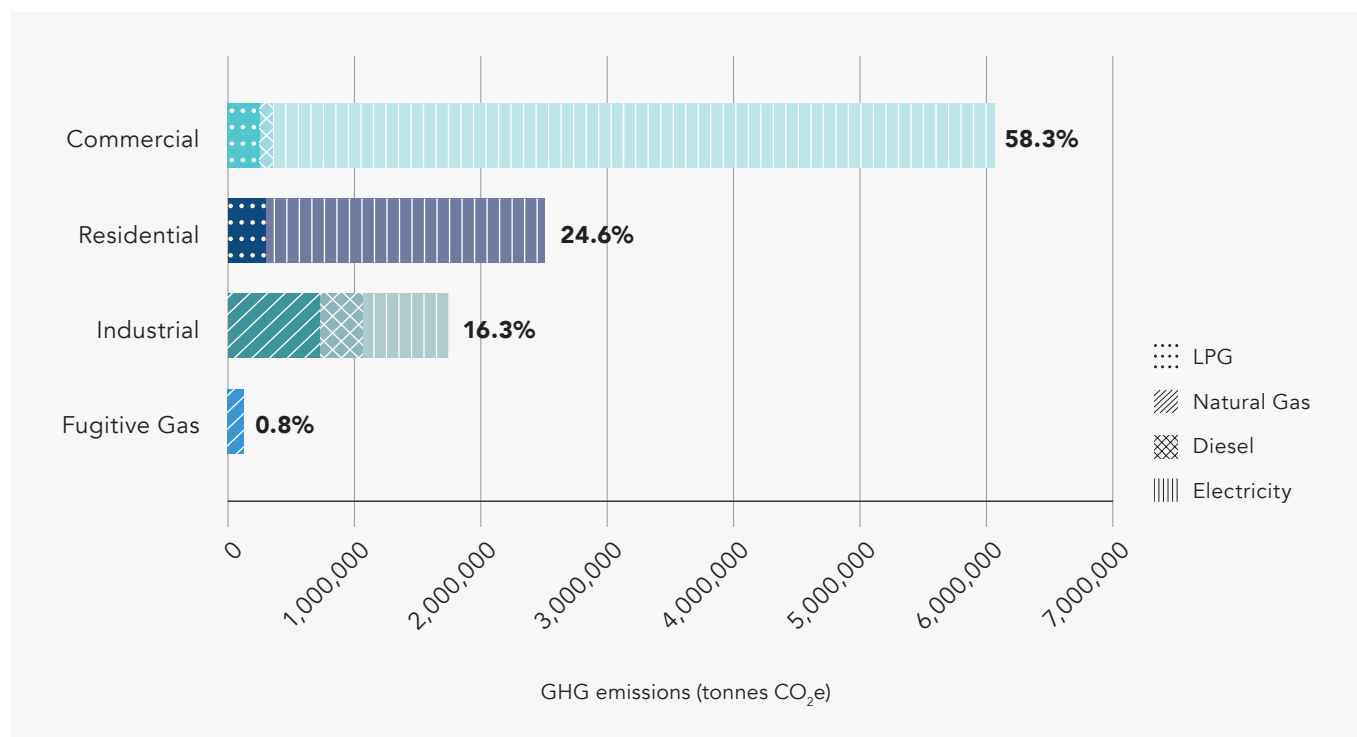
The stationary energy sector contributed 41.3% (10,354,689 tonnes CO<sub>2</sub>e) of total emissions in Kuala Lumpur in 2017.

Commercial and institutional buildings are the source of most emissions in the stationary sector, responsible for 58.5% of total emissions in the sector (6,032,192 tonnes of CO<sub>2</sub>e). These are comprised of emissions related to electricity usage and combustion of LPG used for cooking purposes, with the majority coming from electricity usage. Similarly, the majority of GHG emissions from residential buildings (totalling 2,548,414 tonnes of CO<sub>2</sub>e) are attributable to electricity consumption. Multiple studies in Kuala Lumpur have shown an increasing trend in

the intensity of the urban heat island (UHI) effect, which in the future increase cooling demand, carbon emissions and exacerbate heat, through the use of air conditioning. Subsidies on electricity, which stabilise the end-user tariff, might also be a contributing factor to high levels of electricity usage.

Industrial facilities were responsible for 1,691,311 tonnes of CO<sub>2</sub>e in the stationary energy sector. This is a relatively small quantity due to the limited manufacturing and industrial activities occurring within the city boundary. Fugitive emissions from leakage of natural gas (inclusive of LPG) amount to 0.8% of total emissions (82,772 CO<sub>2</sub>e) in the stationary sector.





**Figure 12:** Stationary Energy Emissions by Sub-Sector and by Fuel Type

### HOW WERE THESE EMISSIONS MEASURED?

Due to the challenges and limitations in data availability and estimating, emissions from usage of small-scale generators have not been included in this GHG inventory. The quantity of emissions from small, likely inefficient, generators, which are typically diesel-fuelled, is therefore unknown. Cultural, arts and sporting events, as well as the 'Pasar Malam', often employ diesel generators to provide a source of temporary electric power. Most high-rise buildings also have back-up generators, which are turned on periodically for short periods for maintenance purposes.

Future GHG inventories for Kuala Lumpur should develop methodologies to include such emissions from generators. Additionally, feed-in electrical connection points may be considered for the venues for cultural, arts and sporting activities, which would potentially be a long-term solution to remove this particular emissions source, as part of the city's move towards carbon neutrality.

**“In the development of the KLCAP2050, an updated GHG Emissions Inventory for base year 2017 was developed for Kuala Lumpur. The City recorded emissions of 25,094,052 tonnes CO<sub>2</sub>e, or 14.0 tonnes of CO<sub>2</sub>e per capita.”**





### Waste

The waste sector generated 3% (777,209 tonnes CO<sub>2</sub>e) of total emissions in Kuala Lumpur in 2017. The waste sector for KL is comprised of emissions from solid waste and wastewater disposal and management.

With more than 709,000 tonnes of waste generated in Kuala Lumpur being sent to landfill, approximately 572,481 tonnes of CO<sub>2</sub>e were emitted from decomposition. With an absence of landfill sites within the city boundary, the waste was transported to neighbouring states for treatment, and is, therefore, accounted for as Scope 3 emissions (waste generated within the city but disposed of outside of city boundaries). Similarly, hazardous waste (including clinical

waste) generated in Kuala Lumpur would be incinerated in facilities outside the city boundary, causing a further 2,269 tonnes CO<sub>2</sub>e of Scope 3 emissions. Due to the poor segregation of waste as well as a lack of collection infrastructure and composting facilities, composting of organic waste is not widely adopted in Kuala Lumpur. Only a small share of emissions (0.2%) came from composting in the waste sector, totalling 1,355 tonnes of CO<sub>2</sub>e in 2017—this despite the considerable proportion of food waste overall in Kuala Lumpur’s waste stream.

Wastewater is the second largest source of emissions (25.9%) in the waste sector, amounting to 201,104 tonnes of CO<sub>2</sub>e, which primarily originated from the treatment of domestic wastewater.

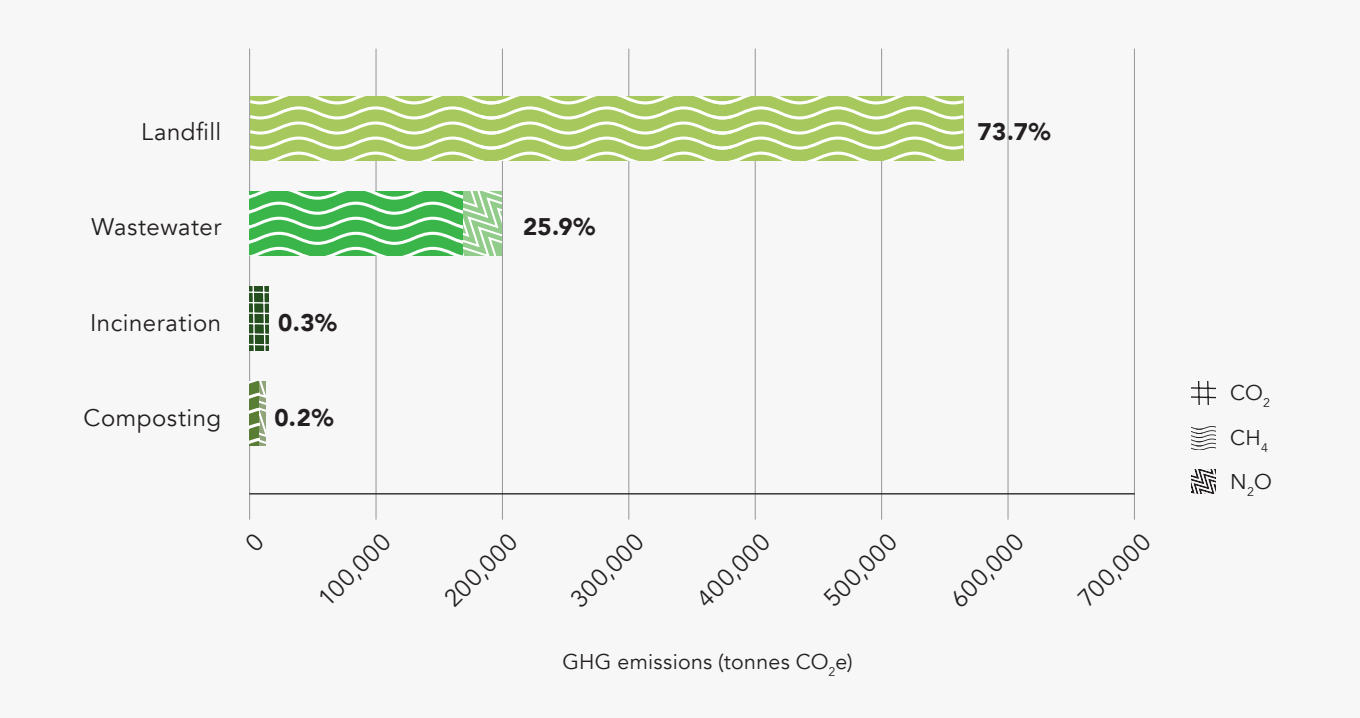


Figure 13: Waste Emissions by Waste Disposal Method

## Tracking Carbon Emissions & Future Inventory Iterations

The GHG Emissions inventory is a crucial mechanism to quantify and estimate, track, report and evaluate a city's carbon emissions as well as to measure its progress in implementing climate action. An updated inventory can give an indication to KLCH of the extent to which the initiatives and actions implemented for climate change mitigation have resulted in actual GHG, or its equivalent in carbon emissions reductions over time.

Certain data challenges were identified during the development of the 2017 GHG emissions inventory, which also impacted the consequent modelling of the Business-as-Usual scenario. Within the GPC standards, trade-offs

on accuracy and completeness may be made through the estimation methodologies and data sources used in the development of the inventory. As highlighted in the section above, the current inventory has components where scaled-down regional or national data were used in lieu of Kuala Lumpur-specific data. With each iteration of Kuala Lumpur's city-wide inventory in the future, KLCH aims to invest in its capacity for data collection and retention to improve the accuracy and completeness of its GHG emissions data. The improved quality of GHG quantification will be a valuable input to robust monitoring, reporting and evaluation of ongoing implementation of action, as well as for updated scenario modelling.

## Carbon Emissions Trajectory Under Business-as-Usual (BaU) Scenario

Based on the GHG Inventory, which presents the base year carbon emissions profile for the city of Kuala Lumpur, several scenarios for Kuala Lumpur's future carbon emissions profile were established. The objectives for undertaking scenario modelling of emissions reductions in 2030 and 2050 include:

- To provide strategic-level analysis to help the city identify and prioritise greenhouse gas reduction strategies and low carbon infrastructure actions
- To allow the city to see quickly the impacts on emissions from different proposed policies, projects and implementation assumptions
- To help develop and compare multiple scenarios that identify paths towards carbon neutrality
- To ensure that scenarios and emissions reduction strategies are developed on city-specific robust activity data and modelling methodology that reflects the city's context and conditions

All of these will contribute to Kuala Lumpur's sectoral emissions reductions to meet a 1.5 degree scenario as committed to in *Deadline 2020*.

This section highlights the development of the Business-as-Usual (BaU) Scenario for the city up to 2050. The BaU scenario represents the baseline forecast, which is a 'no additional action scenario' where current trends and initiatives are carried out, but with no additional ambitious mitigation efforts implemented by the city or other entities. The baseline forecast serves as a reference against which the impact of emissions reduction scenarios can be measured.

The data utilised to develop the BaU scenario for Kuala Lumpur up to 2050 was based primarily on two data sets—population and GDP, taken from the World Bank Malaysia Economic Report, as well as feedback from engagement sessions with various KLCH departments. The resulting economic and population projection details are as follows for two key milestone years, 2030 and 2050:

Table 4: Projected Economic & Population Data

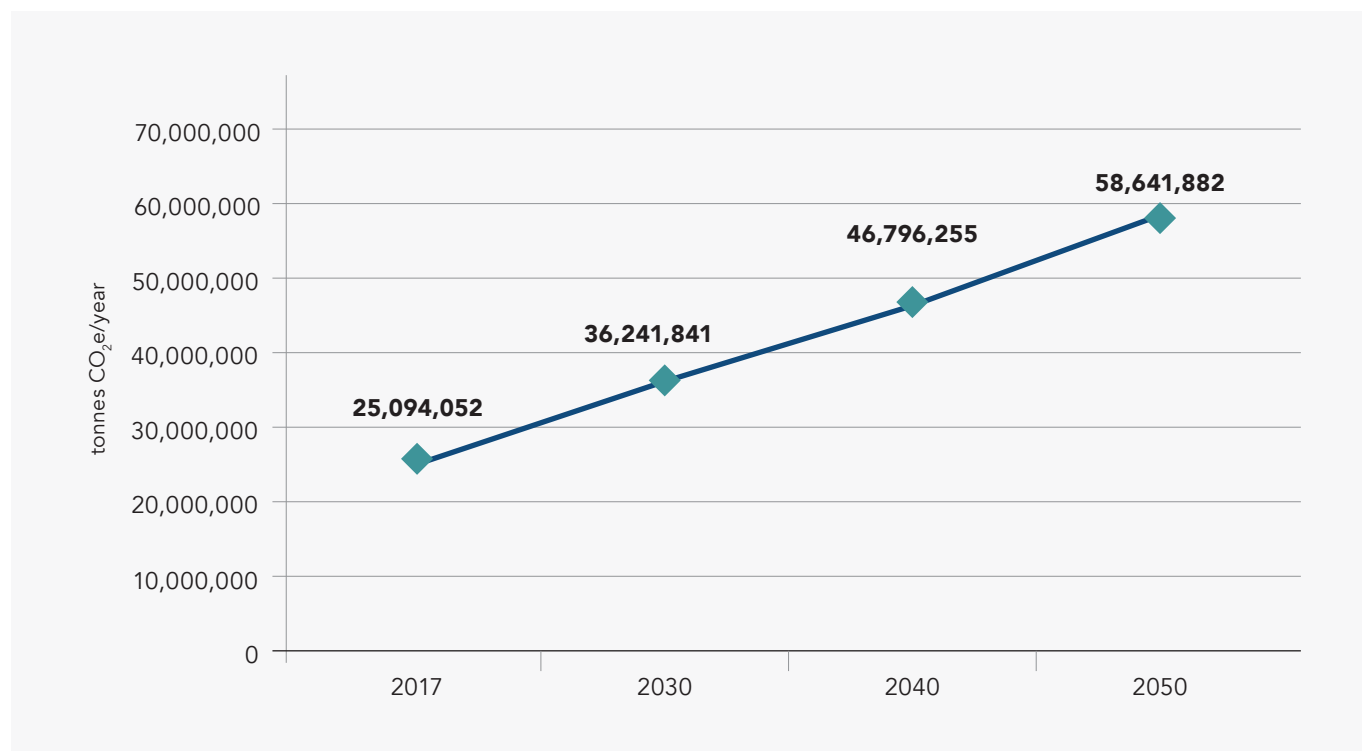
DATA PROJECTION	2030	2050
GDP Growth Rate	4.5%	3.5%
GDP (RM billion)	399	850
Population Growth Rate	1.0%	0.7%
Population (million)	2.1	2.3

### Technical Notes

1. Final GDP Growth Rates were set at 0.5% higher than the World Bank Report's figures, as this was on National Projections and Kuala Lumpur's GDP has historically performed higher than national GDP.
2. Population projections were initially based on the World Bank Report's figures, then adjusted to result in Department of Statistics Malaysia (DOSM) and KLSP2040 projected figures for 2030 and 2040; 2050's follows this adjusted trend.

In establishing the BaU scenario, KLCH took into consideration the city context and data such as geography, demographics, economic and sectoral data, such as building floor areas and, where available, corresponding emissions data. Sub-sector specific trends based on historical data such as real estate and employment growth rates were also considered to ensure that the BaU scenario is developed to be a close estimate of the projected growth of Kuala Lumpur.

It should be noted that realised (actual and recorded) economic and population growth data can differ considerably from what is projected, as any type of forecasting has its limitations and is dependent on underlying assumptions. With every iteration of scenario modelling in the future, these assumptions should be refined based on any available and improved datasets.



**Figure 14:** Emissions Forecasts from 2017 up to 2050

It is projected that, without ambitious actions undertaken by KLCH, the carbon emissions for the city of Kuala Lumpur will increase by 2.3 times by 2050 from the base year emissions of 2017.



## A 2050 Carbon Neutrality Scenario for Kuala Lumpur

Following the development of the BaU baseline scenario, potential carbon emissions reduction scenarios were explored for the city of Kuala Lumpur to reach carbon neutrality by 2050. Based on Kuala Lumpur's commitment to *Deadline 2020 (D2020)*, Kuala Lumpur, in this KLCAP2050, is committed to achieving a 60% reduction in its absolute carbon emissions by 2030 and to achieving carbon neutrality by 2050; the pathway to achieve this commitment will be detailed in this section.

From the KLLCSBP2030, Kuala Lumpur has an existing 2030 target of 70% carbon emissions reduction per unit of GDP, based on the 2010 baseline. Taking into account projected GDP growth, this actually translates to an absolute increase of 40% in Kuala Lumpur's carbon emissions by 2030 from its 2010 baseline. The Climate Action Plan, therefore, aims to identify ambitious actions which can instead achieve the required reductions in absolute emissions under the D2020 commitment.

Using the updated base year carbon emissions profile of 2017 (as described in the previous section), two future carbon emissions scenarios were developed to identify carbon emissions reductions trajectories which:

- Meet Kuala Lumpur's carbon emissions reduction target based on a *Council-Led Scenario* to 2030, aligned with KLLCSBP2030 targets
- Highlight how an *Integrated Approach Scenario* to 2030 can deliver the carbon emissions reduction target which is aligned with Deadline 2020 commitments

Ensures Kuala Lumpur's carbon emissions are significantly reduced to achieve carbon neutrality by 2050. These two scenarios are outlined below.

### Kuala Lumpur's Carbon Emissions Reductions Scenarios

Two climate action carbon emissions reduction scenarios were developed:

**i. Council-Led Scenario:** This is driven by strategies and actions that are ambitious yet achievable within the authority of KLCH, and includes collaboration at Federal government level and the implementation of all existing National policies. This scenario modelled the impact of actions from the KLLCSBP2030 and this KLCAP2050, highlighting the carbon emissions reductions that KLCH-led initiatives can produce.

**ii. Integrated Approach Scenario:** This scenario relies on an integrated approach across KLCH, the Federal government and other agencies to overcome existing barriers. It highlights the potential emissions reductions that can occur if all parties align policies in an integrated manner and commit to high targets to complement these policies. This scenario is mostly comprised of strategies and actions that are higher in ambition than those in the Council-Led Scenario, often due to the limitations of authority and influence of KLCH as the city council.

For transparency and clarity in reporting, KLCH will report the three indicators listed below, emphasising their commitment in providing ambitious and readily comparable targets:

1. An intensity unit comparison to the BaU scenario such as 'per unit GDP' and 'per capita'
2. An absolute estimation of tonnes CO<sub>2</sub>e reduced in comparison to the base year emissions
3. An absolute comparison to the BaU scenario, expressed in % reduction

As noted in the table below, both scenarios show the need for ambitious climate action to achieve Kuala Lumpur's targets.

**Table 5:** Comparison of Projected Absolute CO<sub>2</sub> Emissions Scenarios

SCENARIO	2030 PROJECTED CO <sub>2</sub> EMISSIONS kt CO <sub>2</sub> e/year <sup>3</sup>	2030 CHANGE VERSUS BASE YEAR EMISSIONS (2017)*	2030 TONNES CO <sub>2</sub> PER PERSON	2050 PROJECTED CO <sub>2</sub> EMISSIONS kt CO <sub>2</sub> e/year	2050 CHANGE VERSUS BASE YEAR EMISSIONS (2017)*	2050 TONNES CO <sub>2</sub> PER PERSON
<b>Business-as-Usual</b>	36,242		17.3	58,620		25.5
<b>Council-Led</b>	21,647	-13.7%	10.3	24,588	-2.0%	10.7
<b>Integrated Approach</b>	11,132	-55.6%	5.3	4,171	-83.4%	1.8

\*2017 is the Base Year for the KLCAP2050 and the Carbon Emissions for the year was 25,094 kt CO<sub>2</sub>e

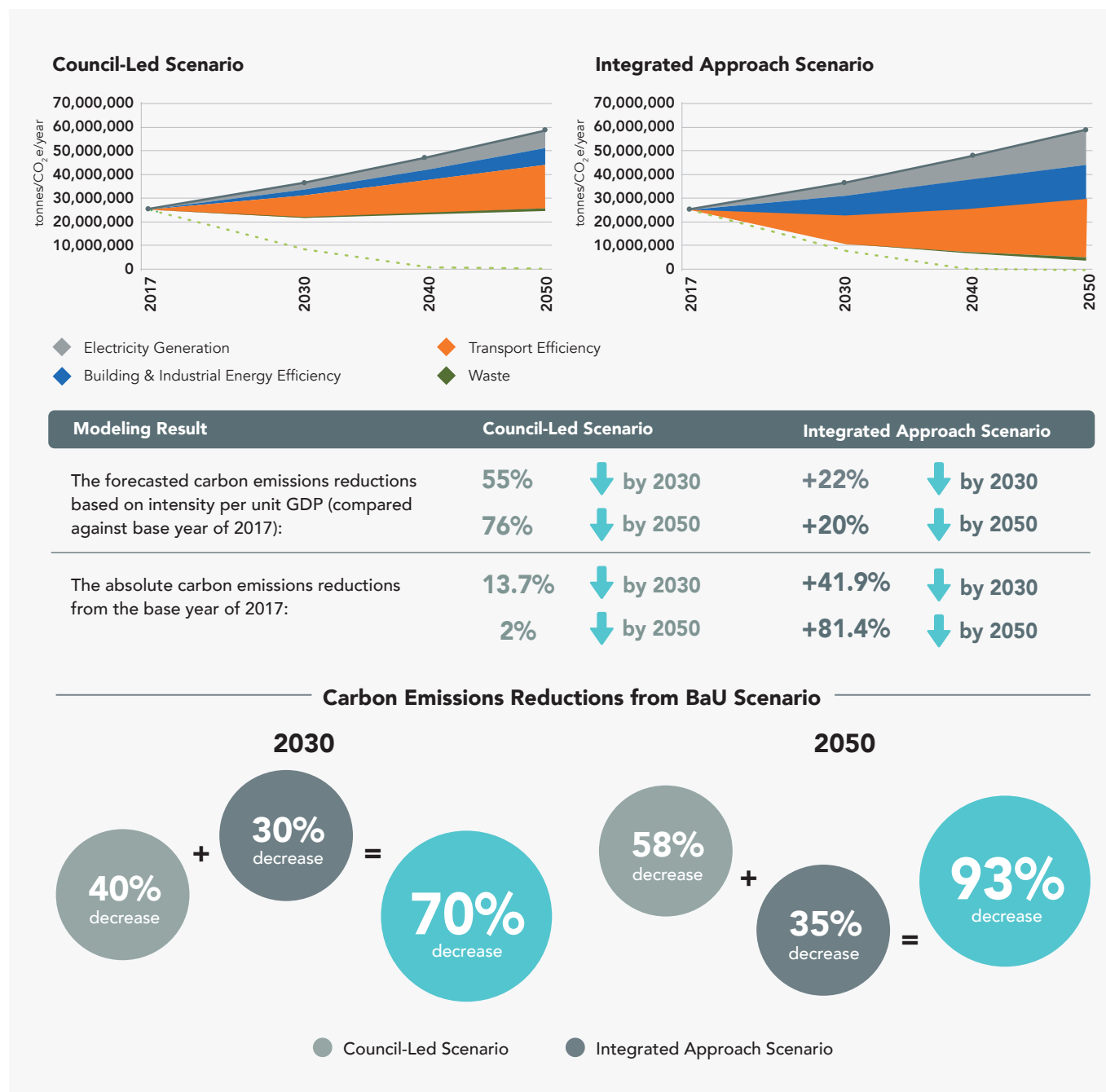
N.B. Projected data must be evaluated regularly, with 5-year cycles encourages, as economic events and unforeseen issues (such as global pandemics) can severely impact growth projections.

<sup>3</sup> kt CO<sub>2</sub>e/yr = thousand tonnes of CO<sub>2</sub> equivalent per year

In the Council-Led scenario, KLCH would achieve the current KLLCSBP2030 targets, but further actions are needed to achieve D2020 commitments, especially in further reducing the GHG emissions beyond 2030 towards carbon neutrality by 2050.

The Integrated Approach scenario demonstrates that Kuala Lumpur will be able to achieve significant carbon emissions reductions by 2030, and further significant reduction over the ensuing decades towards carbon neutrality by 2050. This scenario would be possible

if existing barriers to action are overcome, which will require strong coordination and collaboration among all stakeholders, including supportive and ambitious policy shifts from the Federal Government. KLCH is committed to the collaborative approaches required to achieve the actions in the Integrated Approach scenario and advocates strongly for the vertical integration of policies with the Federal Government, as well as horizontal integration across various city stakeholders, including the private sector and communities.



**Figure 15:** Emissions Trajectories Under Both Council-Led and Integrated Approach Scenarios

\*Projections of BaU Scenario, Council-Led Scenario and the Integrated Scenario are based on C40's Pathways tool and estimated projection and historical trends in Kuala Lumpur

## Key Strategies for Carbon Emissions Reductions in Kuala Lumpur

Several key strategies were identified at a sectoral level for Kuala Lumpur to achieve its carbon emissions reduction targets. These are summarised below and further outlined in following sections.

**Table 6:** Sectoral Emissions Reduction Potential with Identified Key Strategies

SECTOR*	SCENARIO	CARBON EMISSIONS REDUCTION POTENTIAL (of sectoral BaU emissions)		KEY STRATEGIES
		2030	2050	
<b>Electricity Generation</b>	Council-Led	7.1%	13.2%	<b>1.</b> Grid decarbonisation—based on existing targets by the Federal Government
	Integrated Approach	36.6%	30.6%	<b>2.</b> Distributed renewable energy—Building-integrated photovoltaics (BIPV) solar and other renewable energy (RE) uptake <ul style="list-style-type: none"> <li>• <i>Integrated Approach scenario increases both strategies immensely; relies on robust Federal policy such as removing fossil fuels from the grid by 2050.</i></li> </ul>
<b>Building</b>	Council-Led	11.4%	23.3%	<b>1.</b> New building energy efficiency—largely building envelope and equipment efficiency (as below for existing buildings)
	Integrated Approach	13.7%	26.5%	<b>2.</b> Existing building energy efficiency—largely equipment efficiency (air conditioning, lighting, water heating and other equipment, to a lesser extent retrofitting for building envelope) <ul style="list-style-type: none"> <li>• <i>Integrated Approach scenario increases penetration of high efficiency equipment, requiring strong push from Federal Government to increase incentives, and remove subsidies/create barriers for low efficiency equipment.</i></li> </ul>
<b>Transportation</b>	Council-Led	50.1%	68.2%	<b>1.</b> Modal shift—from private vehicles to public transport and active mobility
	Integrated Approach	65.5%	93.1%	<b>2.</b> Fuel efficiency—decreased diesel usage and increased electrification of vehicles <ul style="list-style-type: none"> <li>• <i>Integrated Approach scenario derives most changes from high uptake of electrification of vehicles, requiring a strong push through federal incentives for electric vehicles (EVs).</i></li> </ul>

\*Waste and Industry are excluded as their respective share of total emissions is minimal





### **Council-Led Scenario**

In this scenario, the city council, KLCH, has the authority and power to implement actions to achieve carbon emissions reductions.

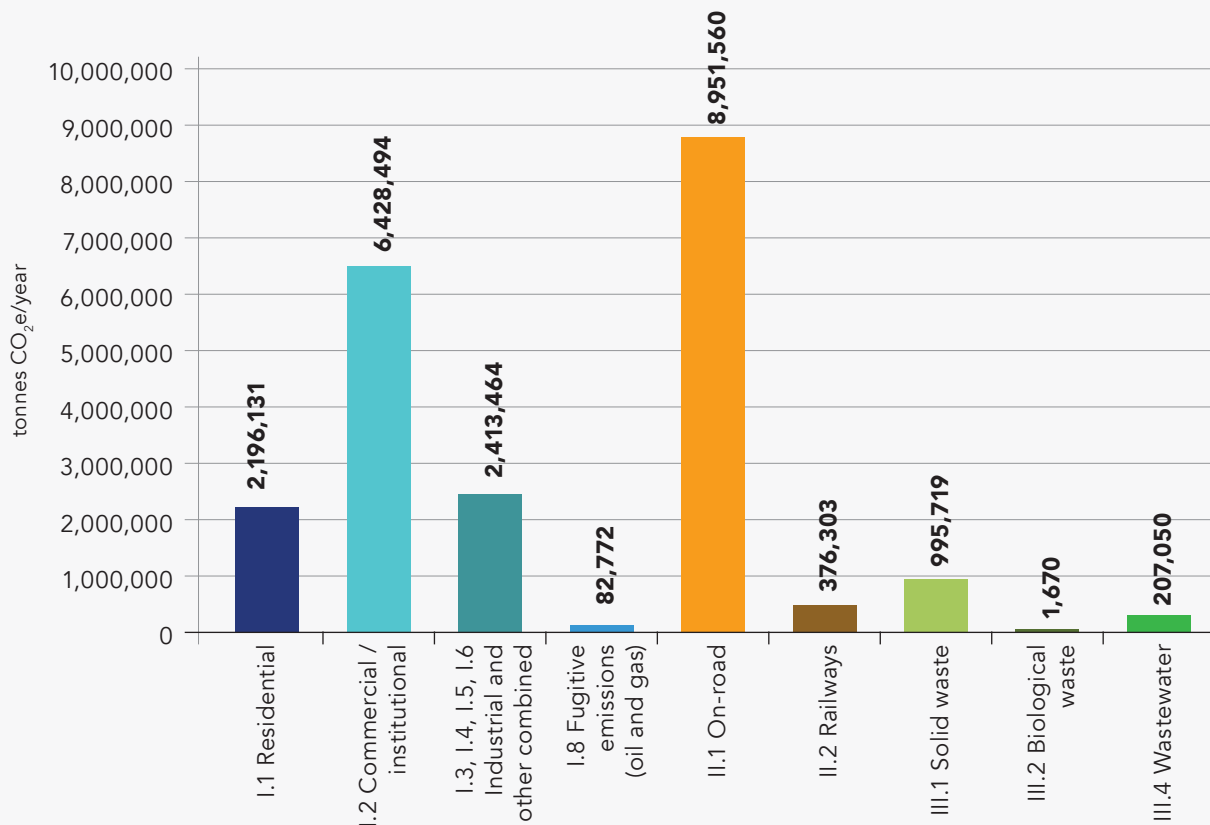
The Council-Led Scenario would be achieved largely via existing KLLCSBP2030 actions (some of which are prioritised in this KLCAP2050), working within existing Federal policies and plans, such as the National Renewable Energy Policy and Action Plan (NREAP), National Energy Efficiency Action Plan (NEEAP), National Transport Policy (NTP) and publicly declared renewable energy targets. The details of actions and their related targets can be found in Chapter 4.

Based on the modelling, as illustrated in Table 6: the Council-Led Scenario cannot achieve the required D2020 targets in year 2030, nor in 2050. The shortfall is largely due to the lack of power and capacity for KLCH to implement more ambitious actions, such as those that influence community behavioural changes, commercial market priorities and the policies of Federal ministries and agencies. For example, KLCH is unable to mandate and provide high levels of tax exemptions, subsidies or other incentives for vehicle owners in order to accelerate adoption of electric vehicles; nor does KLCH have the power to remove subsidies from fossil fuel for electricity and transportation use.

**“The Integrated Approach Scenario  
will reduce future emissions compared with  
BaU scenario forecast levels by  
70% in 2030 and 93% in 2050.”**

### Strategies to Address Remaining Emissions from Council-Led Scenario

The emissions that would remain after taking the actions in the Council-Led Scenario provide an insight into the sectoral opportunities for either increasing the ambition of actions or pinpointing additional actions necessary for the achievement of KLCH's Deadline 2020 targets. These opportunities are analysed and documented in the Integrated Approach Scenario. In the Council-Led Scenario, the key remaining emissions sources by 2050 come from residential, commercial and institutional buildings, industrial energy, and on-road transportation as shown below. These emissions are primarily due to the heavy reliance on fossil fuels in Malaysia—both for generation of electricity power and transportation fuels.



**Figure 16:** Kuala Lumpur's Remaining Emissions from Council-Led Scenario in 2050



To address these remaining emissions, several key strategies were identified that will be required for Kuala Lumpur to meet its D2020 interim 2030 and eventual 2050 targets:

**Table 7:** Key Strategies Required for Kuala Lumpur to Achieve its Deadline 2020 Commitment

KEY STRATEGIES	DESCRIPTION
<b>Decarbonising the electricity grid &amp; increasing building-integrated photovoltaics (BIPV)</b>	Increasing RE generation for the electricity grid and encouraging building-integrated renewable energy, driven by incentives set/provided through Federal Government and its agencies.
<b>Transport electrification</b>	Moving away from fossil-fuel motorised vehicles will require strong federal-level policies, such as decreasing fossil fuel subsidies, removing high taxes on imported electric vehicles, and providing incentives for electric vehicle uptake.
<b>Energy efficiency in residential, commercial and institutional buildings, &amp; industrial energy efficiency</b>	Federal policy and incentives to drive retrofitting of equipment with new high energy efficiency models such as air conditioning, lighting, water heating, industrial process equipment.

While fossil fuel and electricity costs remain low and subsidised, implementing many of these actions will be challenging. The Integrated Approach Scenario explores the potential carbon emissions reduction that could occur if there were aligned targets and strong collaboration in policy and implementation across different stakeholders.

### ***The Integrated Approach Scenario***

This more ambitious scenario can achieve targets that cannot be met under the Council-Led Scenario by identifying and implementing key strategies involving shifts in policy at Federal Government level. The modelling for this scenario identifies the existing barriers to overcome to make it possible for KLCH to achieve its D2020 targets.

The strategies identified in the Integrated Approach Scenario are not within KLCH's control, due to limits in authority and capacity and political, financial, governance, technical and market barriers. That said, KLCH is able to play a leading role in advocating for solutions which can be implemented at Federal or sub-national levels to overcome these barriers.

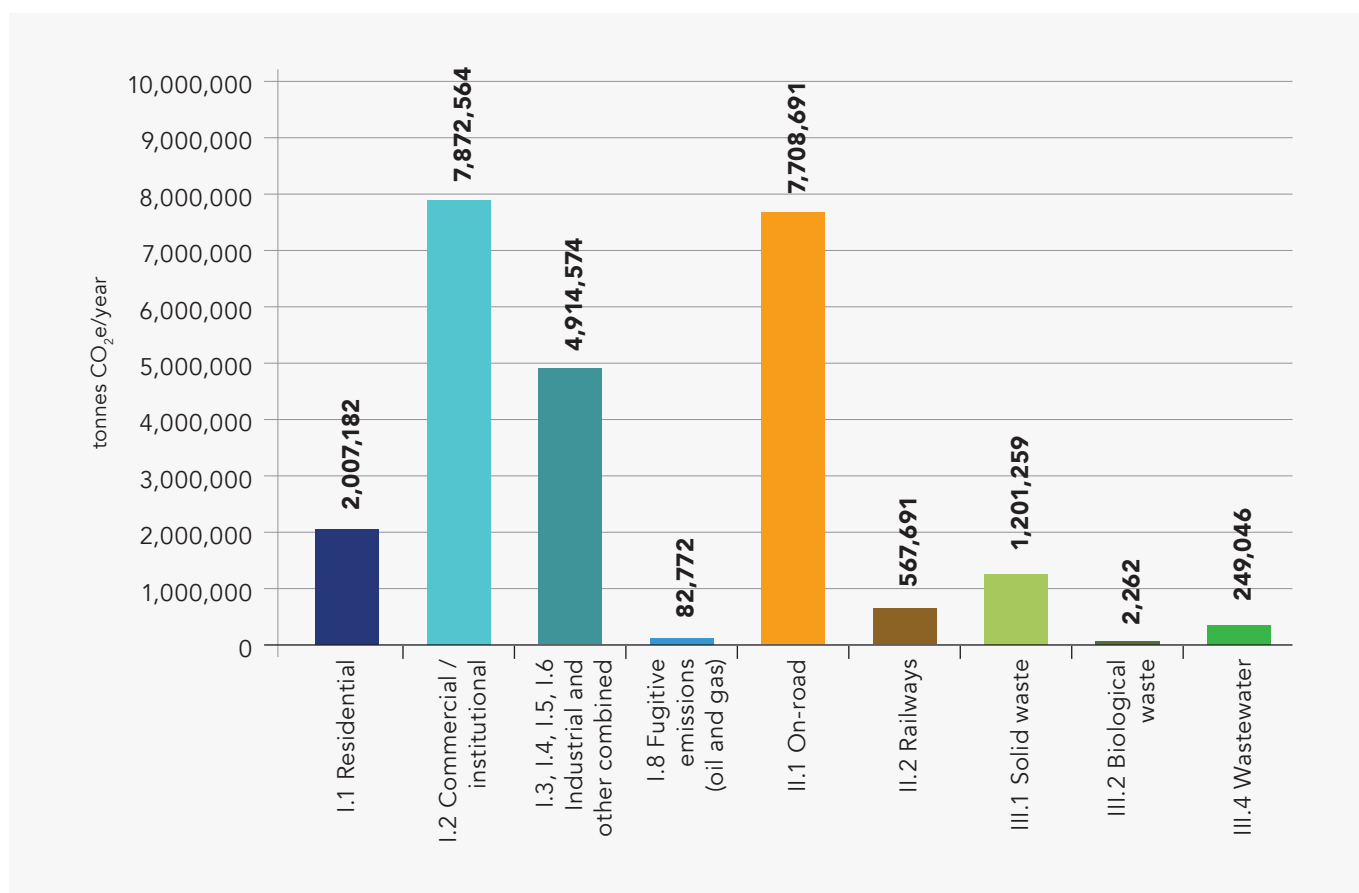




## Residual Emissions

Residual emissions are the emissions determined as being too challenging to eliminate. The scenario modelling indicates that even if barriers to emissions reduction could be removed through the strategies and actions included under the Integrated Approach Scenario there would be residual emissions in the city of Kuala Lumpur. These would include situations where no known mitigation technology exists or where a low emission alternative is likely to remain technically or economically non-viable for the foreseeable future. From initial investigations, it is projected that Kuala Lumpur's primary residual emissions sources in 2050 would be (top 3):

- **Solid Waste:** Jurisdiction over waste management policies falls under a separate Federal ministry, while enforcement is governed by a different agency and their contractors
- **Commercial & Institutional Buildings:** While the emissions from this source under the Integrated scenario decrease by over 80%, the many high-rise buildings in Kuala Lumpur will have limited scope to offset their carbon emissions through building-integrated RE generation
- **On-road transportation:** residual emissions remain here largely due to the lack of authority for KLCH to regulate and enforce changes in private transportation, as well as the possible impact of continued low or even subsidised cost of fossil fuel



**Figure 17:** Kuala Lumpur's Residual Emissions in 2050

The residual emissions in 2050 total to 4,171,983 tonnes CO<sub>2</sub>e per year, even after exhausting all actions in the Council-Led and Integrated Approach scenarios. With the above understanding of the contributing sectors, KLCH will maintain an up-to-date estimate of residual emissions via future iterations of GPC inventories and scenario modelling and continue to explore possible solutions to address these residual emissions.

Potential solutions include carbon off-sets, where available. For Malaysia, green energy purchase can be strongly advocated for the private sector through collaborative







incentives from both the Federal and city level. Federal Government can create more accessible policies and tax exemption incentives, while local government such as KLCH can offer favourable licence rates for business operations that undertake such green initiatives.

*For further details and understanding of the barriers for implementing carbon reduction strategies and actions in Kuala Lumpur and how they may be overcome, please refer to Chapter 5.*

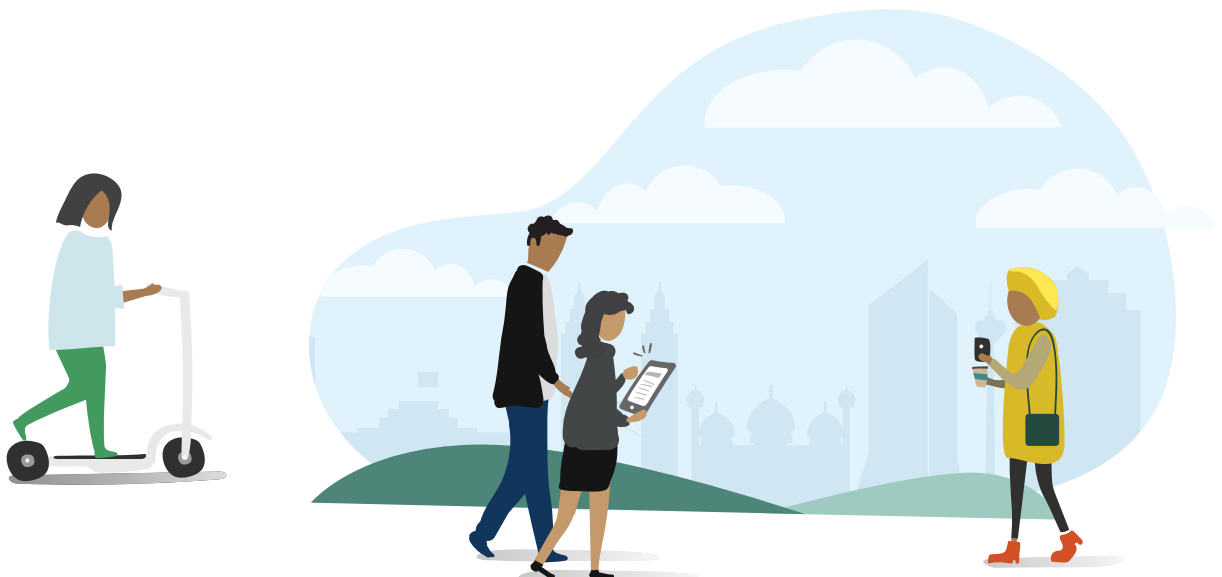
## How Will Kuala Lumpur Achieve its 2030 & 2050 Targets?

While KLCH is capable of implementing the prioritised actions as part of its commitment to D2020, to surpass its existing 2030 target and achieve carbon neutrality KLCH will require collaboration with all stakeholders across the city:

**Table 8:** Stakeholders to Engage and their Roles in Achieving KLCH Carbon Neutrality Targets

STAKEHOLDER	ROLES
 <b>Federal government</b>	Set ambitious policy direction and targets
 <b>Federal agencies</b>	Authority and mandate
 <b>Government-linked corporations</b>	Delivery partners
 <b>Private businesses of all sizes</b>	Partnerships and implementers
 <b>Communities</b>	Partnerships and community-driven implementers
 <b>NGOs &amp; social enterprises</b>	Partnerships and implementers

The city can implement interventions within its authority; where it lacks authority, significant collaboration will be required. KLCH also intends to develop partnerships for action implementation, which can be fostered through stakeholder engagement. Significant private business and community-led based actions will also be required, along with considerable push from and alignment with the Federal Government and its agencies.



# Climate Hazards in Kuala Lumpur

As well as taking action to mitigate climate change by reducing the carbon emissions from the city, Kuala Lumpur must also understand and take action to protect itself from the hazards which arise from existing and ongoing climate change.

To understand better the climate hazards faced by Kuala Lumpur, a Qualitative Climate Risk Assessment (QCRA) was conducted to

evaluate climate-related trends that have been monitored over recent decades, as well as the projection of climate hazards which lie ahead for Kuala Lumpur. Climate hazards are defined as threatening climate events that have the potential to cause damage or harm to humans, assets and natural systems. Kuala Lumpur is already in recent history facing increasing occurrence and intensity of such events.

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## Identified Hazards & Historical Trends

For the city of Kuala Lumpur, the QCRA identified three key climate hazards: **heat, floods and storms**, and **drought**.

As the city is located inland, it does not directly face the climate change challenges which threaten coastal cities due to sea level rise and associated consequences such as saltwater intrusion.

With its tropical climate, Kuala Lumpur has experienced flooding, with historical events such as the Great Kuala Lumpur Floods of 1971 etched in older residents' memories. Over the years, as the city underwent rapid development, improvements have been made to Kuala Lumpur's infrastructure to manage flood risk, among them the Stormwater Management and Road Tunnel ('SMART')<sup>4</sup> and two stormwater diverters at the Keroh and Gombak Rivers.

It is important to note, however, that the climate has continued to change, as reflected in historical tracking of the city's temperature and rainfall data; existing adaptation measures might not maintain their efficacy in the face of more intense climate events. Kuala Lumpur is already experiencing these hazards, with worsening impacts observed over time, and these trends are expected to continue as the climate continues to change. One recent example is the September 2020 floods, when area surrounding the confluence of the Gombak and Klang rivers overflowed due to heavy upstream and

downstream rainfall at an unprecedented intensity; while there were no casualties, significant economic damage and disruption occurred.

There is a series of collateral consequences associated with Kuala Lumpur's three key climate hazards which are outlined in this next section of the CAP. Overarching impacts include disruption to the population and economic activities, as well as public health consequences.

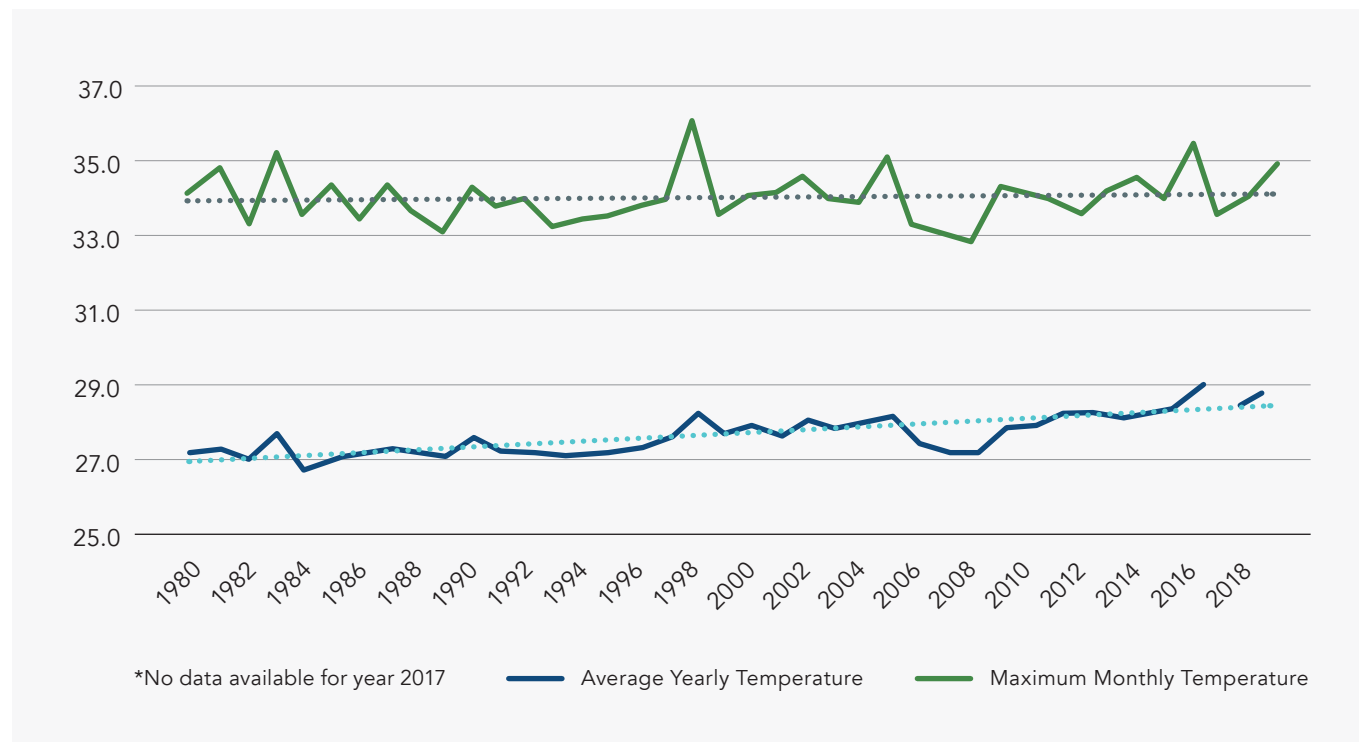


<sup>4</sup> <http://smarttunnel.com.my/>



## Heat

According to the Third National Communication and Second Biannual Update Report, Peninsula Malaysia has witnessed 0.24°C increase in average temperature since 1970.<sup>5</sup> Kuala Lumpur and its surrounding areas, meanwhile, has recorded a 1°C increase in average annual temperature over the past 40 years, as shown below. This is attributable largely to the loss in vegetated land and tree shade cover as well as rapid urban development increasing impermeable surfaces with high thermal mass.



**Figure 18:** Average Temperature and Maximum Monthly Temperature, Klang Valley, 1980–2019<sup>6</sup>

## Urban Heat Island

The related urban heat island (UHI) phenomenon also contributes to and compounds this temperature increase trend. UHIs are caused by concrete, stone and road surfaces absorbing large amounts of heat energy from the sun. This effect is visible during daytime with urban temperatures up to a couple of degrees warmer than the surrounding countryside, and even more so during night-time as the fabric of the built environment slowly releases the heat it has absorbed during daytime. With the rapid and dense urbanisation of Kuala Lumpur, the air temperature of the city has increased more markedly in the areas with high built up areas than less built up areas with tree cover<sup>7</sup>. The UHI effect drives increased demand for energy in buildings for cooling and exacerbates air pollution issues, affecting residents' quality of life.

Exposure to and risk from heat hazards will therefore vary across different terrains of the city with the UHI phenomenon worsening over time.

**“UHIs are caused by concrete, stone and road surfaces absorbing large amounts of heat energy from the sun. This effect is visible during daytime with urban temperatures up to a couple of degrees warmer than the surrounding countryside, and even more so during night-time as the fabric of the built environment slowly releases the heat it has absorbed.”**

<sup>5</sup> 2018, Ministry of Environment and Water (then MESTECC), Malaysia Third National Communication And Second Biennial Update Report To The UNFCCC

<sup>6</sup> 2020, Malaysian Meteorological Department, Ministry of Environment and Water

<sup>7</sup> <https://maps.thinkcity.com.my/think-city/maps/106291/land-surface-temperature-of-kuala-lumpur-city-center#>

## Heat & Public Health

It should be noted an increase in temperature can cause the rate of virus multiplication in the Aedes mosquito to increase as well. This can be noted by the Dengue outbreaks in Kuala Lumpur, which has increased over time as well<sup>8</sup>.

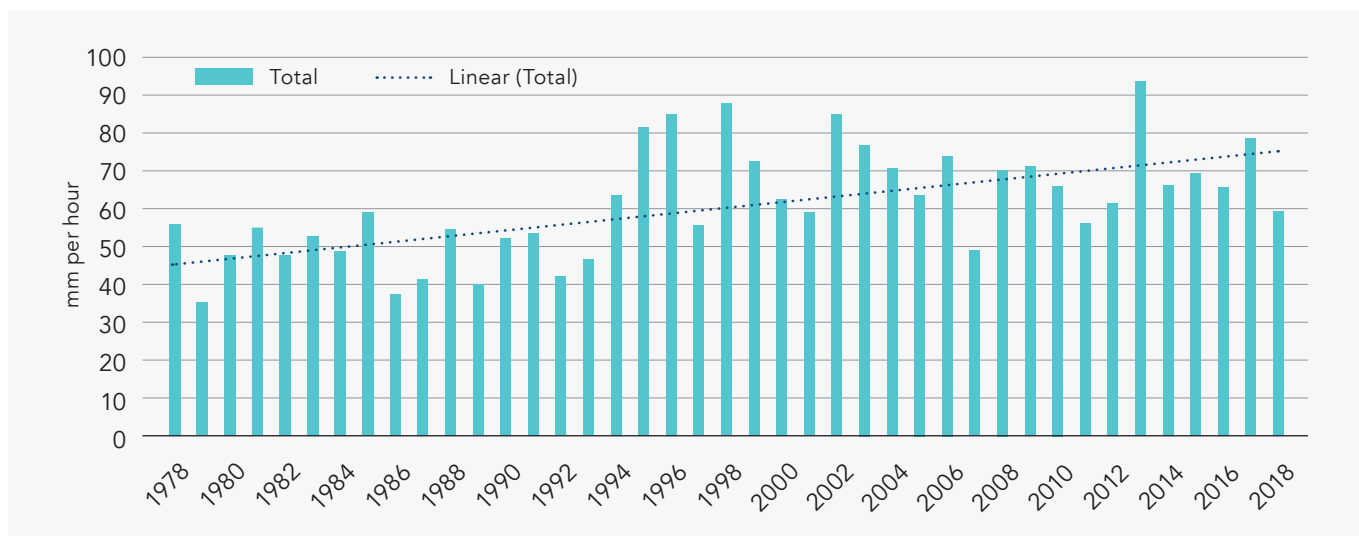


**Figure 19:** Number of Dengue Cases and Deaths in Malaysia<sup>9</sup>

Additionally, increased temperature affects human health, causing heat strokes and disrupting sleep. The decrease in outdoor activities by the population in a hotter climate also negatively impacts public health.

## Floods & Storms

City dwellers in Kuala Lumpur are already experiencing changes in precipitation patterns. Since 1980, there has been an upward trend in rainfall intensity<sup>10</sup>. This has been experienced differently in different parts of the city. The diverse topography of Kuala Lumpur and its surrounding Klang Valley creates marked differences in rainfall distribution, ranging from 2000mm to 4000mm<sup>11</sup>. Areas which historically received less precipitation are now experiencing significantly increased rainfall—this is correlated with the UHI phenomenon and Kuala Lumpur's location within a valley. Heavy downpours in Kuala Lumpur are becoming more extreme, as indicated by maximum precipitation (mm/hour), as shown below. This places stress on the city's stormwater management system and has increased the risk of flash floods.



**Figure 20:** Annual Maximum Hourly Precipitation in Kuala Lumpur, 1978–2018<sup>12</sup>

<sup>8</sup> 2019, The Star, Number of dengue cases set to hit all-time high

<sup>9</sup> Ibid.

<sup>10</sup> 2020, Department of Irrigation and Drainage, Ministry of Environment and Water

<sup>11</sup> Ibid.

<sup>12</sup> Ibid.



### **Flash Floods**

Flash floods are mostly caused by heavy downpours, when stormwater management systems are unable to channel away the sudden high-volume of water flow. While precipitation plays a major role, clogged drains and water channels with decreased capacity also contribute to flash floods.<sup>13</sup>

Historically, Kuala Lumpur has had several major floods, with significant incidents recorded in 1926, 1971, and in the early 2000s. Up till 2020, no major flooding incident has occurred since the opening of the 'SMART' Tunnel in 2007 and the operation of the Keroh and Gombak River Diverters. Nevertheless, it has remained common for 'water ponding' to occur on roads, which worsens traffic congestion and exacerbates carbon emissions from on-road transportation. In the period between 2016–2019, 50 flash flood hot spots has been identified in Kuala Lumpur.

### **River Flooding**

Kuala Lumpur was built along the flood plains of the Klang River and has been subjected to river flooding since its earliest days. River floods remain a hazard, particularly for the lower-lying areas in Kuala Lumpur. While flash floods regularly occur, incidences of river flooding are rarer, although they have become more frequent in recent years. Last year, residents of Kuala Lumpur witnessed Sungai Toba flooding in Segambut Dalam, which was partially caused by poorly managed construction sites; Sungai

Klang and Gombak also broke its banks for the first time in years, inundating shophouses in the historical area surrounding Masjid Jamek.<sup>14</sup>

### **Landslide**

Landslides are a frequent phenomenon in Kuala Lumpur, caused primarily by a combination of extreme rainfall, faulty maintenance of the drainage system, and exposed slopes. The city is estimated to have the second highest incidence of landslides in the country, with the most fatal consequences<sup>15</sup>. In recent years, two landslides were significant:

- i. Bukit Ceylon, 2009: A construction worker was killed when a landslide occurred in the heart of the city;
- ii. Puncak Setiawangsa, 2012: Residents of 46 houses in this desirable neighbourhood were evacuated due to the failure of a 43-metre-tall engineered slope-protection wall.

### **Floods, Storms & Public Health**

As Kuala Lumpur is heavily reliant on surface water for its water supply, it is also vulnerable to river pollution. Flash floods and river flooding bring additional contaminants into the waterbody, which may induce public health issues. Additionally, as residents become exposed to the flooding water, the cases of water-based vector-borne disease may occur.

<sup>13</sup> 2018, Bhuiyan et al., Direct Impact of Flash Floods in Kuala Lumpur City: Secondary Data-Based Analysis

<sup>14</sup> 2020, Berita Harian, Terowong Smartt Menyelamatkan Ibu Negara daripada Banjir

<https://www.bharian.com.my/berita/nasional/2020/09/730395/terowong-smart-selamatkan-ibu-kota-daripada-banjir>

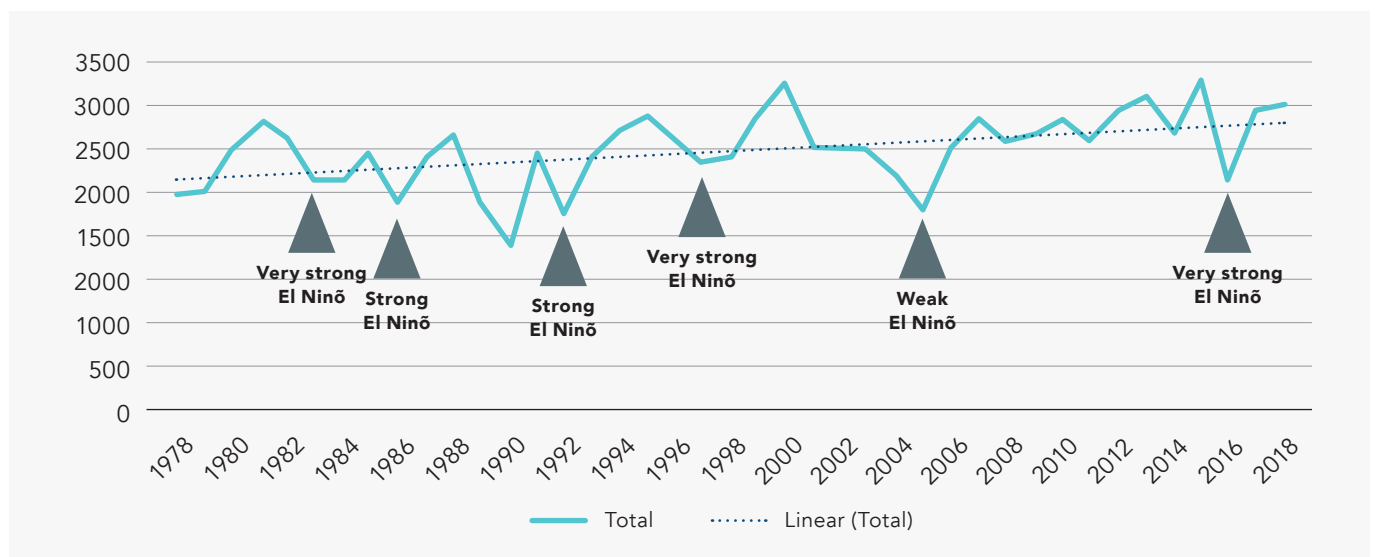
<sup>15</sup> 2018, The Star, Malaysia among countries especially prone to landslides



## Drought

Although Kuala Lumpur has received abundant levels of rainfall in the last 50 years, water shortages still occur. It has been observed that there is a visible correlation between the *El Niño* global climate phenomenon and the city's drought events conditions. *El Niño* conditions occur when abnormally warm water accumulates in tropical latitudes of the central and eastern Pacific Ocean. Consequently, tropical rains that would fall over Southeast Asia shift eastwards. This results in increased temperature and drought conditions in many parts of Malaysia, including Kuala Lumpur<sup>16</sup>.

With the changing climate, the city has experienced prolonged dry periods, as well as changes to the locational pattern of rainfall. As a result, water catchment areas have experienced decreasing rainfall, causing water levels at reservoirs to drop. During the drought periods of 1998 and 2014, water rationing measures were required due to low water level in the reservoirs that serve Kuala Lumpur and the surrounding Klang Valley.



**Figure 21:** Total Annual Precipitation in Kuala Lumpur (mm) vs the Scale of El Niño Phenomenon, 1978–2018<sup>17</sup>

## Water Stress

Water stress, which is commonly defined as the ratio of demand for water by society divided by available renewable surface and groundwater supplies, is an indicator of competition for water resources<sup>18</sup>. An increase in water stress indicates increased competition among users. The demand for water grows along with population growth, meaning that periodic drops in water supply in Kuala Lumpur become more critical as the city grows.

The main source of water for Kuala Lumpur is the Sungai Selangor Dam, which has been identified as vulnerable to drought<sup>19</sup>. In 2014–2015, Sungai Selangor Dam experienced several months of storage levels at below 50% capacity<sup>20</sup>. An increase in water stress would hit the urban poor the hardest, due to their general lack of resources and access to alternative supply (e.g. bottled water, alternative food supplies) and worsened sanitary conditions, at odds with KLCH's goal of inclusive development.

## Sinkholes

Sinkholes have occurred throughout the years in the city of Kuala Lumpur, mostly in areas where the underlying geological composition is based on limestone. Roads are also particularly prone to the hazard, due to a lack of structural support elements in their construction.

Air pollution from the city tends to increase the acidity of rainfall, which corrodes limestone and further exacerbate the incidences of sinkholes.

## Drought & Public Health

With shortage of water during dry spells, health hazards can emerge. According to the World Health Organisation, drought may lead to acute and chronic health effects, including dehydration, malnutrition, increased risk of infectious diseases due to worsened sanitary conditions, mental health issues, and disruptions to local healthcare provision.<sup>21</sup>

<sup>16</sup> 2019, Free Malaysia Today, Temperatures could hit 40°C in some parts of Malaysia, expert warns

<sup>17</sup> 2020, Department of Irrigation and Drainage, Ministry of Environment and Water

<sup>18</sup> 2015, WRI, Aqueduct Water Stress Projections Data: Ratio of water withdrawal to supply, SSP2 RCP8.5 scenario, 2040

<sup>19</sup> 2018, Ministry of Environment and Water (then MESTEC), Malaysia Third National Communication And Second Biennial Update Report To The UNFCCC

<sup>20</sup> Ibid.

<sup>21</sup> N.d, World Health Organisation, Drought—Impact

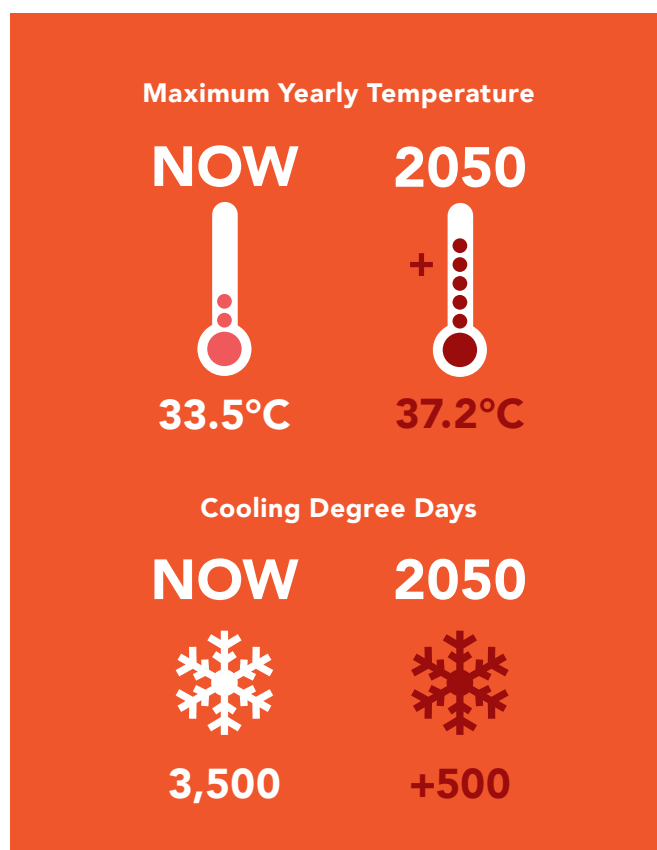
## Projections to 2050 and Risk Assessments

Based on the established climate hazards for Kuala Lumpur and the consequential impacts that have been identified and outlined above, this section of the KLCAP2050 will identify the projected impacts on the city and its population in 2050, based on the IPCC Representative Concentration Pathway (RCP) 8.5 scenario.<sup>22</sup>

### Heat

Even with climate change mitigation measures, the temperature on Earth is still expected to rise. In Kuala Lumpur, under a worst case scenario, the maximum yearly temperatures are expected to increase up to 3.5°C to 4°C.<sup>23</sup> Kuala Lumpur has been projected to experience a substantial increase in cooling degree days<sup>24</sup> over coming years—rising by 500 days in 2050. Increased heat in the city may also further increase carbon emissions from electricity usage, driven by the increased need of air conditioning.

With the anticipated increase in heat, the following associated risks have been identified to inform adaptation measures required in Kuala Lumpur:



**Figure 22:** Projected Increase in Temperature and Cooling Degree Days in Kuala Lumpur by 2050<sup>25</sup>



**High Risk**

#### INCREASED HEAT-RELATED ILLNESSES

Extreme heat conditions can lead to heat-related diseases such as dengue fever and heat stroke, which may be fatal. The elderly and outside labour workers are particularly vulnerable.



**High Risk**

#### AIR POLLUTION

Heat increases the impact of air pollution and haze conditions. Some air-borne pollutants are linked to health problems, including respiratory diseases; and also environmental damage, such as acid rain.



**High Risk**

#### CHANGE IN WEATHER PATTERN

In hot conditions, the likelihood of weather extremes, such as heavy rainfall and hailstorms will increase, which may subsequently induce the occurrence of hazardous phenomena such as flash floods and sinkholes.



**Medium Risk**

#### INCREASED ENERGY AND WATER DEMAND

In Kuala Lumpur, there is already a high level of energy consumption for indoor cooling; this is liable to increase as temperatures rise. During heat waves, water use also increases, potentially adding to simultaneous water stress issues.



**Medium Risk**

#### COMFORT AND QUALITY OF LIFE

Being outside in the sun is becoming increasingly uncomfortable in Kuala Lumpur, causing people to stay at home, which may lead to less active lifestyles and related long-term public health challenges (including obesity, heart disease, and mental health problems). Cooling costs also go up with the increased time spent indoors, potentially further exacerbating risks related to stress and mental health, particularly for the less affluent.

<sup>22</sup> RCPs are scenarios that include time series of emissions and concentrations of greenhouse gases (GHGs) and aerosols and chemically active gases, as well as land use/land cover. RCP 8.5 is a high pathway for which radiative forcing reaches greater than 8.5 W m<sup>-2</sup> by 2100 and continues to rise for some amount of time.

<sup>23</sup> 2018, Berg et al.; 2010, Yang et al.; Copernicus Climate Change Service (C3S), Maximum monthly values of daily maximum temperature: reference period (1971-2000) versus future projection (2041-2070), RCP8.5, based on CMIP5 ensemble mean

<sup>24</sup> Cooling degree days is another indicator used to measure increased heat and the associated 'cooling load' requirement from air conditioning. The indicator is calculated as the sum of degrees that the daily average temperature is above 18.3°C, as per the U.S. Energy Information Agency.

<sup>25</sup> 2018. NASA. NASA Earth Exchange Global Daily Downscaled Projections (NEX-GDDP); 2018. Vizuality, Cooling degree days, derived from NASA Earth Exchange Global Daily Downscaled Projections (NEX-GDDP) RCP8.5

## Floods & Storms

With extreme cloudbursts expected to become more intense in the future due to climate change, floods and storms continue to pose significant risk for the city of Kuala Lumpur and its inhabitants. The likelihood of river flooding and flash floods is expected to increase towards 2050 and beyond.

An indicator of the worsening precipitation events is the amount of rainfall over a 24-hour period with an intensity that happens only once every 50 years. By 2050, this number is expected to increase to 327mm of rainfall, as compared to the projected 2025 level at 300mm. As a comparison, the 10 September 2020 floods saw rainfalls of between 150–200mm at various points over five hours, throughout Kuala Lumpur.<sup>26</sup>

With the anticipated increase in the occurrence and severity of floods and storms, the following associated risks have been identified to inform adaptation measures required in Kuala Lumpur:



**Very High Risk**

### DISRUPTION OF TRAFFIC

In Kuala Lumpur, where traffic is already heavy and congested, extreme rainfall has a larger impact on travel times, due to difficult driving conditions, flooding and accidents. Climate change is expected to bring higher peak flows, causing more areas to be flooded. From 2030 to 2050, it has been estimated that approximately 30 additional kilometres of road would be exposed to flooding.



**High Risk**

### LANDSLIDES

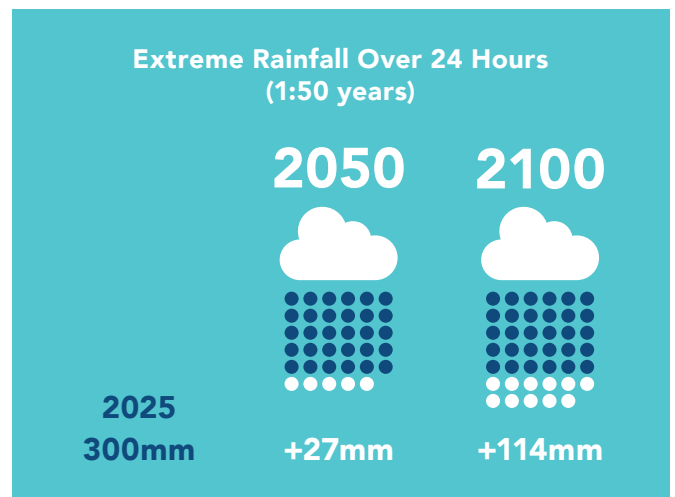
The changing climate is expected to increase the intensity and frequency of extreme rainfall events that trigger landslides. Landslides have many adverse effects, including but not limited to blocking traffic and causing damage to buildings, and at worst, human life.



**High Risk**

### TRAFFIC ACCIDENTS

Under wet conditions, incidence of traffic accidents increases significantly, causing harm to victims, damage to cars, infrastructure and other property, and subsequent personal and economic burdens. The B40 communities would be particularly at risk due to their comparatively lower level of insurance coverage and higher usage of two-wheeled vehicles.



**Figure 23:** Projected Extreme Rainfall in Kuala Lumpur in 2100 and Downtown Flooding<sup>27</sup>



**Medium Risk**

### DAMAGE TO BUILDINGS AND INFRASTRUCTURE

Flooding can have a devastating effect on ground and underground level houses, business premises and municipal infrastructure. Similar to traffic accidents, the urban poor may be impacted by relatively larger losses due to their limited resources and the prohibitive cost of insurance coverage.



**Medium Risk**

### MAINTENANCE COSTS

With increased risk of flooding, good maintenance of the stormwater management system and rivers are critical. Additionally, flooding events may cause damage to infrastructure and buildings in the city, with costs required for necessary repair and refurbishment.

<sup>26</sup> 2020, New Straits Times, KL can't handle more than 70mm, says hydrologist

<sup>27</sup> 2014. NAHRIM. Extension Study on the Impacts of Climate Change on the Hydrological Regime and Water Resources of Peninsular Malaysia Return Period Precipitation for 24, 48 and Accumulated Precipitation over the Kelang Watershed.



## Drought

With the changing climate compounded by the El Niño phenomenon, Kuala Lumpur is projected to endure more frequent and prolonged periods of drought. While the overall level of precipitation is expected to increase, it is expected that the precipitation pattern will include longer dry spells and more extreme downpours.

According to climate modelling, by 2050, February and March in Kuala Lumpur are expected to be drier than at present, and the length of days without rain, i.e. a 'dry spell', to increase to 45 days in a worst case projection.<sup>28</sup>

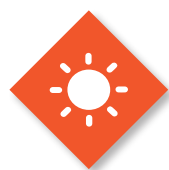
With more dry/drought conditions expected, the following associated risks have been identified to inform adaptation measures required in Kuala Lumpur:



**High Risk**

### DISRUPTION TO BUSINESS OPERATIONS

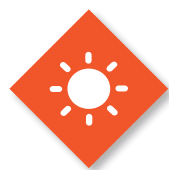
Drought conditions lead to changes in water availability, which may cause disruptions to many day-to-day activities for businesses.



**High Risk**

### INCREASED DRINKING WATER SHORTAGE

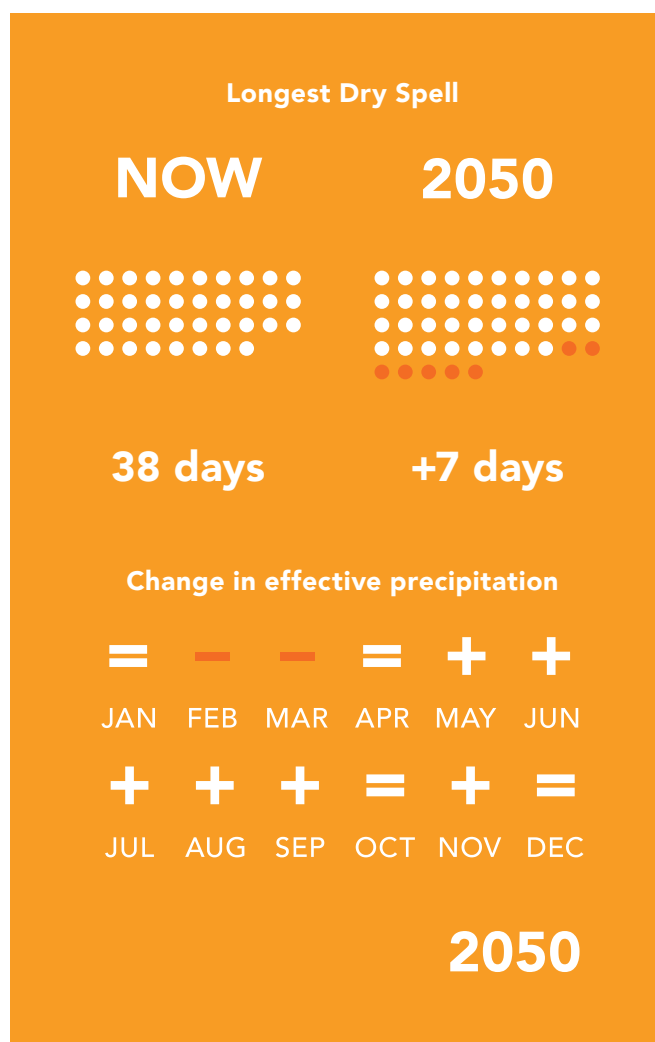
Long dry spells have caused issues in water availability in Kuala Lumpur as upstream dams deplete. According to the Ministry of Environment and Water, by 2040 the Dam Sungai Selangor may face significant dry spells with a return period of more than 10 years. The World Resource Institute (WRI) indicates that the current low level of water stress will worsen to a high level by 2040<sup>30</sup>. Water rationing measures may be needed more often, disproportionately impacting poor communities, who struggle to access alternative resources and more directly affected by impacts on sanitation.



**High Risk**

### TRANSBOUNDARY HAZE

Under dry conditions, haze from transboundary fires can stay in the air over a long period, adding to air pollution and increased public health risks in the city.



**Figure 24:** Projected Dry Spell and Change in Effective Precipitation in Kuala Lumpur by 2050<sup>29</sup>



**Medium Risk**

### HEALTH ISSUES

Particulate matters suspended in hotter air can irritate lungs, causing chronic respiratory illnesses, increasing the burden on the healthcare system. Growing studies have indicated a strong link between air pollution and cardiovascular disease as well.



**Medium Risk**

### LANDSLIDES

While landslides are directly caused by rainfall, the risk of landslides is also increased after periods of drought, especially in exposed areas. Considering the potential loss of green areas if urbanisation development continues in future, the landslide risk may increase further.

<sup>28</sup> 2018, Berg et al.; Copernicus Climate Change Service, Maximum number of consecutive dry days (daily precipitation < 1mm) over a 30 year period

<sup>29</sup> 2018, Berg et al.; Copernicus Climate Change Service, Maximum number of consecutive dry days (daily precipitation < 1mm) over a 30 year period, Change in effective precipitation over a 30 year period. RCP8.5 ensemble average

<sup>30</sup> 2015, WRI, Aqueduct Water Stress Projections Data

## Key Strategies for Climate-Related Risk Reduction in Kuala Lumpur

KLCH is determined to develop and implement strategic climate actions to address the adaptation considerations outlined in the previous section. KLCH will plan and prepare for the identified high-risk climate hazards that have already been occurring in the municipality of Kuala Lumpur and which are likely to worsen over time. In this CAP, strategies can be integrated with carbon emissions reduction as well as deliver benefits for the greater community, sensitive to the needs of vulnerable and marginalised groups in the population.

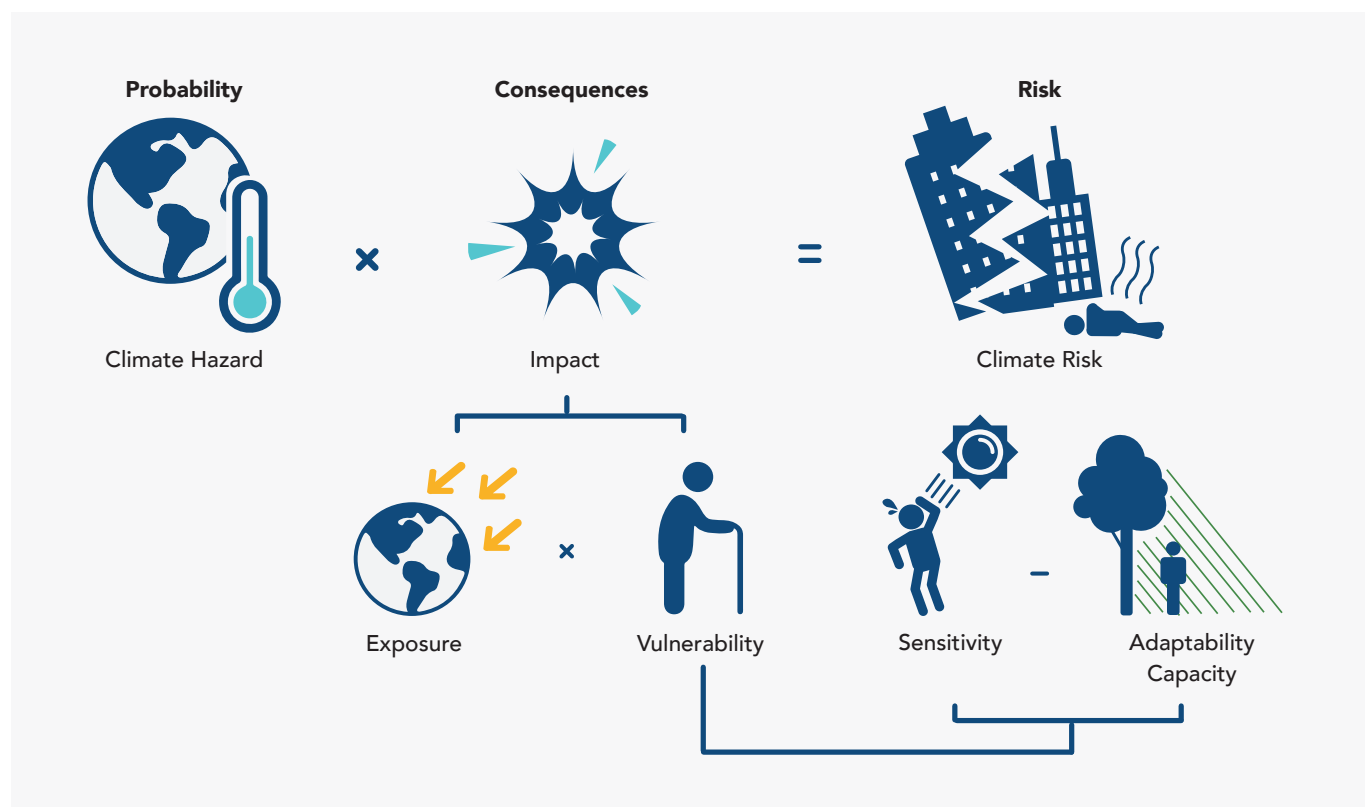
As the issue of climate change is complex, uncertain and occurs beyond the authority and boundary of Kuala Lumpur, KLCH will need to collaborate with cross-boundary local authorities as well as state and federal agencies to plan and implement adaptation actions, pooling resources and coordinating to deliver ambitious solutions that will have multiple layers of benefits.

### **Developing Goals & Strategies to Decrease Climate Risk**

KLCH aims to work towards significantly reducing the risks and impacts of climate hazards and simultaneously build the long-term resilience of the city and its citizens.

The direction for adaptation goals requires measurable targets and strategies. Based on the climate hazards identified and explored in previous sections of this CAP, KLCH has identified three goals, with supporting strategies to guide the development and implementation of short- and medium-term interventions. These strategies will be translated into implementable actions in the following chapters.

Each goal aims to address a specific climate hazard for the city of Kuala Lumpur, while the strategies identified provide the mechanisms for how the goal will be achieved in reducing the impacts of the climate hazard by (i) reducing exposure and (ii) increasing adaptive capacity, as outlined below.



**Figure 25:** Managing Climate Risks Through Decreasing Probability and Minimising Potential Consequences

## Reduce Climate Risk by Reducing Exposure

KLCH will aim to decrease the exposure of the city and its population to climate risks through infrastructural upgrades. The strategies associated with this approach include:

- **Reducing Urban Heat Islands** in public areas through increased vegetation canopy over hard surfaces
- **Implementing Low Impact Development (LID)** or 'sponge' effect for the city's impermeable hardscape
- **Developing increased water storage capacities** in preparation for drought events

## Build Resilience Through Increased Adaptive Capacity

Simultaneously, KLCH will increase the adaptive capacity<sup>31</sup> of the city and its population through strategies which include the improved monitoring and of climate hazard events, as well as increasing community awareness of climate hazards. These strategies are focused on strengthening the city's ability to prepare for and withstand the impacts of climate change, as well as to 'bounce' back from climate hazard events. These strategies include:

- **Data collection and monitoring:** Weather monitoring and early warning systems
- **Responding to disaster events:** Mobilising emergency rescue squads as well as clean-up crew
- **Preparing and building community resilience:** Raising awareness for community members of potential threats due to heat waves (e.g. dehydration)

The integration of Disaster Risk Reduction (DRR) principles to KLCH's climate adaptation actions will be undertaken as the city develops these strategies further and collaboratively with relevant partners.

Ambitious and transformative strategies are the focus of this CAP, as KLCH addresses the looming impacts of climate hazards on the city's environment, economy and society. In the following section these high-level strategies will be translated into actions. KLCH will strive to meet adaptation goals by utilising nature-based solutions in order to yield the greatest multiple benefits, across climate change mitigation, adaptation and inclusivity.

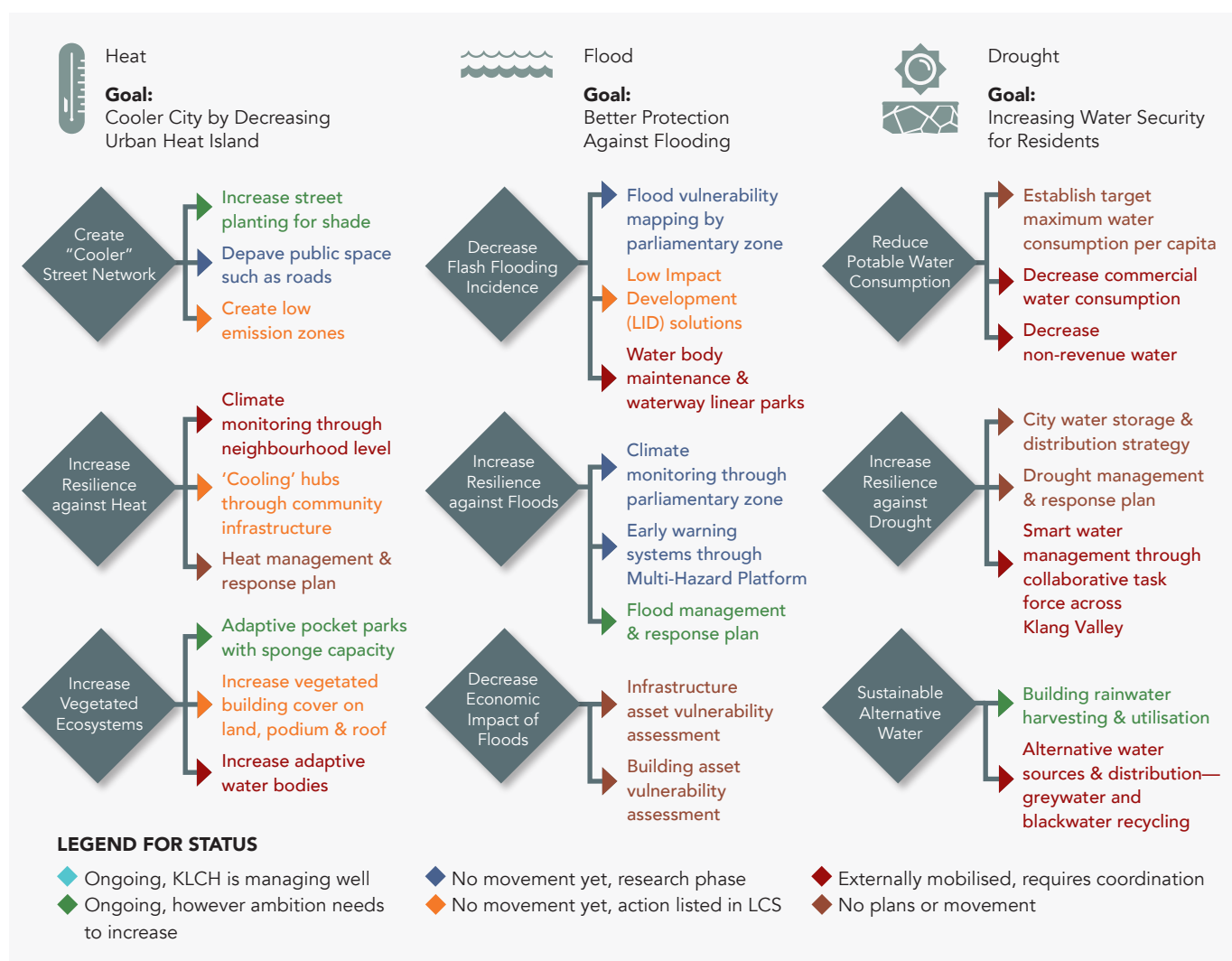


Figure 26: KLCH Adaptation Goal Setting and Status

<sup>31</sup> Adaptive capacity refers to the ability and willingness of systems to adjust to potential damage, to take advantage of opportunities, or to respond to consequences of climate change. Systems here can be natural systems, individuals, or institutions such as governments.





As an onward journey from the KLLCSBP2030, 15 priority climate actions were identified and defined through roadmaps across five strategic areas to be implemented by 2030 and 2050. These priority actions were selected based on their potential in delivering emissions reductions and climate resilience, equitable benefits and promotion of community inclusion, and feasibility based on KLCH's capacity and powers to influence action.

# 04 DEVELOPING PRIORITY ACTIONS

# Ongoing KLCH Initiatives

As the first step in prioritising climate actions, a review of existing climate initiatives in Kuala Lumpur was undertaken to understand their respective scope, beneficial impacts, implementation status and lessons learned that should be taken forward when planning new climate actions.

## Kuala Lumpur Low Carbon Society Blueprint 2030

In the KLLCSBP2030, a total of 245 climate programmes or actions were identified under 10 strategic themes. These themes relate closely to the mitigation sectors as well as the climate hazards identified in the preceding chapter. The following seven themes contained the majority of actions that would be prioritised for the KLCAP2050.

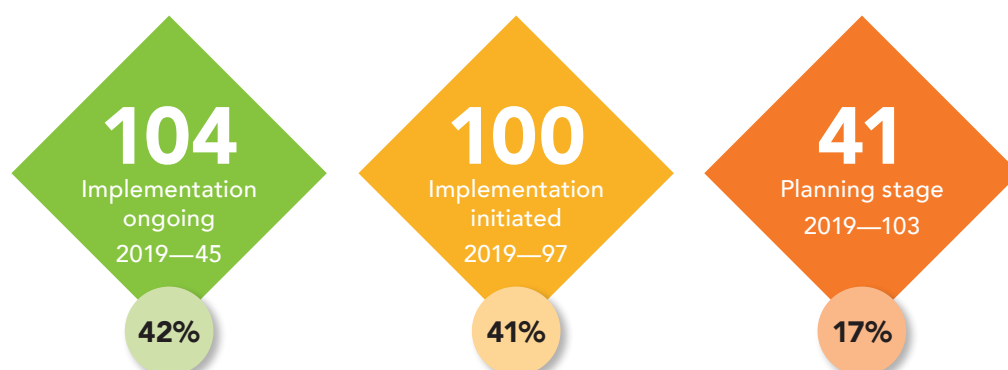
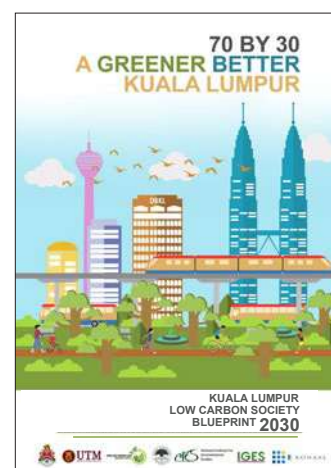
**Table 9:** KLLCSBP2030 & KLCAP2050 Themes

KLLCSBP2030 STRATEGIC THEMES	KLCAP2050 CLIMATE THEME
Energy Efficient Spatial Structure	Transport & Planning
Green Mobility	Transport & Planning
Sustainable Energy System	Stationary Energy
Low Carbon Green Building	Stationary Energy
Green and Blue Network	Adaptation
Sustainable Waste Management	Waste
Sustainable Water and Wastewater Management	Adaptation & Waste

To date, a number of these have already been rolled out and the status update below provides an overview of the implementation status of these 245 programmes or actions.

The KLLCSBP2030 is a document primarily focused on mitigating climate change, although many actions identified within it also offer the potential to enhance adaptive capacity across different sectors in the city. The roll-out or piloting of programmes under the KLLCSBP2030 sheds light on the feasibility and efficacy of the ongoing actions, providing good precedents for further iteration and expansion of these and other climate actions.

The case studies featured provide examples of ongoing KLLCSBP2030 projects, including the outcome, impact and ways forward to expand and integrate climate action implementation for increased benefits.





## Case Study 1: Increasing Nature-Based Solutions through Community Gardens under Local Agenda 21

Implementation status: Ongoing



**Background:** The Community Garden initiative falls under the 'Clean & Beautiful KL' theme of Local Agenda 21 (LA21)<sup>1</sup>, which has been rolled out nationwide since 2005. Community Gardens are implemented through built partnerships with local communities.

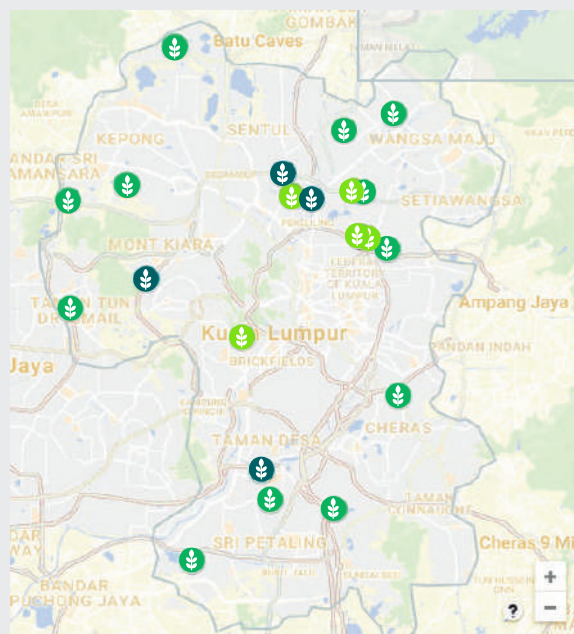
**The story so far:** Across the municipality, there are currently two types of community gardens: 28 smaller Urban Gardens, and one large Herb Garden, containing an urban orchard. The existing gardens represent seven acres of community space that was originally in the form of under-utilised green spaces, infrastructure reserves and rooftops, all of which have been set aside for local communities to cultivate plants and engender a stronger sense of community. An additional 20 Community Gardens are expected to be established by the end 2021 across Kuala Lumpur.

KLCH is in the process of formalising long-term goals in relation to Community Gardens, recognising that establishing Community Gardens supports the overall long-term vision of a 'Low Carbon Society'. This includes achieving 30% green cover in the city and targeting at least 2.0 ha of open space per 1,000 population.

**Integrating with Climate Action Planning:** Through the KLCAP2050, the potential has been recognised for Community Garden projects to be carried out under the priority action focused on 'Depaving Public Space'. This will encourage joint Public-Private Partnership (PPP) initiatives to work on increasing the permeability of Kuala Lumpur's surfaces, as well as replacing hard

surfaces with vegetation to help decrease both the UHI phenomenon and flash floods. By supporting the creation of new permeable and vegetated areas as well as planting trees in locations which support the network of shaded pedestrian priority routes, the Community Gardens programme has great potential to contribute to carbon emissions reduction by reducing the demand for air conditioning via natural cooling for immediately surrounding areas. It has the potential to encourage uptake of active mobility if implemented in an integrated manner with street planting initiatives.

**Next steps:** KLCH will continue to facilitate and expand the Community Garden programme, while identifying potential locations for incorporating climate adaptation projects within Community Garden spaces. KLCH will also determine an appropriate mechanism to monitor and measure progress and contribution to KLCAP2050 targets on an ongoing basis.



**Figure 30:** Locations of LA21 Community Gardens Across the KL Municipal Area

### Key:



Community Garden by Residents Association



Community Garden by Organisations / Institutions



Community Garden by Schools

<sup>1</sup> <https://www.facebook.com/localagenda21kl/>



## Case Study 2: Mitigation and Inclusive Strategy through the GoKL Bus

Implementation status: Ongoing



**Background:** Kuala Lumpur has high levels of traffic congestion and a very high private motorised vehicle ownership rate. In order to combat the reliance on private vehicle usage, KLCH introduced the *GoKL Bus Service*, a free and frequent option for moving around the city area.



**The story so far:** From 2012 to 2021, KLCH's GoKL bus service grown from three to seven bus routes that primarily serve the city centre, in a bid to reduce congestion and its associated carbon emissions. The service is free and frequent during peak hours arriving every five minutes, and while the routes cover more city centre locations, a recent line has been introduced to link a nearby suburb. The locations of the routes focus on connecting high-demand routes to social housing estates to serve Kuala Lumpur's B40 community. The ridership is high, with 2019's peak usage at 19.7 million riders that year. This averages to 35,000 passengers per day! The GoKL Bus Service is regularly used by migrant workers, who often only get minimum wage, highlighting an additional equity benefit of the free KLCH service.

**Next steps:** KLCH intend to electrify their GoKL Bus Fleet of 67 buses over the next several years further working towards reducing carbon emissions from the transportation sector.

## Case Study 3: Sustainable Solutions through Road Surface Materials

Implementation status: Research & Pilot Project

**Background:** Each year, KLCH allocates a large proportion of their budget to maintaining roads and drainage, with close to RM200 million spent in 2020. Over the next 30 years, the projected increase in temperature and rainfall intensity will accelerate deterioration of road surface quality. Enhancing the durability of roads will, therefore, incur cost savings as well as decrease the use of raw materials in the long term.

**The story so far:** KLCH is actively cooperating with the Malaysian Rubber Board to advance the sustainability of city roads and a pilot project has been initiated along Jalan Parliament. This pilot to test the application of rubberised bitumen, uses Cuplump Modified Asphalt (CMA) to create stronger roads that require less maintenance. The plan to use CMA is currently under study including identifying roads for implementation.

### Integrating with Climate Action Planning:

While safety improvement and savings on maintenance will be the biggest benefit, the prolonged lifespan of road will increase from the current duration of five years to ten years. As CMA roads are capable of enduring higher temperatures, the durability and safety are especially important when the UHI and temperature in the city rises.

**Next steps:** Further rollout is planned after a successful pilot on Jalan Parliament. KLCH is also planning to study additional road surface materials such as incorporating recycled waste and using permeable materials to create safe, good quality roads with added mitigation and adaptation benefits.





The KLLCSBP2030 has an overarching target of reducing the municipality's carbon emissions intensity by 70% per unit GDP by 2030, although the targets at programme or action level, was not established. As a result, while a very large number of actions are being planned or implemented, there is little information being collected and synthesised to ascertain the success of these actions in relation to their intended impacts. This in turn means a lack of insight into how to optimise the efficient allocation of resources towards Kuala Lumpur's overall climate vision. Reflecting on this, Chapter 5 elaborates on considerations for the governance, monitoring, evaluation and reporting that are needed.



## Draft Kuala Lumpur Structure Plan (KLSP2040)

The KLSP2040 incorporates KLCH's key strategic goals, such as mode shifts towards public transport and active mobility, while identifying low carbon development and building city resilience as key priorities for KLCH in the coming decades. The KLCAP2050 has referenced this document to understand the relevant future goals and targets that KLCH has identified, in order to integrate them into the climate actions implementation strategies.

**Table 10:** Goals and Underlying Climate Action Components in the KLSP2040

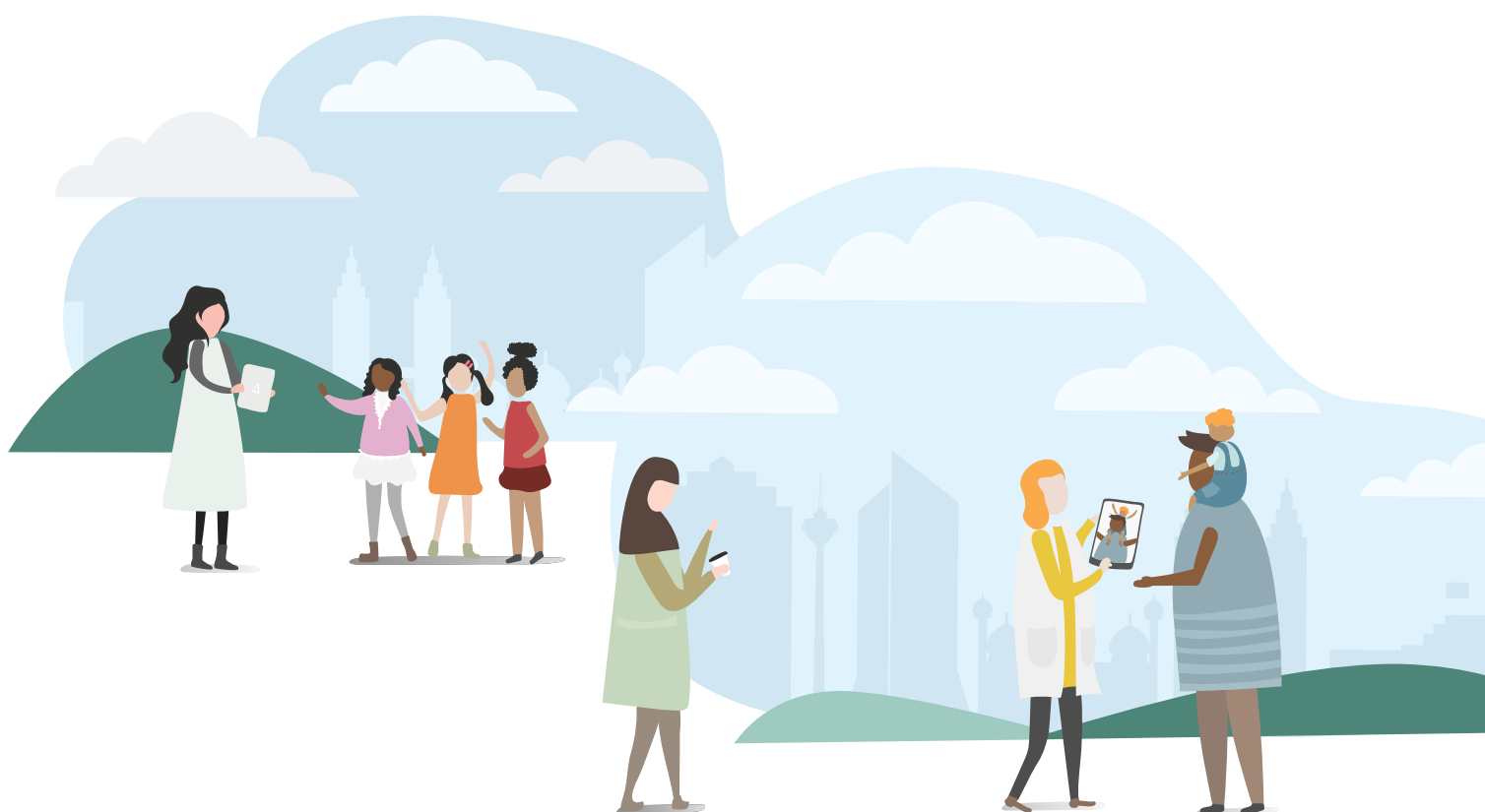
SIX GOALS OF THE KLSP2040, 'A CITY FOR ALL'	KLCAP2050 CLIMATE THEME
<b>An Innovative &amp; Productive City</b>	Economic & Inclusive
<b>An Inclusive &amp; Equitable City</b>	Inclusive & Planning
<b>A Healthy &amp; Vibrant City</b>	Inclusive & Adaptation
<b>A Climate Smart &amp; Low Carbon City</b>	Mitigation & Adaptation
<b>An Efficient &amp; Environmentally Friendly Mobility City</b>	Mitigation & Inclusive
<b>A City of Integrated &amp; Sustainable Development</b>	Mitigation, Adaptation & Inclusive

## KLCH Strategic Plan 2021–2030

The KLCH Strategic Plan 2021–2030 is another key set of documents that helps to guide KLCH’s climate initiatives with KLLCSBP2030 falling under these set of documents. The climate-related policies and plans below are listed within KLCH Strategic Plan 2021–2030. These are relevant to climate actions contained in the KLLCSBP2030 and the subsequent KLCAP2050, highlight KLCH’s commitment to progressing with planning and implementing actions that will address key mitigation and adaptation priorities.

**Table 11:** Policy Documents Listed Within KLCH Strategic Plan 2021–2030 that are Relevant to Climate Actions

RELEVANT POLICY DOCUMENTS LISTED WITHIN KLCH STRATEGIC PLAN	CLIMATE THEME
<b>KLSP2040</b>	All
<b>KL Local Plan 2040</b>	All
<b>KLLCSBP2030</b>	Mitigation
<b>KL Landscape Masterplan</b>	Adaptation—Heat & Flood
<b>KL Traffic Masterplan</b>	Mitigation—Transport
<b>ICT Strategic Plan 2021–2025 &amp; 2026–2030</b>	Governance
<b>Human Resource Strategic Plan 2025</b>	Governance
<b>KL Pedestrian and Cycling Masterplan 2019–2028</b>	Transport & Planning
<b>Sustainable Development Goals</b>	Socio-economic, Mitigation, Adaptation, Inclusivity
<b>Pedestrian Street Masterplan</b>	Transport & Planning
<b>KL Rainwater Drainage and Management System Masterplan</b>	Adaptation





# Developing Kuala Lumpur's Priority Climate Actions

## The Approach

Following the assessment of Kuala Lumpur's socio-economic context, carbon emissions profile, climate hazards and existing climate initiatives, KLCH carried out a detailed review of the actions in the KLLCSBP2030 to identify and prioritise actions which needed to be developed further.

During this process, KLCH benefitted from the contributions of various internal departments, government agencies, experts and organisations, all of whom contributed towards the process in different ways to reflect their unique positioning. The aim of this process, highlighted below, was to ensure that the prioritised actions were selected in a comprehensive and rigorous manner.

The final outcome of the process was the selection of fifteen key climate actions, listed on Table 12, based on the evaluation criteria identified below:

- potential for emissions reduction and/or climate risk reduction
- potential for generating wider social benefits, particularly for vulnerable communities
- feasibility of implementation
- synergies with other actions on the list
- potential risk of poor investment



**Figure 27:** The Process of Prioritising Climate Actions in Kuala Lumpur

Following the evaluation process, a final list of 15 key climate actions across five strategic areas were selected following stakeholder consultation for implementation between now and 2030. These 15 actions were explored in greater detail, examining elements from design to implementation.

**Table 12:** Mapping the 15 Prioritised Actions Against KLLCSBP2030

CAP CLIMATE STRATEGIES	KLCH'S 15 PRIORITISED CLIMATE ACTIONS	RELATED KLLCSBP2030 PROGRAMME
<b>Mobility &amp; Infrastructure</b>	Street Design to Prioritise Active Mobility	GM2, SS29, & SS30
	Comfortable & Safe Pedestrian Networks	SS9, SS6 & SS11
	Accessible Affordable Housing in Priority Area	SS7
	Dedicated Bus Lane Network	GM8
<b>Green Adaptive City</b>	Deploy Low Impact Development (LID)	WW12
	Depave Public Space with the Community	SS28
	Protect Parks & Increase Biodiverse Areas	BG1 & BG15
<b>Energy Efficient &amp; Climate-Proof Buildings</b>	Building Vegetation Covering	GB7
	Low Carbon Building Checklist Validation	GB23
	Building Performance Benchmarking and Rating	GB21
	Near Zero Emissions Building Roadmap	*MI1
<b>Smart Waste Management</b>	Solid Waste Reduction through a Waste Management Masterplan	*MI2
<b>Disaster Management</b>	Flood Management & Response Plan	*AD1
	Heat Management & Response Plan	*AD2
	Drought Management & Response Plan	*AD3

\*Indicates new action identified for the KLCAP2050

## Overview of the Prioritised Actions & Climate Strategies

In order to execute implementation efficiently, the Climate Action Plan organises specific climate actions under five Climate Strategies. These five strategies broadly cover thematic areas relevant to Kuala Lumpur's climate action journey, primarily:

- **Green Adaptive City**—Adaptation actions to reduce climate risk
- **Mobility & Infrastructure**—Mitigation actions from transport sector
- **Energy Efficient & Climate-Proof Buildings**—Mitigation actions from building sector
- **Smart Waste Management**—Mitigation actions from waste sector
- **Disaster Management**—Adaptation actions to build adaptive capacity

The five priority climate strategies and actions for Kuala Lumpur up to 2030 provide an overview of the five climate strategies, related sectors, hazards, and SDGs<sup>2</sup> as well as the vulnerable groups that have been identified as being most impacted by the actions' implementation.

The categorisation of actions into five strategies was done to promote integrated implementation across climate actions through identifying synergies and opportunities for 'piggybacking', for example, grouping climate actions with similar or interrelated goals under a single strategy, as well as achieving greater cost efficiency and minimising risk of malinvestment. The following sections will explore each climate strategy, from the actions contained as well as the inclusive impacts identified.

<sup>2</sup> The 17 UN Sustainable Development Goals promote prosperity while protecting the planet. They recognize that ending poverty must go hand-in-hand with strategies that build economic growth and address a range of social needs including education, health, social protection, and job opportunities, while tackling climate change and environmental protection. A full list of the 17 SDGs and further information on them is available at: <https://www.un.org/sustainabledevelopment/>

**Table 13:** The Five Priority Climate Strategies and Actions for Kuala Lumpur up to 2030

STRATEGY / SECTORS AND HAZARDS COVERED	UN SDGS MAINLY ADDRESSED	LOW-INCOME COMMUNITIES	ELDERLY
<b>A. Mobility &amp; Infrastructure</b> Transport & Urban Planning Heat	  		
<b>B. Green Adaptive City</b> Flooding Heat Cross Hazard	  		
<b>C. Energy Efficient &amp; Climate-Proof Buildings</b> Building Heat Drought Cross Hazard	  		
<b>D. Smart Waste Management</b> Waste	  		
<b>E. Disaster Management</b> Flooding Heat Drought	  		

## Incorporating Inclusivity in Climate Action Planning

Throughout the climate action planning process, there has been an emphasis on prioritising and designing climate actions with inclusivity in mind. Inclusive climate action ensures that projects, programmes and policies are geared towards KLCH's efforts to create equal opportunities for all, regardless of background and upbringing. Climate action has the potential to deliver inequitable impacts, where the benefits of the action are inaccessible to certain groups in society (through being unavailable or not affordable to those groups). It is therefore important to analyse how those in minority groups, at-risk or marginalised communities could be impacted, factoring these assessments in to the design and implementation of climate actions.

The potential impacts of climate action implementation can be either positive or negative, and KLCH is determined to foster greater positive impacts for vulnerable groups in the city, while ensuring that negative impacts are avoided wherever possible. A summary analysis of the potential impacts of each group of actions has been prepared in the following section. These include consideration for KLCH as well as businesses and residents of the city to further understand the roles they can play where relevant and applicable.



KEY IMPACTED GROUPS					
YOUTH / CHILDREN	WOMEN	PEOPLE WITH DISABILITIES	OUTDOOR / INFORMAL WORKERS	MIGRANTS	TOURISTS
◆	◆	◆		◆	◆
			◆	◆	
			◆		
			◆		
◆	◆	◆	◆	◆	

## Mobility & Infrastructure

### Prioritised Action #A1

Street Design to Prioritise Active Mobility

Mitigation & Adaptation Heat

#### City Level

The prioritisation of active mobility requires street intersections and crossings to be designed to favour pedestrians and cyclists while deprioritising motor vehicles. In addition, the climate resilience of active mobility infrastructure must be improved to ensure maximum usability throughout the year. Modified road and street design can empower citizens to seek alternative transport options and reduce reliance on motorised vehicles, thus reducing GHG emissions and air and noise pollution. Proper planning of active mobility routes can also reduce vulnerability to UHI around major transport networks.

To advance street design, KLCH intends to identify key priority locations around Kuala Lumpur, based on

considerations such as likelihood of pedestrian and cyclist activity, distance to high density commercial and residential areas, and current collision or pedestrian accident rates. Retrofitting key intersections based on priority needs would be the focus for initial implementation of this action.

### Prioritised Action #A2

Comfortable & Safe Pedestrian Networks

Mitigation & Adaptation Heat

#### City Level

Complementing the previous action, the upgrade of pedestrian networks will also focus on modification of routes and sidewalk design to increase pedestrian mobility and provide equitable and fair accessibility for all members of society. Safety and connectivity of pedestrian networks to travel hubs, transit-oriented developments, and also schools and other public institutions such as hospitals, is very important. With upgraded pedestrian networks,

footfall is expected to rise, diverting citizens from vehicle-based transportation, reducing emissions from cars and other motorised traffic.

Master planning of the pedestrian network will take into account locations of key amenities, public services and institutions, as well as existing pedestrian infrastructure and walkability assessments. KLCH also aims to invest in inclusive sub-actions such as the installation of improved lighting and public furniture (benches, tables, etc.) to encourage walking and foster safety. There will be synergies with other actions, including creation of pocket parks, community-led depaving, and the expansion of urban green spaces that should be considered during planning and implementation of this action.

### Prioritised Action #A3

Accessible Affordable Housing in Priority Areas

#### Mitigation & Adaptation

##### City Level

The provision of affordable housing involves partnerships with developers and allowing development on parcels of land around existing transit-oriented developments or mixed-use centres where a portion, for example minimum of 30%, of units provided affordable housing. With housing built close to transit stations, residents are encouraged to utilise public transport. This reduces single-user car travel, leading to reductions in GHG emissions from cars and other motorised traffic.

For the development of affordable homes with good transit access, KLCH will identify remaining land available for residential development, map this against transit stations, and communicate with spatial planners, communities and stakeholders. Meanwhile, KLCH will create guidelines to determine affordable housing requirements to ensure re-sale price is controlled by binding conditions for buyers.



### Prioritised Action #A4

Dedicated Bus Lane Network

#### Mitigation & Adaptation

##### City Level

In order to improve the quality of bus service and its reliability, it is crucial for the bus network to be studied. Where there is a high demand and the locations allow, these bus routes will be prioritised for segregated and dedicated bus lanes. The introduction of segregated bus lanes and improved public transportation services will encourage ridership. Meanwhile, better data management is instrumental in assessing needs and performance to inform route analysis and development. This action seeks to deliver increased uptake of public bus usage, including feeder buses, to decrease traffic congestion as well as emissions from motorised traffic.

KLCH is also committed to improve last-mile connectivity, where last-mile routes for feeder buses for MRTs and LRTs will be identified. To leverage the synergies across actions, this action will require cooperation between KLCH departments and agencies to integrate hazard emergency response planning, urban greening systems and energy-efficiency measures, to incorporate climate resilience into the urban bus network.

### WHAT INCLUSIVE BENEFITS WILL THE MOBILITY & INFRASTRUCTURE STRATEGY BRING?

1. Building affordable housing near transit stations can offer greater mobility, connectivity, access to employment, education, public services and recreation for marginalised communities, particularly those in low-income groups, women and migrants who often rely on public transportation due to inability to obtain loans for motorised vehicles.
2. Attractive walking routes can incentivise active mobility and improve connectivity between districts. Greater footfall in streets and neighbourhoods with commercial storefronts may increase economic activity, which could be particularly valuable in lower-income neighbourhoods. Malaysia's high rates of obesity and cardiovascular disease can be decreased with physical activity. By providing good, safe and comfortable infrastructure, walking or cycling can be incorporated into daily lifestyles and schedules, not solely as exercise.











## Green Adaptive City

### Prioritised Action #B1

Deploy Low Impact Development (LID) Mitigation

Flooding Heat

#### Neighbourhood Level

Low Impact Development (LID) employs a design approach that mimics natural ecosystems, such as infiltration and evaporation. It enables better management of stormwater runoff and protects water quality. The deployment of LID projects in Kuala Lumpur targets flood-prone locations near areas with higher vulnerable communities. As LID projects increased natural ecosystems, such as vegetated land area, additional recreational space is created, biodiversity is protected, and the urban cooling effect will occur for immediately surrounding areas. The better management of flooding can also contribute to the reduction of water-borne diseases.

The introduction of LID will adopt a two-pronged approach, combining a broader mapping analysis with an approach to identify, evaluate, implement and monitor potential pilot projects for LID. Potential synergies emerge from this action such as utilising LID water storage solutions for use during dry spells at parks or public facilities..

### Prioritised Action #B2

Depave Public Space with the Community

Mitigation & Adaptation Flooding Heat

#### Neighbourhood Level

Through community landscaping programmes, public land can be depaved, increasing green, vegetated areas through collaborative management. Increasing landscaped areas improves rainfall retention capacities and improves infiltration, which will reduce flooding. During extreme heat, communities without access to cooling could benefit

from shading in landscaped areas which can be close to 10°C in difference or even more pending other factors such as canopy density and wind speed. Moreover, these projects provide space for recreation and biodiversity. Participation of communities in the creation and use of these green spaces helps create awareness and capacity building opportunities for citizens.

Aside from city planners, residents and civil society organisations will be engaged to identify public land with potential to be depaved. Communities will also be actively responsible for the monitoring and maintenance of pilot depaving projects, such as urban farming. Based on successful pilot results, KLCH would establish relevant guidelines to facilitate long-term scaled-up implementation across the city.

### Prioritised Action #B3

Protect Parks & Increase Biodiverse Areas

Mitigation & Adaptation Heat Cross Hazard

#### City Level

With the maintenance and expansion of forests and parks, greater green space cover will reduce UHI effect, and also retain and infiltrate greater volumes of rainwater, thus benefiting both heat and flood risk mitigation. The preservation and expansion of green spaces is not only beneficial for climate action, it also protects and encourages biodiversity. By establishing the Kuala Lumpur Landscape Masterplan (LMP), the protection of reserved forests and parks can be formalised, and the expansion of such areas identified.

In developing the LMP, the KLCH team intends to synergise with other council initiatives through incorporating active mobility priority routes, integrating canopy cover monitoring as well as identification of areas to create new urban parks and forests.

## WHAT INCLUSIVE BENEFITS WILL THE GREEN ADAPTIVE CITY STRATEGY BRING?

1. The construction of green infrastructure projects and promotion of landscaping can create employment opportunities for lesser skilled or temporary workers, including in low income communities.
2. New or upgraded green infrastructure will provide shaded spaces for cooling during extreme heat, beneficial for those without access to air conditioners in homes and workplaces. Residents that utilise active mobility as a means of transportation and outdoor workers such as street cleaners, hawkers and farmers market staff will benefit and be protected in extreme heat events.
3. Green areas provide space for recreation, particularly for low-income citizens, women and the elderly. The Covid-19 pandemic has highlighted need for increased green infrastructure for physical as well as mental health benefits.
4. With potential to reduce disruption caused by flooding, increased vegetation and vegetated areas has the potential to increase property values, which places lower-income areas to become gentrified.

## Energy Efficient & Climate Proof Buildings

### Prioritised Action #C1

Building Vegetation Covering

Building Mitigation & Adaptation Heat Cross Hazard

#### Street Level

This action focuses on the expansion of green area cover on building roofs, podiums and walls. Localised green covering provides a cooling effect to reduce UHI and contributes to wider mitigation efforts through sequestering CO<sub>2</sub> in vegetation, while bringing positive influence on energy and water management costs. Green covering can also help to retain storm water and filter pollutants if designed with this consideration, thereby, helping to address flood hazards and health-related risks.

KLCH aims to develop guidelines to require for increased green covering on buildings, including standards, maintenance requirements, and guidance on inclusivity and community engagement to raise awareness for property owners to undertake this action within their property area.

### Prioritised Action #C2

Low Carbon Building Checklist Validation

Building Mitigation & Adaptation Heat Drought

#### City Level

This action aims to mainstream low carbon buildings through incorporating relevant requirements into a mandatory checklist and requiring endorsement from professional signatories on the passive and active design elements of new buildings. Passive design elements include building envelope standards, while active design elements include efficiency of air conditioning and energy monitoring systems. Wider adoption of low carbon building measures, such as improved insulation and glazing, can reduce heat from entering buildings. Thereby reducing the impact of extreme heat and UHI effect, subsequently reduce energy consumption from cooling systems.

KLCH intends to create guidelines for new developments and major renovations, formulating regulations for the adoption of low carbon measures. In this process, experts from academia and the private sector will be involved to advise on and refine the building checklist for use across a variety of building types.

### Prioritised Action #C3

Building Performance Benchmarking & Rating

Building Mitigation & Adaptation Heat

#### City Level

This action focuses on implementing a mandatory building performance rating and benchmarking system to reduce energy consumption by setting targets based on building types. Cost savings from energy consumption may also enable greater ability to invest in other mitigation and adaptation measures in businesses and households.

KLCH aim to create policies to mandate reporting of energy usage of all buildings, and for building owners to provide relevant certification and documentation as disclosure to future tenants or purchasers. As TNB rolls out smart meters in the Klang Valley, KLCH intends to establish an energy monitoring and enforcement mechanism and set building performance targets for certain building types.

### Prioritised Action #C4

Near Zero Emissions Building Roadmap

Building Mitigation & Adaptation Heat Drought

#### City Level

Low carbon emissions buildings are designed and constructed to release very little or no carbon at all during their lifecycles. This action entails the development of a Near Zero Emissions Building (NZEB) roadmap that includes minimum requirements, timeframes for periodic performance rating assessments, and implementation considerations. Similar to Action #C3, alongside reducing GHG emissions from energy consumption, the outcomes of this action will significantly reduce energy usage in buildings and its associated carbon emissions, and, if designed with thoughtful consideration, can assist in mitigating the UHI effect. Cost savings from energy consumption may also enable greater ability to invest in other mitigation and adaptation measures in businesses and households.

This roadmap will be developed and implemented over a longer time-frame, and with consideration of building types, energy consumption profile of Kuala Lumpur's building stock, existing policies, as well as benchmarking analyses. Supporting actions such as energy data disclosure frameworks and incentives such as low carbon building awards may also be introduced to support the implementation of the roadmap.





### WHAT INCLUSIVE BENEFITS WILL THE ENERGY EFFICIENT AND CLIMATE-PROOF BUILDINGS STRATEGY BRING?

1. Mainstreaming low carbon buildings, including retrofitting and upgrading new building projects, could provide job opportunities for low-income individuals as well as create green jobs and opportunities for reskilling or upskilling. Specific programmes such as rooftop farming may also create opportunities for employment and social cohesion amongst different societal groups.
2. The cooling effects of building greening may reduce the impact of extreme heat, while energy efficiency measures such as natural ventilation may improve air quality and reduce indoor temperatures, all bringing potential health benefits, particularly for children, the elderly and people with disabilities, who are more susceptible to heat and air quality issues.
3. Provision of passive cooling technologies in affordable housing such as shading, reflective paints, retrofitting glazing with high Shading Coefficients as well as insulation for sun-exposed walls will reduce energy costs and improve health and wellbeing in low-income communities.

## Smart Waste Management

### Prioritised Action #D1

Solid Waste Reduction through a Waste Masterplan

Waste Mitigation

City Level

Through reuse, recycling, and other landfill diversion practices, such as segregation of organic waste for composting, GHG emissions from the waste sector will decrease. The reduction of solid waste going to landfill will in particular reduce methane emissions generated from anaerobic decomposition; methane is a potent GHG with global warming potential 21 times that of CO<sub>2</sub><sup>3</sup>. In addition, a better waste management system reduces contamination of ecosystems and reduces risks of water-borne illness.

To achieve this, KLCH will develop a Waste Masterplan, that will detail the management of solid waste in the city, include waste reduction and recycling targets and strategies as well as enforcement measures. The informal sector will also be engaged in an effort to identify measures to formalise their role in the system. The KL Cares mobile application. extension<sup>4</sup> may also be leveraged to promote citizen engagement in waste management initiatives.

### WHAT INCLUSIVE BENEFITS WILL SMART WASTE MANAGEMENT STRATEGY BRING?

1. Reengineering Kuala Lumpur's waste management system will provide opportunities to formalise the informal waste collection sector by integrating workers into public or private waste management entities. This would improve wages and offer financial stability for vulnerable individuals such as the urban poor and migrants involved in these activities.
2. Reduced waste pollution into ecosystems would reduce risks of waste-related illness transmission, to which marginalised communities are disproportionately vulnerable. This includes the management and enforcement of industrial wastewater pollution, that can disrupt water supply and disproportionately impact vulnerable groups who might have higher household residents, less financial ability to purchase water and the inability to conduct business.

## Disaster Management

### Prioritised Action #E1

Flood Management & Response Plan

Adaptation Flooding

City Level

Establishing a Flood Management Plan (FMP) will accelerate the development and improve the efficacy of pre-flood mitigation measures, tracking and monitoring systems, as well as cross-functional collaboration among stakeholders. Within the FMP, the identification of high-risk flood areas allows for targeted action or adaptation measures to be prioritised, in order to build resilience and preparedness in high-risk communities. A pre-established Flood Response Plan (FRP), meanwhile, enables increased coordination and a more efficient response including the coordination of monitoring and tracking measures such as injury rates and economic loss. Both the FMP and FRP provide flood risk reduction measures significantly reduce risk of loss of life, flood-induced water-borne diseases, damage to property and loss of livelihoods.

KLCH is committed to developing a holistic FMP and FRP, including (1) developing appropriate forecasting systems, (2) partnering with community stakeholders to increase community-wide knowledge of FRP protocols, (3) establishing emergency-response communication channels, and (4) creating a framework to assist with the accelerated deployment of post-flood recovery efforts.

### Prioritised Action #E2

Heat Management & Response Plan

Adaptation

City Level

Kuala Lumpur is expected to endure more frequent extreme heat waves in the coming decades. The development and communication of a robust Heat Management Plan (HMP) and Heat Response Plan (HRP) is crucial so that public service providers, citizens, business and industry sectors are knowledgeable and prepared when extreme weather conditions hit. The HMP and HRP are also expected to reduce the impact of extreme heat on greenspace and biodiversity, as well as the human society throughout the city.

KLCH is set to develop a HMP that identifies priority areas with higher vulnerable populations, locations with higher urban heat stress, establishes mini-weather monitoring stations, and determines strategy to install cooling projects. In addition, the HRP to be drafted will include response guidelines with thresholds, communication strategy to raise awareness and engage vulnerable communities, and capacity building plan to cope with extreme heat events.

<sup>3</sup> 2010, Abushammala et al., Estimation of Methane Emission from Landfills in Malaysia using the IPCC 2006 FOD Model

<sup>4</sup> <https://www.dbkl.gov.my/en/perkhidmatan/servis-online/klcares/>



### Prioritised Action #E3

#### Drought Management & Response Plan

Adaptation Drought

##### City Level

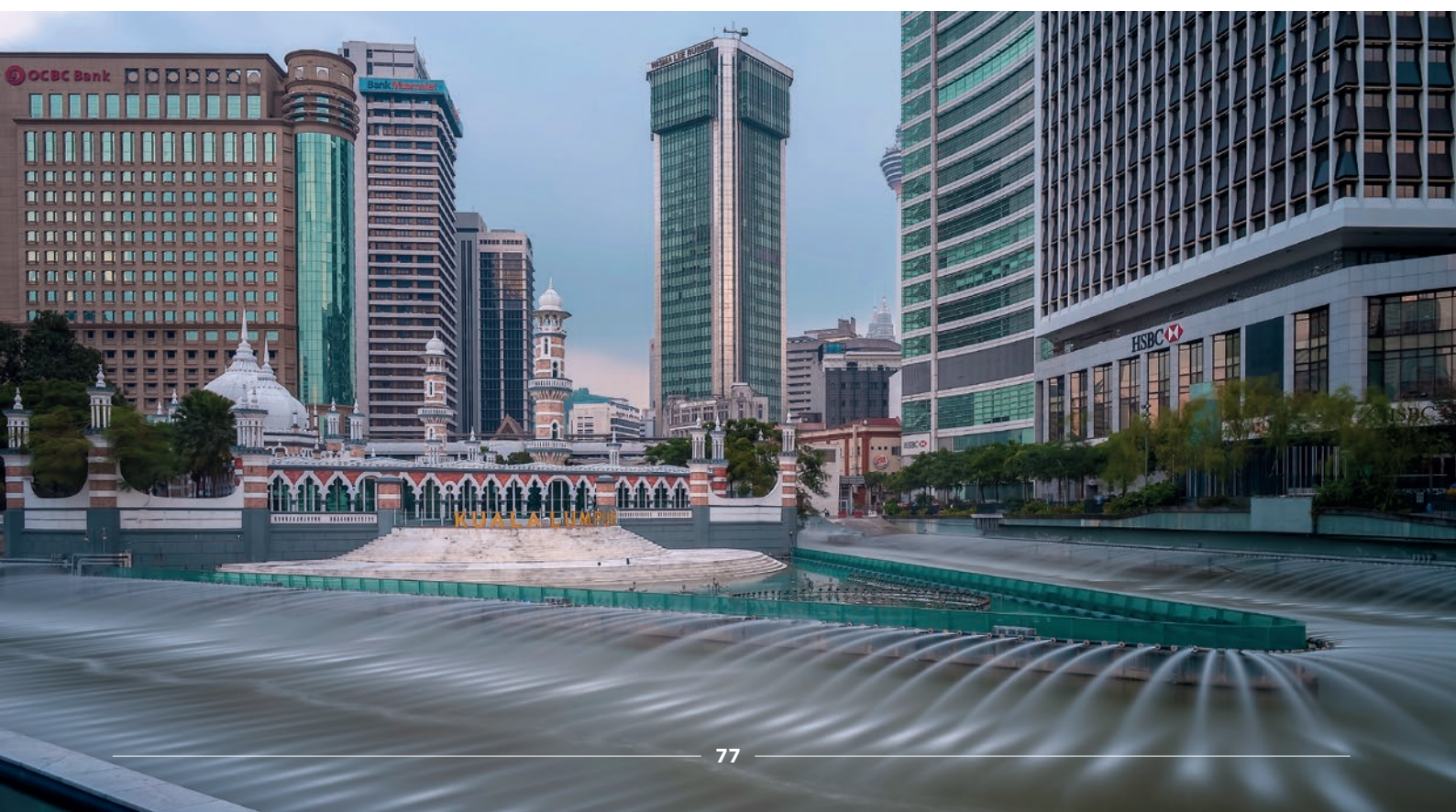
The implementation of an effective Drought Management Plan (DMP) can allow for earlier detection and response. To allow for an early response, it is crucial for mitigation procedures to be pre-defined in a Drought Response Plan (DRP). With the DMP and DRP in place, impact of extreme drought on greenspace and biodiversity throughout the city is expected to be reduced, and resilience in the provision of public services (water supply, sanitation, healthcare) can be achieved during drought conditions.

KLCH will develop a DMP that identifies priority areas, and takes in to account the impact of drought on differing end-users. For the DRP, KLCH aims to formulate a plan that provides guidelines, based on input from community stakeholders, and establishes expected response mobilisation procedures while ensuring that the community awareness is raised on the issue, in particular, on efficient water usage mechanisms such as installation of low flow taps, prior to drought events..

Due to the less frequent incidences of drought, synergies and piggy-backing opportunities should be explored to fund infrastructure projects to increase water storage at city-level. Additionally, sourcing alternative water from retention ponds and recycled wastewater during dry spells will be explored. Increasing efficient water use through awareness raising is an immediate priority for Kuala Lumpur.

### WHAT INCLUSIVE BENEFITS WILL DISASTER MANAGEMENT STRATEGY BRING?

1. The emphasis on community engagement enhances the roles and responsibilities across the community in management and response planning, strengthening social capital and improving adaptive capacity of individuals and communities.
2. Early warning systems that provide information via flexible communication methods, in multiple languages and for all types of citizens, can improve engagement and lead to disaster risk reduction. Weather tracking systems like KLCH's Multi-Hazard Platform (MHP) are being developed to forecast extraordinary weather events and provide early warning for high risk geographic areas.
2. Low-income communities, migrants, outdoor workers, the elderly, women, young people, and people with disabilities are among the most vulnerable in the face of disasters. With preparedness built through the Management and Response Plans, the impacts may be reduced. For example, maintaining access to education for schoolchildren would be improved post-disaster.





# Roadmaps for Delivering Kuala Lumpur's Transformative Actions

This section proposes implementation roadmaps for actions with the greatest potential to generate long-term climate resilience and emissions reductions; by effecting systemic changes while distributing benefits equitably. These transformative actions also offer immense opportunities for long term co-creation with stakeholders.

With climate actions, it is essential that they are planned to achieve milestones across the short-, medium- and long-term for their intended impact to be realised. Continuous and effective implementation, with diligent monitoring under a robust framework of governance within KLCH will determine the success and extent of the impacts of these strategies.

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## Roadmaps for Transformative Mobility & Infrastructure

As cities are hubs for its citizens to prosper through economic growth and activities, its infrastructure and systems on mobility must evolve to accommodate users of various modes of mobility, whilst balancing its impact on space and emissions. As traditional modes of transportation that are high in emissions are reduced and phased out, the space and function can be repurposed to reduce emissions within the city through infrastructure that can assist to mitigate and adapt to climate change.

By prioritising the design of streets to focus on active mobility, such as giving more space to pedestrians and cyclists, opportunities for rainwater storage and urban greening to piggyback on these new designs also arise and can provide adaptive capacity in mitigating climate risks such as flooding and heatwaves. Safer, cooler and increasingly extensive pedestrian networks are vital for connecting public transit hubs, housing and critical services whilst providing space for recreation and urban biodiversity to flourish. As businesses and communities are connected by pedestrian networks, urban safety and accessibility to various user groups can also be improved through strengthened social fabric and connectivity. Prioritising active mobility through street design hence provides not only a safe and comfortable pedestrian network, but also complements directly the expansion of green cover in Kuala Lumpur, increases the city's climate adaptability, helps to lower city temperature and helps manage heat exposure for users, which is identified as a climate risk for Kuala Lumpur.

The multiple co-benefits can only be realised through synergies between climate-focused mobility and urban infrastructure planning and development. With active mobility prioritised for street design, this would increase the comfort level and encourage more users to uptake public transport services provided. As public transport networks expand across the city, critical services and housing should be developed with pedestrianisation and street design for active mobility in mind to connect users with these improved infrastructure networks. Often the responsibility of separate departments and authorities, careful cooperation would be required in addition to consultation with citizen groups to ensure inclusivity and equity implications for citizens.

### **Justification**

As millions of journeys are made daily in Kuala Lumpur, whether by public transport, commercial vehicles or private vehicles, these trips contribute significantly to the greenhouse gas emissions produced in the city. This is especially applicable to Kuala Lumpur as the percentage of private fossil-fuel powered vehicles remains high at 80%. With high carbon emissions, air quality deteriorates causing health-related issues for citizens as well as increasing urban heat island (UHI) effects within the city, exacerbating climate risks such as heatwave and drought.

To create a city that is attractive and safe for pedestrians and cyclists, planners must complement the increasing network of public transport, only then can vehicle use

be decreased to reduce emissions, improve air quality, decrease noise pollution and allow active mobility to be more safe, comfortable, equitable and inclusive. However, this can only be achieved if the required infrastructure is in place.

This is why Kuala Lumpur has an interim target of having 50km of modified roads, enhanced first and last mile facilities at 75% of public transit stations within the central business district by 2025. Ultimately, Kuala Lumpur plans to have 300km of pedestrian network and 300km of dedicated bicycle lane networks in order to achieve its goals of 70% active mobility as modal share within its 2040 target. This is similar to the approach achieved by Singapore which already has a 75% of public transport modal share, encouraged by active mobility infrastructure in a tropical climate setting<sup>5</sup>.

The roadmap on page 80 highlights KLCH's key Mobility & Infrastructure targets over the short-term, medium-term and long-term.

### **Responsibilities and Partnerships**

As the primary department of planning and maintaining infrastructure in KLCH, Infrastructure Planning Department (JPIF) would lead in coordinating the actions within this group. However, it would most certainly work closely with the Urban Transportation Department (JPB) as well as Ministry of Transport (MOT) at the federal level to ensure regulations and standards are adhered to and to complement developments in public transport systems and infrastructure. On the non-governmental level, JPIF will engage citizen and user groups such as Cycling KL, disabled user groups and various Residents Associations to ensure their requirements and varying needs are considered during the planning and execution of actions. The multi-stakeholder approach ensures inclusivity of the actions in benefitting the citizens of the city whilst ensuring the investments into infrastructure by KLCH, ministries and also private corporations such as developers can genuinely unlock the value-add and functions as intended.

### **Prime Monitoring Indicators**

From the KLCH Monitoring, Evaluation and Reporting (MER) framework<sup>6</sup>, the following indicators are relevant to this group of actions:

- Percentage mode share of activity mobility
- Kilometers of pedestrian and cycling infrastructure installed
- PM2.5 and PM10 concentrations
- Total greenhouse gas emissions from transport (t CO<sub>2</sub>e)
- Percentage of population within 30–60 minutes of walking or cycling of critical services and opportunities

<sup>5</sup> Green Plan Singapore: <https://www.greenplan.gov.sg/key-focus-areas/our-targets/>

<sup>6</sup> KL Climate Action Plan Monitoring, Evaluation and Reporting (MER) framework



# Mobility & Infrastructure Strategic Roadmap

## Transformative Climate Actions

### 1A Street Design to Prioritise Active Mobility

### 1B Comfortable & Safe Pedestrian Networks

**2021**

Develop street design guidelines for Active Mobility with Universal Design integrated

11 Parliamentary Walkability Assessments with Residents per year

**2022**

1 Public Campaign on Walking and Cycling for a Livable City per year

Conduct assessment of first- and last mile infrastructure along primary public transportation corridor

**2025**

5 Traffic Calming Pilot Projects implemented per year

Enhanced first and last mile facilities at 12 CBD transit stations

Network of 50km of Pedestrian-prioritized Roads

Enhanced first and last mile facilities at a 75% of CBD transit stations

Develop citizen App to motivate Active Mobility through competitions

Install & improve street furniture and lighting around public transport stations

**2030**

150km Dedicated Bicycle Lane Network

Active mobility >50% of Mode Share

**2050**

300km dedicated bicycle lane network

Active mobility as >70% of Mode Share

300km of Pedestrian Prioritised Street Network

Legends:

Targets

Milestones

Actions

**Figure 28:** Roadmap for Delivering Climate Actions Under the Mobility and Infrastructure Strategy



## Roadmaps for Transformative Green Adaptive City

Kuala Lumpur, being a tropical city, enjoys abundant rainfall and a climate that is conducive for greenery to flourish. However, with rapid development throughout the city and its surroundings, its green spaces have dwindled and have implications towards the city's climate adaptive capacity and residents' wellbeing. As such, there has been conscious effort to retain and increase green spaces within Kuala Lumpur through protection and increase of existing forest reserves and parks through Kuala Lumpur Landscape Masterplan (LMP) at city level. The masterplan is a method to monitor existing green spaces, as well as an effort to increase green spaces through increasing tree planting and establishing pocket parks that are aligned and synchronised to achieve mid-term targets through 50km<sup>2</sup> of green spaces created and maintained, and achieving a 30% tree canopy coverage by 2030.

The importance of green spaces within Kuala Lumpur is also apparent in its role to ensure Low Impact Development (LID) can be pursued. This is especially important given Kuala Lumpur's propensity to suffer from flash floods given its tropical climate induced rainfall, as well as its situation with culverted river tributaries running throughout the city. By being mindful of the flood, heat

or drought risk of areas for proposed development, Kuala Lumpur can ensure its future development is resilient and not overly exposed to climate risks. Potential adaptive actions such as increasing linear urban parks along rivers and waterways can also further mitigate such risks. Increasing permeability of surfaces to manage flooding through depaving surfaces by establishing community landscaping or garden programmes is also another action which can serve as an inclusive measure for various resident groups in the city.

Co-benefits can only be realised through regular engagement and collaboration between departments in development planning, landscaping and engineering departments within Kuala Lumpur. By having a holistic consideration of impact of proposed development areas as well as its potential in increasing green spaces, KLCH would be able to ensure its 2050 target of 60km<sup>2</sup> of LID and five million trees planted, GPS tagged and inventoried, can be achieved. This encourages the city to increase its climate resilience by addressing in tandem Kuala Lumpur's identified climate risks of flooding, heat and drought in an integrated, piggy-backed and synergised manner.



<sup>7</sup> Ibid

## Justification

Green spaces are essential to the wellbeing of citizens, and simultaneously play a crucial role in climate adaptation as the climate changes. Within the city, green spaces such as parks, community gardens, water bodies, landscaping and greenery providing shade are crucial in providing reprieve for citizens and serve as spaces for communities to connect, contributing towards building social fabric which is essential for wellbeing. With mindful and conscious positioning of green spaces throughout the city, it can also serve as behavioural nudges in encouraging adoption of active mobility such as pedestrian or cycling paths if it provides shading and a sense of communal safety.

The larger impact of green spaces within the city is the adaptive capacity it can provide to changes from climate. The function of green spaces can significantly contribute towards permeability of surfaces which is key in mitigating flash floods due to the torrential rainfall that Kuala Lumpur experiences regularly. Besides this adaptive capacity of channelling rainfall to the tributaries and rivers within Kuala Lumpur, linear and pocket parks scattered throughout Kuala Lumpur as well as landscaping also contribute towards lowering the temperature within the city which assists in mitigating urban heat island (UHI) effects. This co-benefit is significant given heat and drought are both climate risks identified for Kuala Lumpur and it can work to ensure its citizens are not overly exposed, resulting in increased healthcare and productivity costs.

The roadmap on page 83 highlights KLCH's key Green Adaptive City targets over the short-term, medium-term and long-term.

## Responsibilities and Partnerships

The Landscape and Recreational Development Department (JPLR) is the lead department in conducting the vegetation

inventory and planning of green spaces, however it would not be truly effective without coordination with the City Planning Department (JPRB) for integration with overall city development planning and the Civil Engineering and Irrigation Department (JKAWS) for flooding and engineering infrastructure to be considered in tandem to mitigate climate risks of flooding as well as to identify areas suitable for LID implementation. In order to realise the synergy of enhancing adoption of active mobility with strategic landscaping, JPIF would also need to be engaged. Additionally, ministries such as the MEWA should be consulted, to ensure that national policy and KLCH's targets are aligned. Last but not least, citizen user groups should be regularly consulted and involved to maximise engagement and action implementation, and private corporations to sponsor initiatives such as pocket parks.

## Prime Monitoring Indicators

From the KLCH Monitoring, Evaluation and Reporting (MER) framework<sup>7</sup>, the following indicators are relevant to this group of actions:

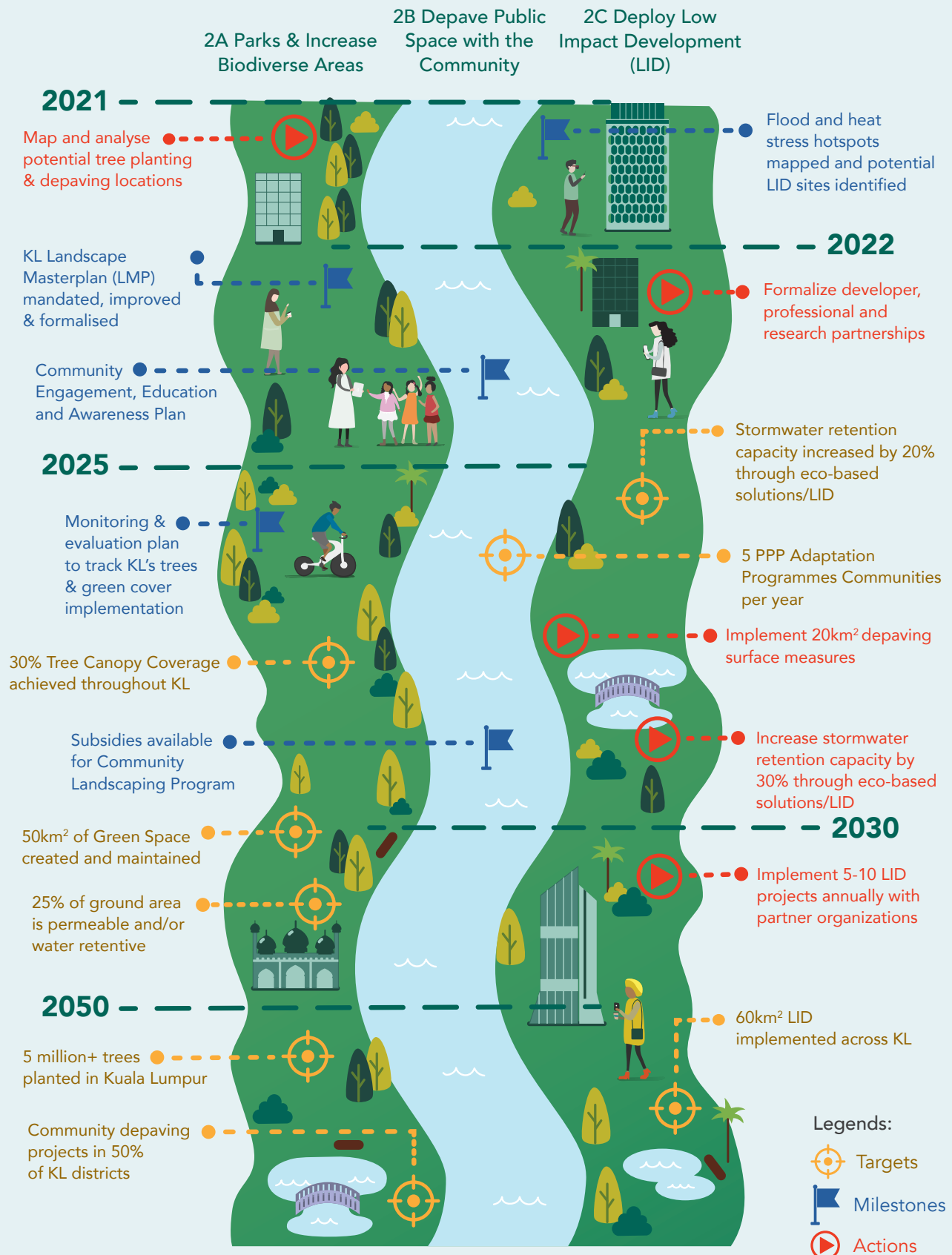
- LID—Volume of water retention capacity created (m<sup>3</sup>) (public and private space)
- LID—Area of vegetated green cover created (m<sup>2</sup>) (public and private space)
- LID—Number of LID measures installed
- LID—°C temperature difference between LID and Non-LID areas
- Community landscaping—% of target neighbourhoods committed to landscaping
- Community landscaping—°C temperature difference between paved and depaved spaces
- LMP—°C temperature difference between vegetated and non-vegetated areas
- LMP—% of population within walking distance of a green spaces



<sup>7</sup> Ibid.

# Green Adaptive City Strategic Roadmap

## Transformative Climate Actions



**Figure 29:** Roadmap for Delivering Climate Actions Under the Green Adaptive City Strategy



## Roadmaps for Transformative Energy Efficient & Climate-Proof Buildings

Buildings are one of the largest emitters of greenhouse gas in cities, and this is no exception for the city of Kuala Lumpur. Density within the city can also contribute to exacerbating climate risks such as heat, through urban heat island effect. Building guidelines and regulations have increasingly introduced energy efficiency or low carbon measures to mitigate these impacts. As a developed city, Kuala Lumpur is home to many public and private buildings that have been built over the past decades and will continue to see new developments being constructed into the future decades.

As a starting point to decrease carbon emissions reductions from the building sector, KLCH will introduce a Low Carbon Building Plan Checklist which will require Validation from Principle Submitting Person (PSP) and serve as a mechanism to extract crucial information on new buildings and major retrofits that influence the energy use from building operations over its lifespan. This Checklist will require building owners in Kuala Lumpur to incorporate and adopt low carbon measures for their buildings. At the same time, a Near Zero Emissions Building (NZEB) roadmap should be established. This action includes a phased timeline approach and serves to inform the community on adopting tighter standards for buildings over a long-term timespan. Targets set by KLCH in the building sector include ensuring that the Low Carbon Building (LCB) Checklist specifications is incorporated into the OSC Approval process and that 75% of all new or major retrofits will meet the requirements by 2025, this checklist will include Building Vegetation Covering targets as well.

Leading by example, KLCH aim to have more than 75% of its buildings meet the LCB Checklist Validation requirements whilst targeting more than 30% of all buildings (including privately-owned) to meet minimum energy consumption targets before 2050. These targets should be supported by various other existing KLLCSBP2030 actions such as Low Carbon Green Building Performance Rating and Benchmarking System based on BEI which will be established through collaboration with various stakeholders.

### Justification

Approval for new development of buildings is regulated by KLCH, and as such can be one of the most effective areas for Kuala Lumpur to introduce low carbon standards in order to realise greenhouse gas emissions reduction and co-benefits such as increasing vegetated cover of buildings to support decreasing the temperature within the city. With the national government and professional bodies such as the Malaysian Green Building Council

(MGBC) already providing and adopting low carbon and energy efficient building guidelines and regulations, Kuala Lumpur's existing and new buildings can realistically adopt these measures to realise the benefit of lower energy consumption and emissions. As KLCH manages most public housing, it is also an area where measures can be introduced without burdening the lower income group of citizens.

The roadmap on page 85 highlights KLCH's key Energy Efficient & Climate-Proof Buildings targets over the short-term, medium-term and long-term.

### Responsibilities and Partnerships

The lead department would be JPRB given it is responsible in approval of new and re-development requests for private buildings through the One Stop Centre (OSC) mechanism and Building Control Department (JKB) to ensure continuous monitoring and enforcement of compliance to standards. However, it would also be key for Project Management and Building Maintenance Department (JPPPB) to be involved given it governs DBKL owned buildings. In ensuring there is no undue burden for the lower socio-economic group in public housing, the Community Development and Urban Wellbeing Department (JPPPB) would also need to be engaged to ensure the measures are implemented with inclusive considerations for vulnerable groups.

### Prime Monitoring Indicators

From the DBKL Monitoring, Evaluation and Reporting (MER) framework<sup>8</sup>, the following indicators are relevant to this group of actions:

- Increasing the requirement of Building Vegetation Covering—Number or % of buildings with minimum vegetated covering on building implemented
- NZEB Roadmap—City council approval of near zero emissions building roadmap
- NZEB Roadmap—Number or % of proposed incentives for usage of roadmap (disaggregated for target audience)
- NZEB Roadmap—% of buildings the policy applies to or exceeding minimum requirements
- NZEB Roadmap—Number or % of residential and commercial buildings retrofitted
- LCB Checklist—% of all building floor area the LCB policies apply to (disaggregated to income level in neighbourhood)
- LCB Checklist—Benchmarking policy % of all new buildings the policy applies to
- LCB Checklist—Energy consumption of public buildings per year (kWh / m<sup>2</sup> / year)

<sup>8</sup> Ibid

# Energy Efficient & Climate-Proof Buildings Strategic Roadmap

## Transformative Climate Actions

### 3A Low Carbon Building Checklist Validation

### 3B Near Zero Emissions Building Roadmap

### 3C Building Vegetation Covering

2021

Engage industry, community & academia to develop LCB checklist

Develop Low Carbon GHG Building Roadmap & outline targets

2022

Roadmap targets applicable to all new residential and commercial buildings

2025

LCB Checklist legislated in OSC approval process

LCB Roadmap Subsidies available for 3-5 Pilot Projects

LCB guidelines expanded for all buildings and renovations in KL

Near-zero performance standards implemented across 10% of new buildings

>75% new building for comply to LCB Checklist

2030

10 Green Covering Projects Implemented

30 Green Building Vegetation Covering Projects Completed

2050

100% of Buildings meet LCB Checklist requirements

All commercial buildings meet target Building Energy Intensity (BEI)

Legends:

Targets

Milestones

Actions

Figure 30: Roadmap for Delivering Climate Actions in Energy Efficient and Climate-Proof Buildings Strategy

## Roadmaps for Transformative Smart Waste Management

Kuala Lumpur generates significant amounts of solid waste on a daily basis, and KLCH is responsible for managing solid waste for a large part of the city, and has outsourced waste collection via a concessionaire. As solid waste continues to increase in Kuala Lumpur, KLCH is determined to influence its citizens in reducing waste generation through public awareness and introduction of guidelines.

Kuala Lumpur is developing a Waste Masterplan where solid waste reduction measures are introduced. Within its jurisdiction, Kuala Lumpur plans to address solid waste management generation reduction at source through community engagement and education programmes, working with various mechanisms such as schools, public housing communities and private companies. These actions are intended to help Kuala Lumpur achieve its 2025 target of 10% reduction in domestic waste generation through improved source separation. It also aims to increase awareness by actively engaging residents, starting with social housing estates, as well as incorporate solid waste segregation and management requirement into OSC approval considerations by 2025. By these actions, Kuala Lumpur hopes to capitalise on harnessing value generation from waste treatment and disposal which can benefit vulnerable groups such as informal waste workers who currently remain segregated from the formal system. By 2050, Kuala Lumpur targets a solid waste diversion of more than 50% from landfill disposal.

Smart waste management would undoubtedly provide co-benefits such as reducing greenhouse gas emissions from landfills, as well as encourage citizens to reduce, reuse and recycle resources whenever possible. Additionally, if solid waste can be reduced, the funds being spent by KLCH on waste collection and management can be reduced, thereby freeing up resources that can be redirected to provide other services to its people.

### Disaster Management

The actions contained within the Disaster Management group has not been developed through a strategic roadmap as these are all new actions for KLCH. Further deliberation and discussion with relevant stakeholders, namely federal and other government agencies, is required prior to detailing an implementation roadmap and setting tangible targets. Due to the cross-boundary impacts of climate hazard events, much coordination will be required to successfully plan and implement these actions to ensure that synergies and piggy-backing is undertaken, trade-offs minimised and finally, malinvestment avoided.

### Justification

Waste management is an area where it is essential as a public service and has an unavoidable environmental impact of greenhouse gas emissions through conventional means of disposal. However, through smart waste management measures such as segregating, reusing and recycling materials as well as exploring how waste can be converted into value such as composting or landfill gas recapture, the measures can benefit the citizens through new channels of value as well as safeguarding their health by reducing emissions from landfills. By engaging communities on waste reduction and integrating informal waste sector workers, the actions can also improve equity and inclusion of society towards a common goal.

The roadmap on page 87 highlights KLCH's key Smart Waste Management targets over the short-term, medium-term and long-term.

### Responsibilities and Partnerships

The lead department is the Health and Safety Department (JKAS), however collaboration with the Licensing and Business Development Department (JPPP) and JPKKB would be key to ensure that private building owners of industrial, commercial and institutional premises as well as residents will be made aware, engaged and collaborate to achieve KLCH's targets. As jurisdiction of KLCH is limited, constant engagement with Ministry of Local Government and Housing (KPKT), waste management agency (SWCorp) and concessionaire (Alam Flora) would be critical in ensuring that targets and policies are not conflicting and remain ambitious. Non-governmental groups will also be key partners for KLCH especially involvement in raising public awareness. Private corporations can collaborate with KLCH in experimenting and exploring various waste management and value generation solutions that can be mutually beneficial.

### Prime Monitoring Indicators

From the DBKL Monitoring, Evaluation and Reporting (MER) framework<sup>9</sup>, the following indicators are relevant to this group of actions:

- Waste generated per capita (kg / person / year)
- Percentage % of the city's solid waste that is recycled
- Revenue recovered from recyclables (RM / year)

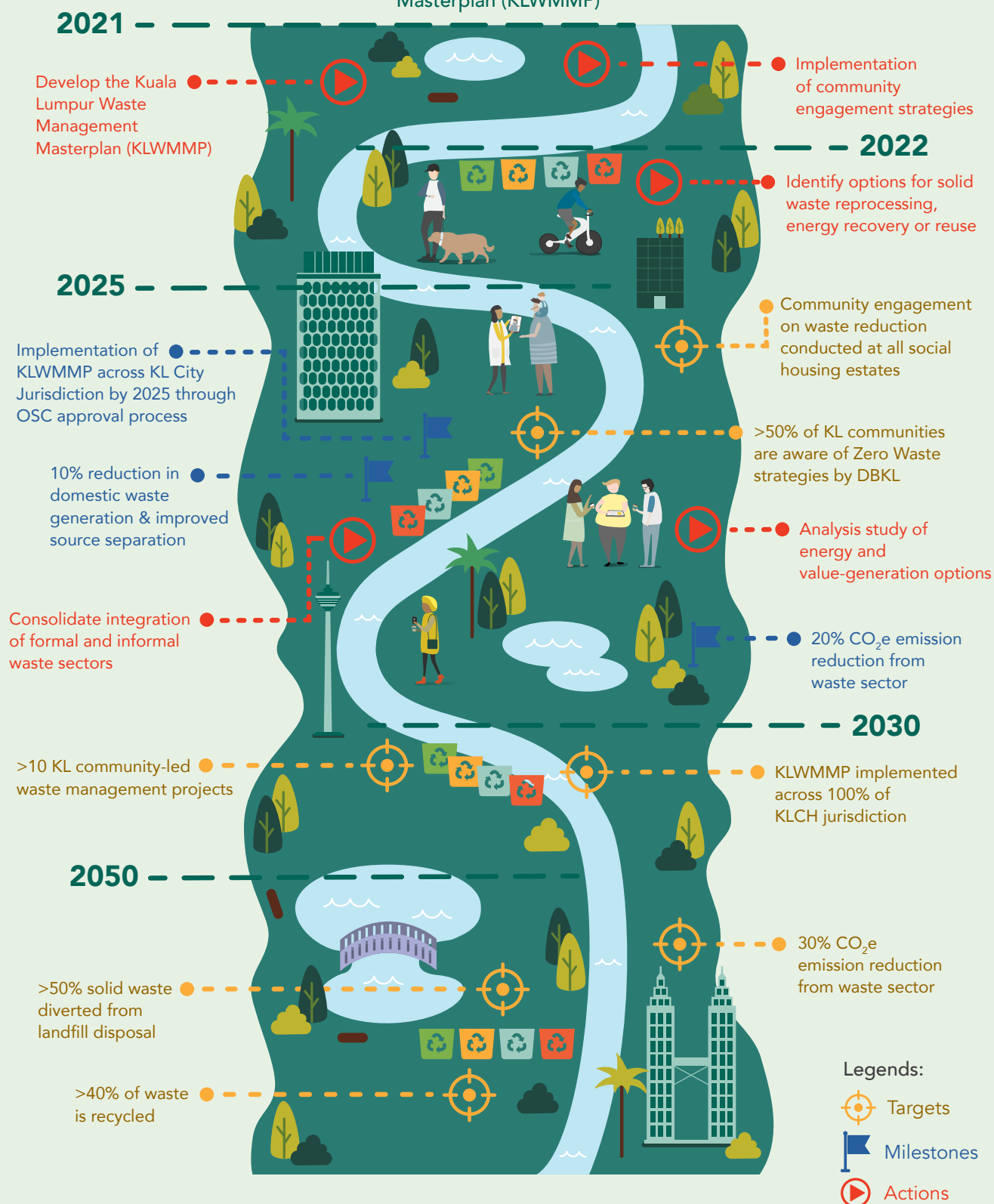
<sup>9</sup> Ibid



# Smart Waste Management Strategic Roadmap

## Transformative Climate Actions

4A Solid Waste Reduction, through  
the Kuala Lumpur Waste Management  
Masterplan (KLWMMP)



**Figure 31:** Roadmap for Delivering Climate Actions in Smart Waste Management Strategy

# 05 PLANNING FOR IMPLEMENTATION

Meaningful implementation of actions hinges on the ability of KLCH to govern them in an accountable manner.

A governance structure sets roles and responsibilities across KLCH for delivery, financing and coordination.

The monitoring, evaluation and reporting (MER) process details

KLCH's commitment to periodically communicate the progress and benefits of climate actions in Kuala Lumpur.



# Governance

KLCH is led by the Mayor of Kuala Lumpur; who is assisted by four Executive Directors, each of whom manages several of the 22 KLCH departments. Relating to climate action, the Kuala Lumpur Low Carbon Society Blueprint 2030 (KLLCSBP2030) mobilised a similar structure to govern the implementation of the 245 actions identified, with the Low Carbon Secretariat being the main coordinators.

For the development of the KLCAP2050, KLCH established an interdepartmental climate action planning working group overseen by the Low Carbon Secretariat, from the Sustainable City Unit of the City Planning Department. Since January 2020, the working group developed actions and set targets for the KLCAP2050.



Former KLCH Mayor Liaising with Minister of Housing and Local Government



## Governing Kuala Lumpur's Climate Actions

Sustaining the good governance from the climate action planning process is critical to follow-through with the implementation of the actions set out in the KLCAP2050.

A good governance structure establishes ownership and accountability for KLCH as well as KLCH's implementation partners and stakeholders. This is central to how the KLCAP2050 remains relevant, grows in ambition and remains at the forefront of the city's strategic priorities.

KLCH has identified that their current governance structure to execute the KLLCSBP2030 actions works well from an implementation perspective. However, improvements could be made in defining milestones, establishing targets and leading collaboration. There are also limitations in monitoring and evaluating climate actions, where positive and negative impacts of some actions may slip through the cracks as it is not being tracked or measured effectively.

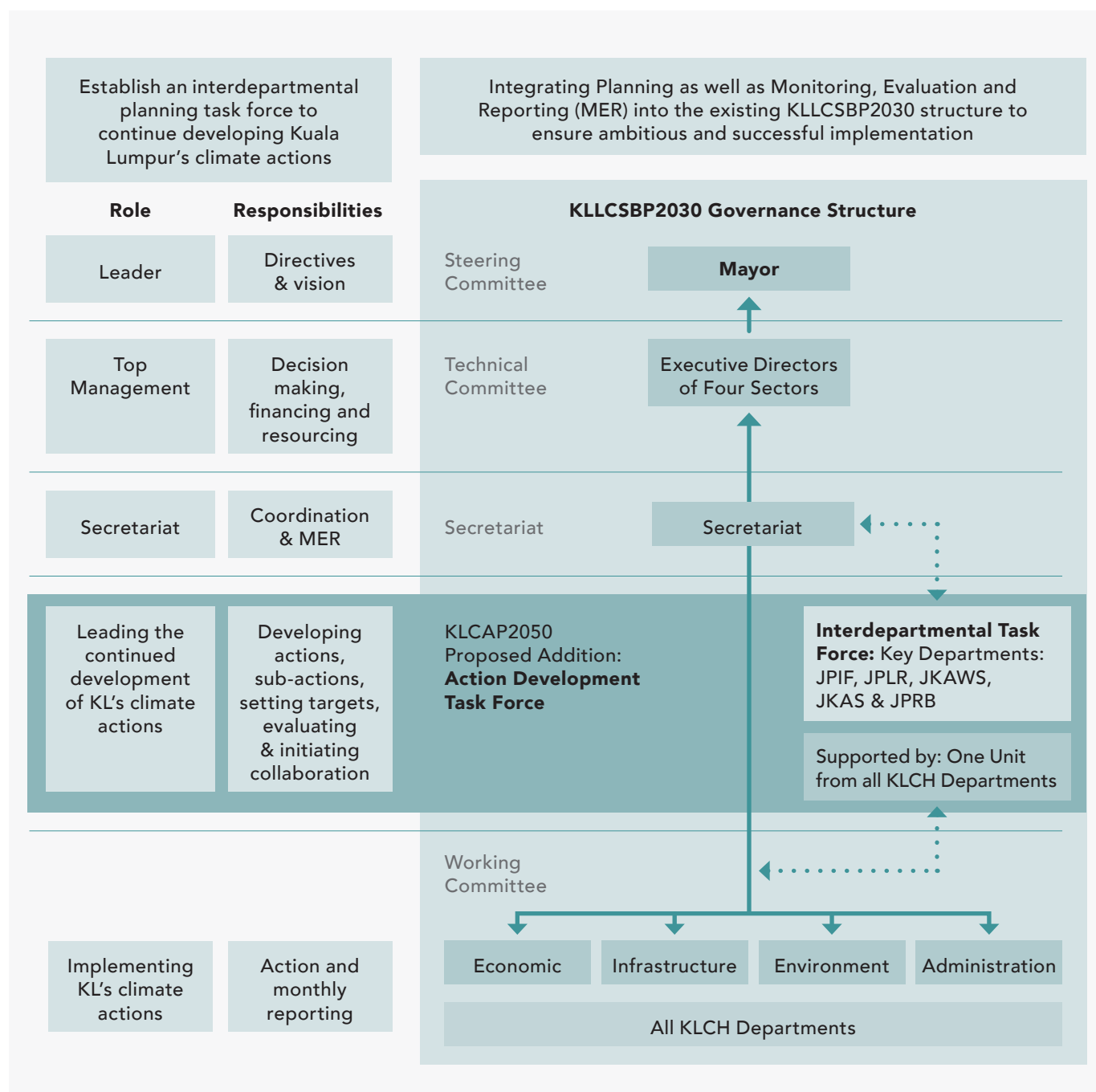



Figure 32: Proposed KLCH Climate Action Governance





KLCH will therefore establish an interdepartmental Task Force that will lead all required aspects climate actions development, in particular, actions from the KLLCSBP2030 that were deemed as high impact, but not prioritised to be explored in this KLCAP2050. This will require heavy coordination between departments and external stakeholders, and is crucial in ensuring that actions are implemented with high ambition and are approached in an integrated manner. The Task Force will also lead and initiate stakeholder engagement, both internal and external of KLCH, which will be crucial for well-coordinated advancement of climate action across multiple stakeholders. The proposed Governance Chart on page 90 maps this based on KLCH's existing climate action governance structure, as well as highlights the roles and responsibilities of each stakeholder or group of stakeholders.

KLCH will periodically assess the climate governance structure to ensure that the roles, responsibilities and relationships between city departments and key stakeholders are relevant and effective for climate action development and implementation. In parallel, implementation milestones should be incorporated into the ongoing responsibilities and key performance indicators (KPIs) of each department across the organisation.



# Mainstreaming, Resources & Financing

Opportunities exist to consolidate human resources, pool financing or funding from existing initiatives within KLCH's current budget allocation. Furthermore, there is a chance to lower the barriers to implementation by mainstreaming climate action in other related city policies, plans and programmes.

An example to illustrate the importance of mainstreaming; ensuring that the Landscape department is aware of the Infrastructure department's pedestrian routes upgrade, to ensure that tree planting along those routes is prioritised, and carried out simultaneously with construction works.

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## Mainstreaming Climate Action in Cities

Climate actions range from 'low hanging fruit' to difficult systemic changes that require multiple stakeholders for implementation. Cities must ensure that budget is allocated, and navigate various decision-making and approval mechanisms.

To achieve this, policymakers and development stakeholders should incorporate climate change actions into their new and existing sectoral policies and plans. This process is called mainstreaming and has the potential to<sup>1</sup>:

- Leverage existing resources, funding and finances already assigned to sectoral actions that relate to climate actions
- Contribute to more efficient use of resources through multifunctional solutions or saving money because of multiple benefits
- Reduce nuisance in daily lives by simultaneously implementing actions at one location
- Raise the profile of climate actions to increase support and commitment
- Improve the sustainability and scale of actions to create a window of opportunity for lower priority actions
- Avoid maladaptation or malinvestment

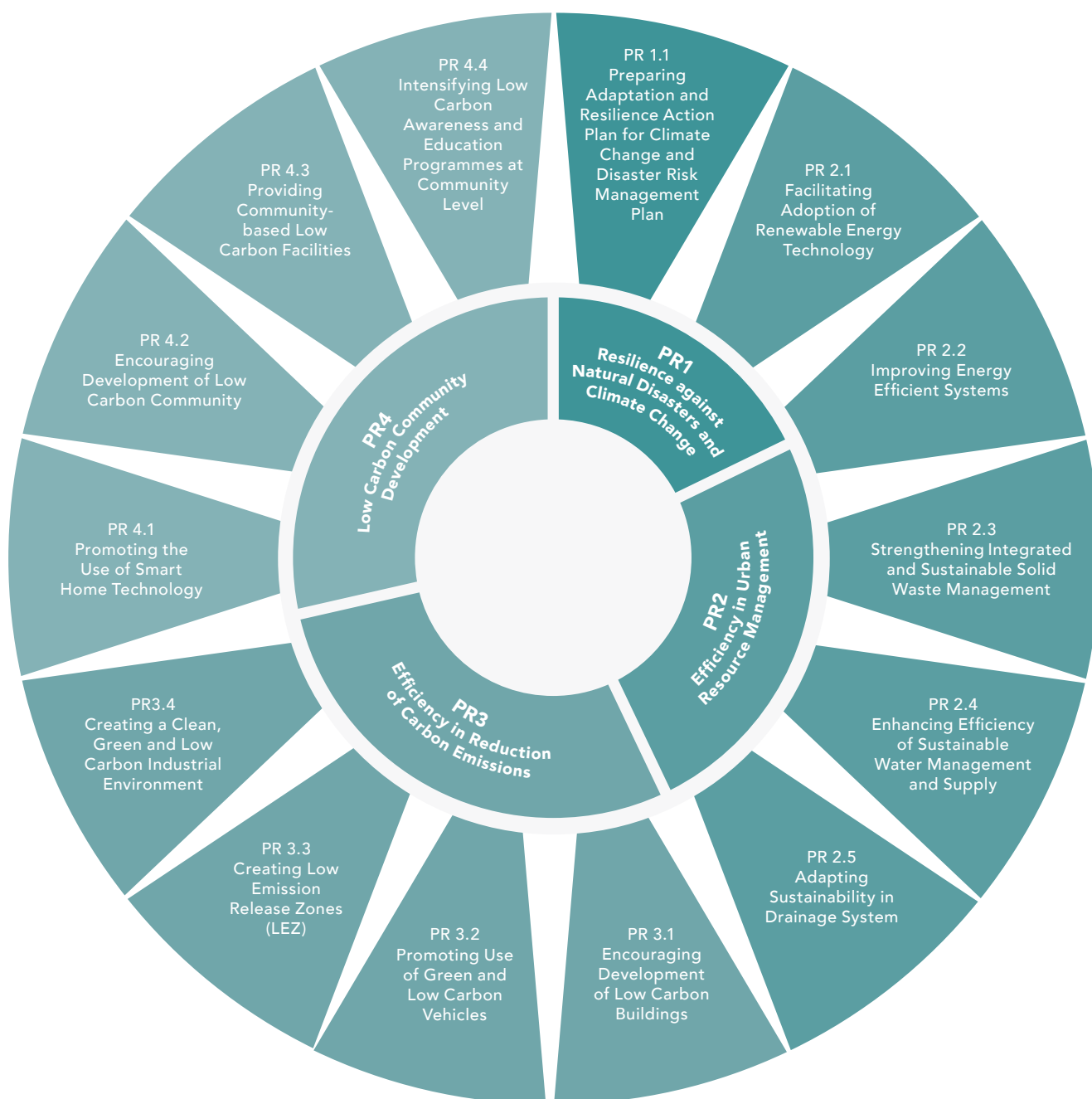
Ensuring sufficient stakeholder engagement and collaboration is crucial for city councils to progress climate actions, and the mainstreaming process can document this process in order to gain greater buy-in and support for climate action all-round.

For KLCH, it was noted that climate action was a key priority in the draft Structure Plan for Kuala Lumpur 2040 (SPKL2040) and 10 key climate-related priorities had been identified for the city of Kuala Lumpur. The Structure Plan guides policy development for Kuala Lumpur over 20 years, thereby highlighting KLCH's commitment to further development of targets and actions relating to the creation of a Climate Smart and Low Carbon Goal within the document.

KLCH is also developing several masterplans and blueprints contained in the KLCH Strategic Plan 2040, which have been identified to support the development and delivery of several climate actions. Like the roadmaps, the mainstreaming opportunities identified focus on four of the five climate groups deemed more transformative.

<sup>1</sup> <https://www.wri.org/publication/climate-planning-to-action>





**Figure 33:** Climate Actions that Have Been Integrated in the Draft SPKL2040

### **Focusing on Ambitious and Transformative Actions**

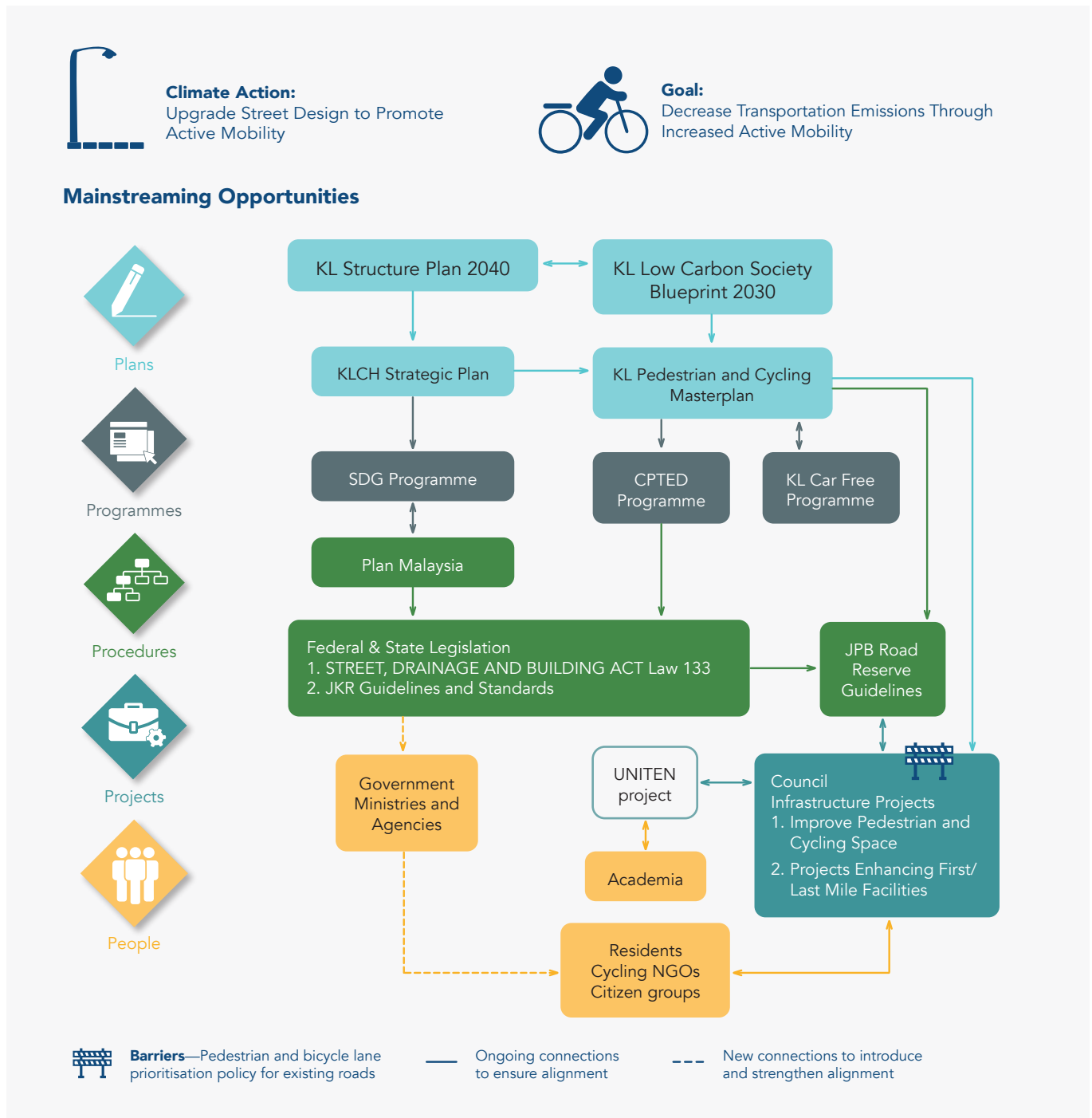
For mainstreaming opportunities to be identified, KLCH focused on key transformative climate actions which were more established and ambitious. These actions tend to tackle the root causes of climate risk by making fundamental changes to the city's systems and creating co-benefits, translating to actions that have the greatest capacity to provide long-term climate resilience and ambitious carbon emissions reduction potential. Additional co-benefits and long-term resilience of transformative actions offer great opportunities for stakeholder co-operation and co-creation.

Transformative actions tend to require:

- *Higher effort and greater cooperation among stakeholders*
- *Longer time span to realise benefits*
- *Greater inclusive co-benefits for city sectors and stakeholders*
- *Long-term resilience potential, often tackling root causes of climate change*

## Mainstreaming Mobility & Infrastructure Actions

The figure below highlights the opportunities to streamline upgrades to Street Design to Promote Active Mobility action. Through goals and strategies identified in KLCH's existing plans as well as programmes, procedures to improve road specification guidelines and projects to enhance first- and last-mile journeys can be developed to support each other.

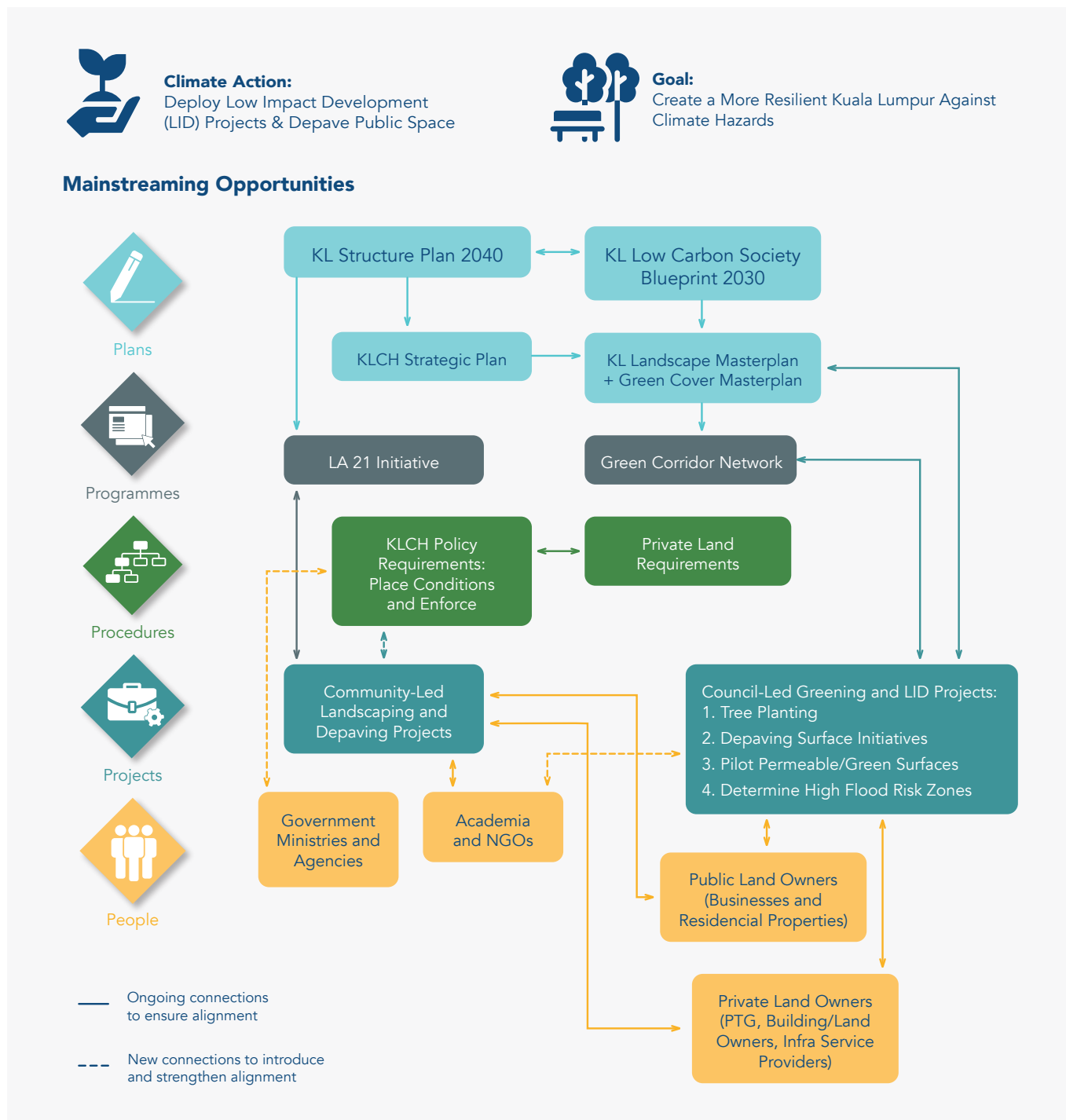


**Figure 34:** Mainstreaming Group 1—Mobility & Infrastructure

In order to progress the KLCAP2050 targets, KLCH will amplify current initiatives, such as increasing pedestrian and cycling priority routes as well as infrastructure provision, building on the increased ambitions required to achieve 2030 and eventually 2050 targets. KLCH have the opportunity to transition their focus to prioritise pedestrians and cyclists through policy and develop guidelines to lower motorised vehicle speed limits and create streets that are conducive for the uptake of active mobility uptake in order to decrease transportation carbon emissions. KLCH will be required to collaborate with multiple external stakeholders to ensure the success of the action, while also providing benefits to stakeholders, such as public transportation concessionaires who will benefit greatly from improved first- and last-mile routes to stations.

## Mainstreaming Green Adaptive City Actions

While at first glance KLCH lacks adaptation-focused actions, plenty of council projects had the potential to incorporate climate risk reduction and resilience-building opportunities. The Deployment of Low Impact Development (LID) projects and Depaving of Public Space are closely linked, with both actions aiming to employ nature-based solutions such as increasing surface permeability and vegetation in the city of Kuala Lumpur to decrease the impacts of flooding and the urban heat island (UHI). Through council and agency collaboration, as well as public-private-partnerships, KLCH's ambitions can be amplified for a more green and resilient Kuala Lumpur.



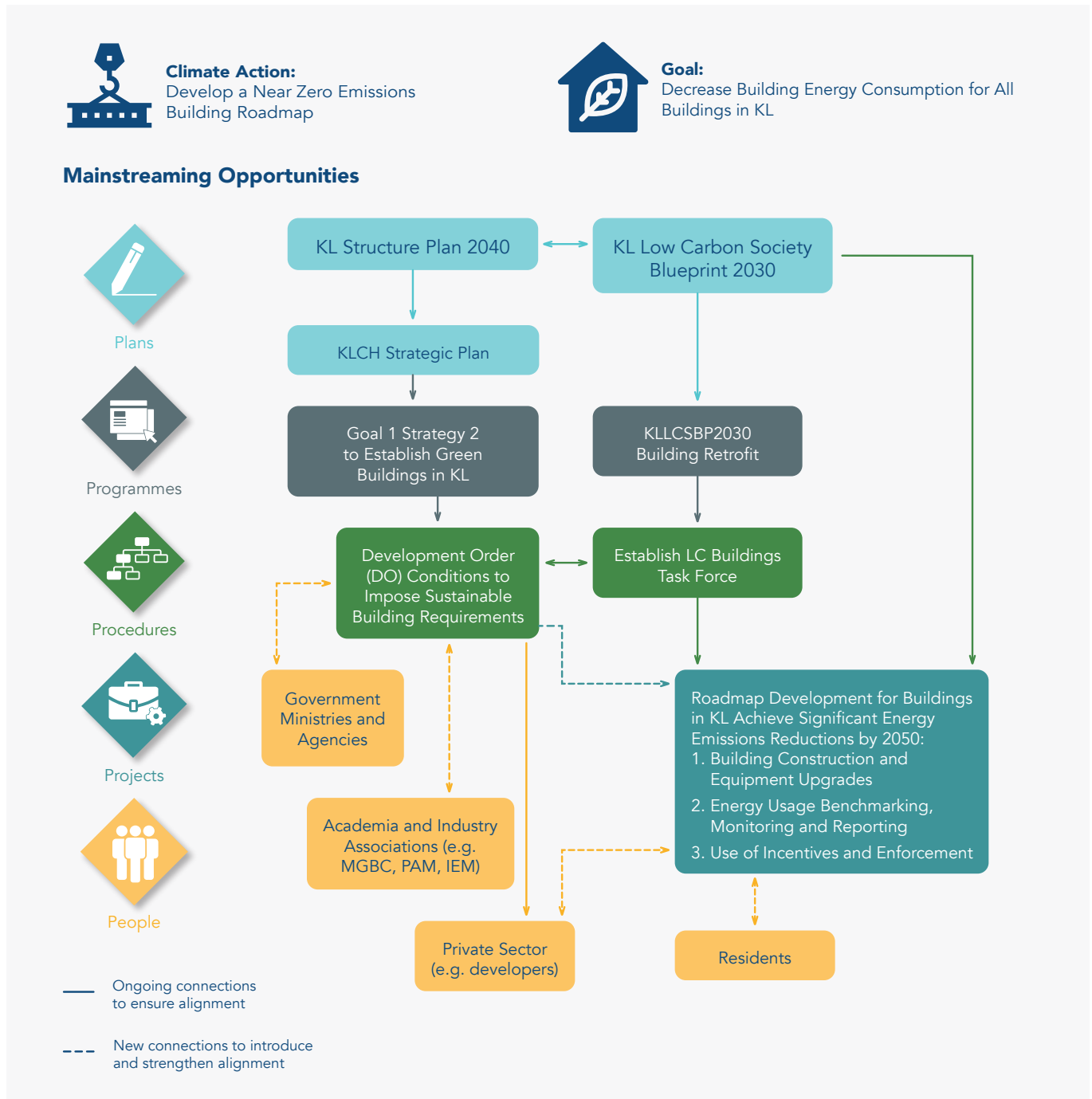
**Figure 35:** Mainstreaming Group 2—Green Adaptive City

While KLCH may be able to implement actions on public land, a large part of the city comprises of privately-owned land, requiring KLCH to engage and collaborate with stakeholders, while increasing awareness and providing incentives for residents and business owners to take on revegetation projects of their own. Understanding the indirectly related initiatives that can support the delivery of the action's objectives will allow lead departments to ensure that coordination is undertaken for action implementation success.



## Mainstreaming Energy Efficient & Climate-Proof Building Actions

KLCH has existing building-related policies in place which currently only apply to new buildings, particularly in the commercial sector. The Near Zero Emissions Building Roadmap is to be built upon KLCH's existing OSC policies. It will increase the stringent regulations to be put in place over the years, and include strategies to improve the energy efficiency and climate resilience of existing buildings.



**Figure 36:** Mainstreaming Group 3—Energy Efficient and Climate-Proof Buildings

Through engaging and collaborating with industry associations as well as the community at large, KLCH will be able to raise awareness, build capacity and incentivise private building retrofits. To lead by example, KLCH will increase their ambition to improve the energy efficiency and climate resilience of their own assets. This action must be mainstreamed across several existing KLCH initiatives, as well as KLCAP2050 and KLLCSBP2030 actions, as their objectives are very similar—to decrease building energy consumption and therefore, carbon emissions. As such, KLCH must approach this long-term and ambitious action through collaboration and heavy involvement with various stakeholders. Excluding stakeholder involvement will increase the risk in failure for the city's building stock to decrease its emissions over the next few decades.

## Mainstreaming Solid Waste Management Actions

KLCH is responsible for solid waste management for a large part of the municipality of Kuala Lumpur, with the exemption of private commercial areas and high-rise residential developments. Implementing waste collection and mandating solid waste, however, fall under different agencies, and so require ample collaboration.

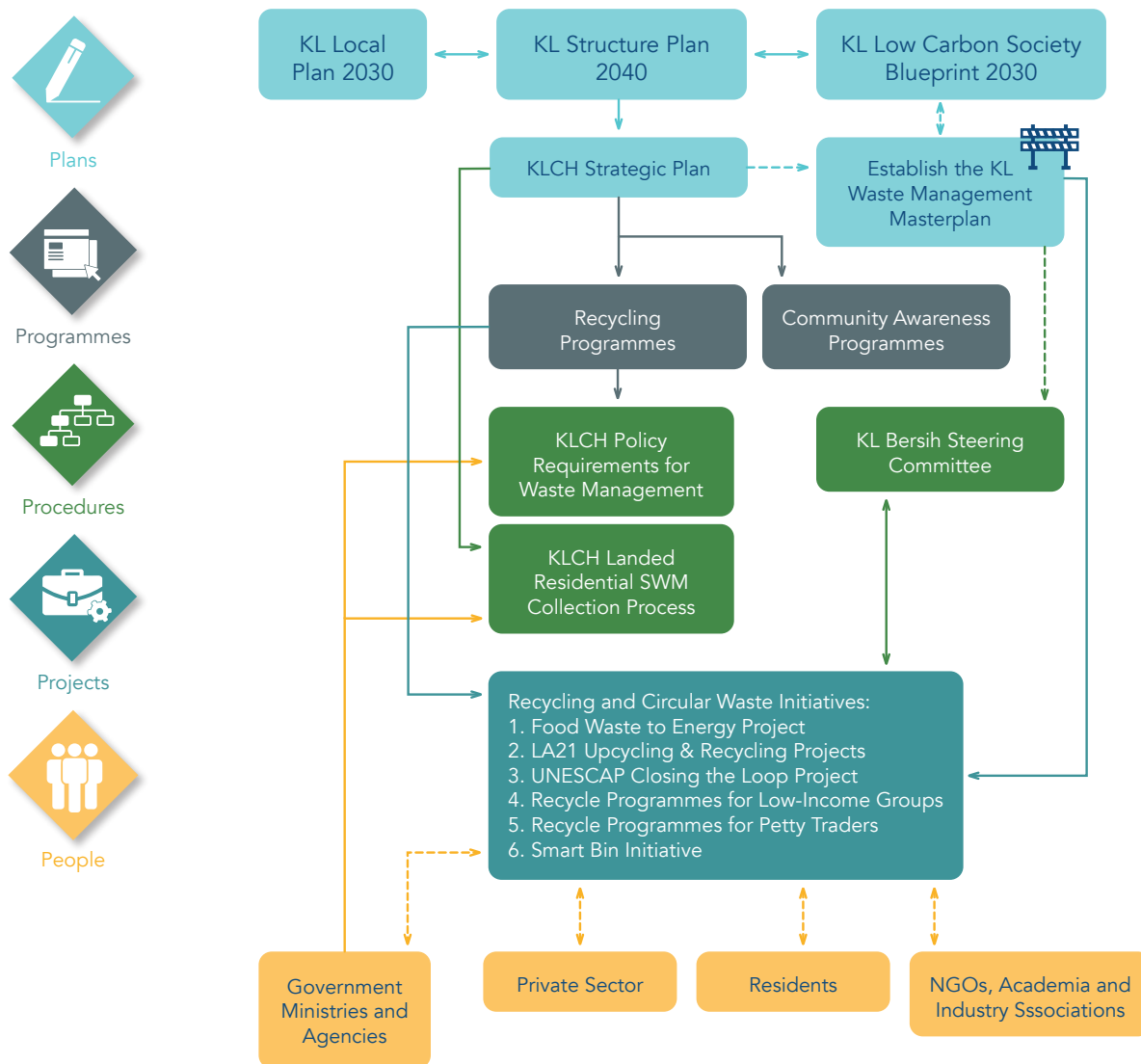


**Climate Action:**  
Establish Solid Waste Reduction  
Through a Waste Masterplan



**Goal:**  
Decrease Waste Generation of the City

### Mainstreaming Opportunities



**Barriers**—Waste collection and disposal is currently depending on external stakeholders. Note that it is important to include these external stakeholders in creating and implementing the KLWMMP. Different jurisdiction limitation between government agencies include KLCH.

— Ongoing connections to ensure alignment

- - - New connections to introduce and strengthen alignment

**Figure 37:** Mainstreaming Group 4—Smart Waste Management

KLCH aim to decrease solid waste generation as well as increase recycling through stakeholder engagement as well as awareness raising campaigns. Additionally, KLCH will continue collaborating and expanding their current programmes with NGOs in schools and social housing estates. Due to the lacking authority for KLCH to enforce solid waste management malpractice and mismanagement, it is critical that there is close collaboration with their key stakeholders—SWCorp and Alam Flora.

## Consistently Working to Mainstream

Mainstreaming climate action is not always straightforward or easy. There are barriers to overcome, such as organisational structures, political factors and resource constraints<sup>2</sup>. As KLCH moves forward with implementation, it will consider the following ingredients to achieving mainstreaming. In addition to monitoring and evaluating the implementation of climate actions, KLCH should also take mainstreaming opportunities for climate actions as they arise in the dynamic, changing and growing city of Kuala Lumpur.



Current KLCH Mayor and Federal Territory Minister Visiting Kuala Lumpur's Parks

## Human Resources for Climate Action Implementation

While the city of Kuala Lumpur has made significant progress with developing and implementing mitigation-related climate actions, the level of awareness and capacity in relation to adaptation-related climate actions is not yet well established.

Without adequate capacity and relevant know-how within KLCH and across the entire municipality, it will be difficult to deliver on action implementation. Milestones and mainstreaming opportunities to consolidate efforts would be delayed or limited.

Within KLCH, the management and planning of climate-related actions is undertaken by the Low Carbon Secretariat, while growing awareness and capacity is the responsibility of the training arm of KLCH, under the Human Resources (HR) Department. The HR Department are also in charge of rolling out Sustainable Development Goal training from 2021, which will greatly assist in raising awareness of the link between mitigation, adaptation, and inclusivity as well as governance and collaboration.

<sup>2</sup> For an elaborate summary of mainstreaming barriers: see Runhaar et al (2017) Mainstreaming climate adaptation: taking stock about "what works" from empirical research worldwide. Resource: <https://link.springer.com/article/10.1007/s10113-017-1259-5>



**“We owe it to the city’s stakeholders who are paying the salaries of some 10,000 full-time and part-time City Hall employees, which is an estimated RM540mil of taxpayer money.... That is why we need to give back to the community through capacity building, by developing, nurturing and strengthening the skills as well as changing the mindsets and attitudes of DBKL<sup>3</sup> staff.”<sup>4</sup>**

**—The Mayor of Kuala Lumpur,  
Datuk Seri Mahadi Che Ngah on perennial issues of Kuala Lumpur**

Moving forward, KLCH will consider embedding climate-related targets into department-level Key Performance Indicators (KPIs). Integrating climate action into departmental and team KPIs related to their work function will encourage departments to ensure that their plans, programmes, procedures and projects are working towards KLCH’s overall climate action targets.

Beyond these initiatives for KLCH’s staff and departments, the council aims to build capacity on conducting meaningful stakeholder engagement in order for KLCH employees to successfully work toward collaboration, raising awareness as well as build civic responsibility among Kuala Lumpur’s population.

This is in-line with KLCH’s long-term vision, ‘A City for All’; building capacity to engage, include and respond to the people it serves is a priority for the Mayor. Kuala Lumpur’s population will play a crucial role in establishing, contributing and actively participating in the implementation of climate action across the city. It is imperative that KLCH endeavours to collaborate with residents, not only on its journey in the development and implementation of climate action, but also on broader issues around climate change and inclusivity and equity.

KLCH has acknowledged that without adequate public engagement and involvement, the actions they implement will not be a success. The Climate Action Plan focuses only on several prioritised actions, many of which include community collaboration, as well as campaigns and programmes to raise awareness. The latter are especially crucial for actions that, due to current limitations on KLCH’s city powers, rely on active involvement across the private sector and the community.

## **City Budgets & Climate Action Financing**

KLCH has an annual budget and expenditure that is derived mostly through licensing fees and property taxes or assessment rates. To date, this has been found to be sufficient to fund KLCH’s programmes. The planning and mechanisms for funding KLCH activities are also based on an annual schedule, with departments designing proposed projects and requesting the necessary budget and finances at the start of the year.

As the capital city of Malaysia, KLCH receives financing and support from several ministries and agencies of the Federal Government, which can be mobilised for larger-scale implementation of climate actions across the city. This funding is not as secure and relies on Federal priorities, which are dependent on the political climate. KLCH has also received international capacity-building and funding for the development of climate-related actions, such as support from the Tokyo Metropolitan Government and the UK Government. This financing has enabled KLCH to carry out initiatives and project support through awareness raising, knowledge sharing and capacity building.

KLCH has a positive outlook on its capacity to self-fund climate action projects, but acknowledges that a pipeline of long-term action planning, development and funding is needed to ensure that financing for projects does not abruptly fall short of achieving carbon neutrality, climate resilience and inclusive action by 2050.

<sup>3</sup> DBKL, Dewan Bandaraya Kuala Lumpur is the name of KLCH in Malay.

<sup>4</sup> 2020, Bavani M, The Star Online, Three Core Issues on the Mayoral Agenda, <https://www.thestar.com.my/metro/metro-news/2020/11/16/three-core-issues-on-the-mayoral-agenda>

# Barriers & Conditionalities for Climate Action in Kuala Lumpur

KLCH has set forth many climate actions and roadmaps for implementation. However, this is not enough to ensure a successful Climate Action Plan. In order to achieve carbon neutrality and climate resilience in the city, KLCH will need to overcome several key barriers and unlock conditional requirements for implementing several climate actions.

## Legal & Institutional

KLCH lacks legal authority over several sectors that are key to the implementation of particular strategies or actions. Sectors such as energy generation and supply, for example, are centrally controlled at Federal level. With the authority split between a Federal agency and the electricity concessionaire, KLCH is itself unable to implement actions or policy requiring decarbonisation of the electricity grid.

Similarly, the push towards electric vehicle (EV) uptake is difficult for KLCH alone to achieve. The regulation for vehicle emissions is controlled by transportation agencies, while tax exemptions and incentives to purchase EVs are managed by the federal-level Ministry of Finance. While KLCH can raise awareness and encourage Kuala Lumpur's population, it will need to engage other government agencies to fully realise this ambition.

Though laws or regulations may prevent or limit KLCH's climate action implementation capacities, KLCH can and will play an active role in initiating engagement and collaborating with stakeholders to implement projects that extend beyond their areas of authority.

To exemplify this, KLCH has begun collaborating with TNB on the installation of renewable energy generation equipment on council assets, to set a precedent for private buildings. The MoU between KLCH and TNB will yield benefits for both organisations to achieve their targets and also support the national renewable energy targets of 20% in 2025<sup>5</sup> (and subsequent longer-term targets). This collaborative relationship can possibly extend to include energy efficiency projects through TNB's smart metering programme expected in early 2022. This will greatly assist in KLCH's energy efficient and climate-proof buildings strategies, including benchmarking building energy consumption prior to grading buildings.

**“But neither do we want to close the door on the possibility of e-scooters without thinking things through first.”<sup>6</sup>**

—The Mayor of Kuala Lumpur,  
Datuk Seri Mahadi Che Ngah  
on e-scooters

KLCH will also focus its own resources to accelerate progress across those areas where it does have the requisite control. Under the leadership of the Mayor, the council is studying safe mechanisms to introduce and encourage personal mobility devices (PMDs) such as e-scooters into the urban streets despite the Police making it illegal to use on all roads. This may help to reduce high levels of personal vehicle usage and traffic congestion, both of which are large contributors to carbon emissions and air pollution. The KLSP2040 and this KLCAP2050 identify the next steps for developing road design guidelines that will take into account users of bicycles and low-speed PMDs such as e-scooters, while also potentially designating pedestrianised streets<sup>7</sup> for the promotion of active mobility.

## Financial & Economic


The ability of KLCH to implement its Climate Action Plan may be constrained by insufficient financial resources, or by rules which restrict KLCH expenditure from being applied in particular ways. Further barriers may limit KLCH's options to access finance from the private commercial sector and/or from international climate finance such as development banks, with the latter typically funding national governments rather than sub-national entities directly.

<sup>5</sup> The Edge Markets Online, Building on the Tenaga legacy for a brighter future, <https://www.theedgemarkets.com/content/advertise/building-on-the-tenaga-legacy-for-a-brighter-future>

<sup>6</sup> Bavani M, The Star Online, DBKL not ready to dismiss use of e-scooters, <https://www.thestar.com.my/metro/metro-news/2021/01/04/dbkl-not-ready-to-dismiss-use-of-e-scooters>

<sup>7</sup> 2020, Veena Babulal, The Star Online, KL wants to pedestrianise 10 roads by 2025, <https://www.nst.com.my/news/nation/2020/02/563965/kl-wants-pedestrianise-10-roads-2025>





A key barrier associated with national policy that directly relates to the current high level of carbon emissions in Kuala Lumpur is the subsidising of the cost of fossil fuels by the national government. This does not encourage Kuala Lumpur's businesses or citizens to undertake retrofitting of buildings to decrease heat gain, nor to invest in more efficient energy-consuming equipment such as air conditioners and refrigerators, and electric vehicles.

The development of the KLCAP2050 has provided opportunities for conversations between KLCH and agencies such as the Energy Commission (Suruhanjaya Tenaga, or ST) and the Ministry of Transport (MOT). More of these multi-level government discussions and collaborations should take place, initiated by KLCH where appropriate.

At the same time, KLCH does have authority and will focus its own efforts and resources in accelerating actions within its control. One such key programme that will begin in 2021 is the progressive electrification of the KLCH-operated GoKL, a public transportation bus fleet.<sup>8</sup> This highlights the city's commitment, as well as serves as a pilot programme for other public and private transportation agencies to move towards the electrification of their own fleets.

<sup>8</sup> 2020, Bernama, The Malay Mail, DBKL to allocate reduced Budget of RM2.653b for 2021, says mayor, <https://www.malaymail.com/news/malaysia/2020/12/17/dbkl-to-allocate-reduced-budget-of-rm2.653b-for-2021-says-mayor/1932847>



## Political & Social

For the Climate Action Plan to be successfully implemented, it will require political and public acceptance and support. KLCH remains dedicated to advancing the identified climate actions, while understanding the potential for conflicts of interest between federal and local authorities, such as the drive to develop highways and high-end development, despite an oversupply of unaffordable homes and unoccupied offices. KLCH is committed to engaging with relevant federal agencies to achieve socially, economically and environmentally beneficial solutions to any conflicting agendas. KLCH will also focus on climate action in areas where it has control, such as improving the infrastructure of Kuala Lumpur to achieve its vision of 'A City for All'.

KLCH noted through its KLLCSBP2030 the need for a Low Carbon Task Force to be established to lead the development of low carbon initiatives as well as foster collaboration with relevant agencies, the private sector and the community at large, in order to ensure that Kuala Lumpur's climate targets can be met unhindered. Based on the addition to the KLCAP2050, the task force can be expanded to become the Low Carbon & Resilient Cities Secretariat.

The LA21 programme is an example of KLCH's successful implementation of various Public-Private-Partnership (PPP) projects, with community-led implementation. Moving forward, the LA21 programme will scale up its implementation and will also increase its scope and ambition to integrate climate change adaptation targets.

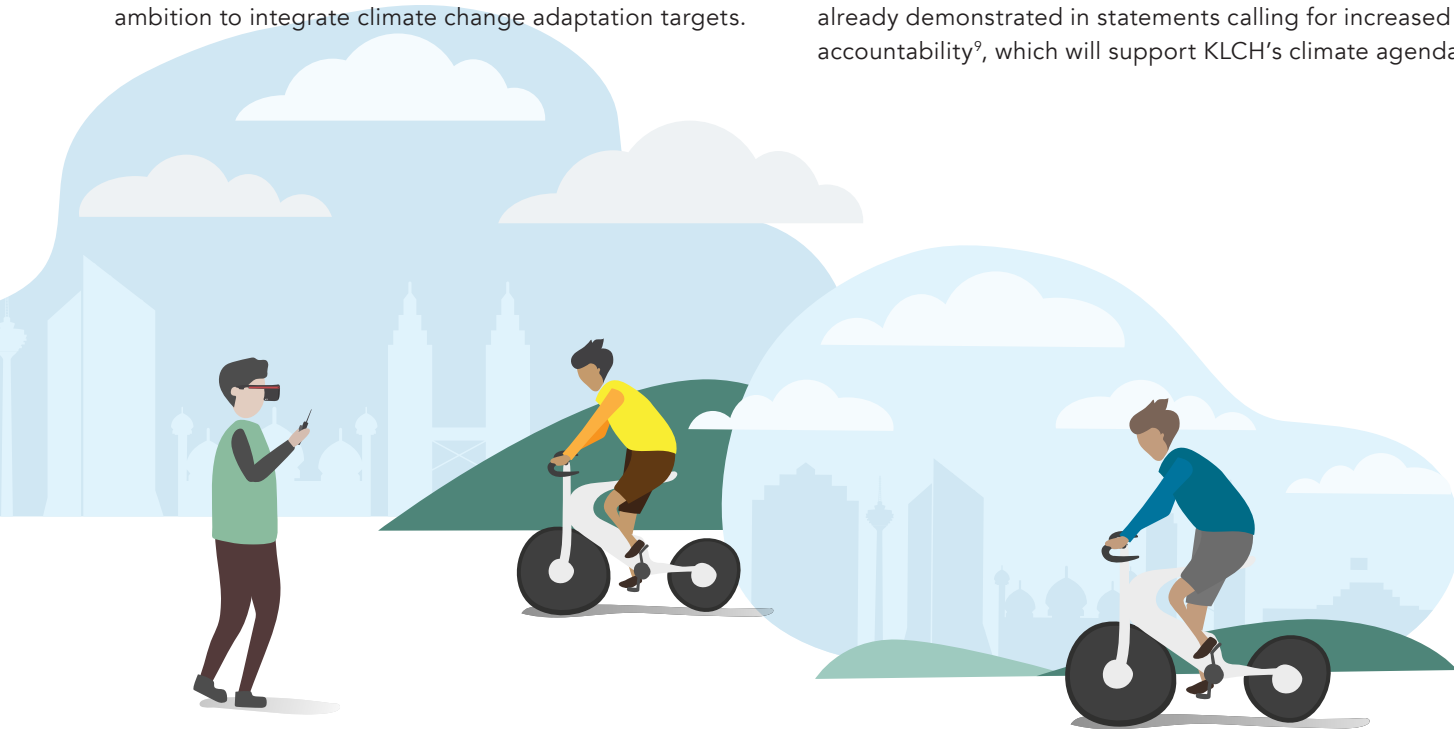
## Practical & Technological

Kuala Lumpur's progress in addressing the call to action implementation may be constrained by practical limitations, such as the level of development and availability of required technologies to facilitate key actions. For example, the current lack of digital infrastructure for high-quality daily data on transportation mode share. Due to the central location of Kuala Lumpur within the Klang Valley conurbation, large volumes of vehicles move, visit, circulate within and pass through KLCH each day. While it will take some years, KLCH is aiming to improve data collection mechanisms through the upgrading of road traffic surveillance cameras. When the project is completed, KLCH will be able to more accurately monitor the success of its transport policies and projects, as well as improve the accuracy of future GHG inventories.

### **Overcoming Barriers Through Collaboration**

KLCH is determined not to allow existing barriers to obstruct progress towards achieving its long-term climate goals and targets. KLCH will pave the way for better integration and roll-out of climate actions. As the 'caretakers' of the capital city of Malaysia, KLCH will lobby for greater parliamentary support for local climate actions, including amendment of by-laws and enforcement of recycling and vehicle speed limits regulations.

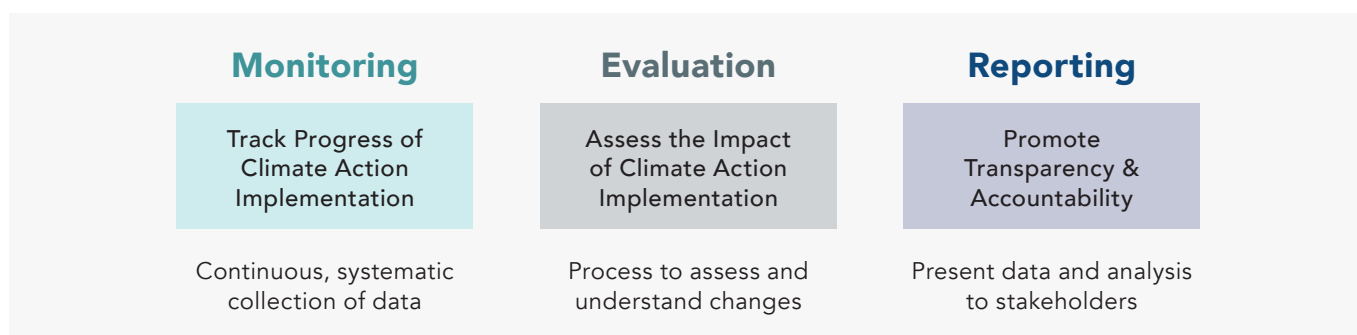
KLCH under the leadership of the current Mayor is determined to create a safe and sustainable city for its residents. Increased transparency with projects, along with a harder stance on government-linked contractors, are already demonstrated in statements calling for increased accountability<sup>9</sup>, which will support KLCH's climate agenda.



<sup>9</sup> 2021, Bavani M, The Star Online, Digging up causes of hole issue, <https://www.thestar.com.my/metro/metro-news/2021/02/08/digging-up-causes-of-hole-issue>

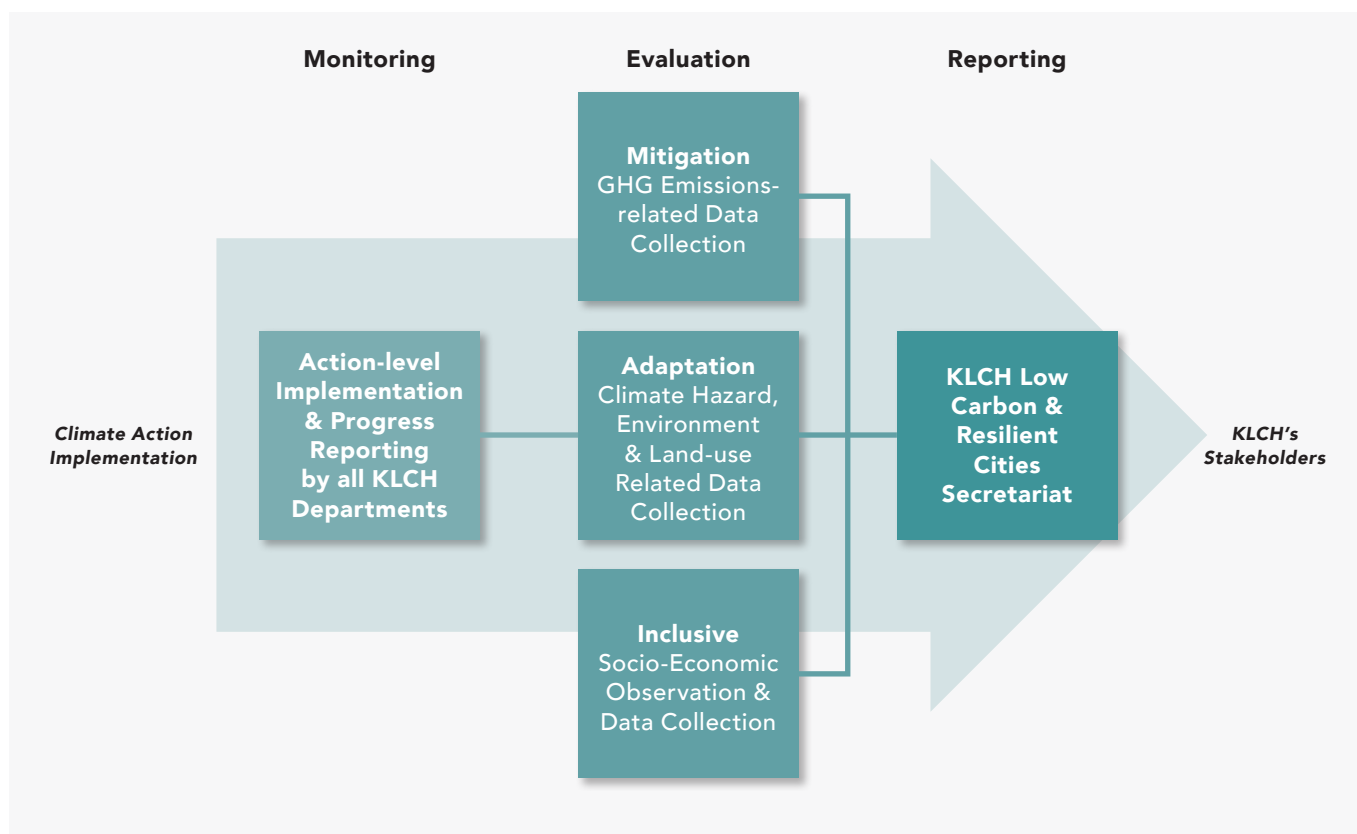
# Monitoring, Evaluation and Reporting Within KLCH

Developing and implementing a climate action plan is not a 'one-off' exercise. It requires continuous monitoring, evaluation and reporting (MER) of progress and periodic updates. MER will allow for actions to be tracked, assessed and reported in an organised manner to promote KLCH's accountability in the implementation of its climate actions.



**Figure 38:** Why Do We Need to Monitor, Evaluate and Report Climate Actions?

This section builds upon the previous governance structure found in the earlier part of this chapter and identifies the mechanism for climate action-level MER. The Figure below demonstrates the flow of information and responsible parties based on the collective effort of KLCH departments. Actions should be monitored on a monthly basis; and depending on the climate action, progress is to be evaluated by KLCH quarterly, biannually or annual.



**Figure 39:** Kuala Lumpur's MER Process and Organisation Involvement

## Monitoring

In order to track the progress of KLCH's prioritised actions, several indicators have been identified for all priority actions. These indicators are to be systematically monitored, to ensure that trends, both positive and negative, can be identified.

An example of how KLCH will be tracking an action is provided for the action **Deploy Low Impact Development (LID)**, which aims to increase water retention capacity to prevent flash floods through nature-based solutions. The indicators identified for monitoring are as follows:

**Table 14:** Example of Action Tracking for Kuala Lumpur's Climate Action Plan

PRIORITY INDICATORS	INDICATOR TITLE	CATEGORY	MONITORING FREQUENCY	RESPONSIBLE DEPARTMENT
1.	Volume of water retention capacity created (m <sup>3</sup> ) (public and private space)	Output	Quarterly/Per project	JKAWS
2.	Area of vegetated green cover created (m <sup>2</sup> ) (public and private space)	Output	Quarterly/Per project	JKAS/JPLR
3.	% of city covered under emergency management plan	Output	Annually	JKAS/JPRB
4.	% of population aware of management campaigns (disaggregated for age group, gender)	Output	Annually/Per project	JPKKB

The indicators identify the different but complementary outputs and outcomes from undertaking the sub-actions and of the action itself. These different indicators weave an important picture relating to action implementation. For example,

- The (1) water retention capacity volume is often influenced by (2) vegetated green area; this might be unevenly spread throughout the city—with one parliamentary area or zone containing a higher water retention volume despite receiving less rainfall
- The (3) proportion of the city covered by an emergency plan could be based on need, i.e. flood and flash flood prone areas

- The final indicator relating to (4) population awareness is important to highlight the knowledge that they live in a flood prone area and are able to call for assistance if needed
- (4) Population awareness can also mobilise residents to work towards implementing their own or joint-collaboration LID initiatives



To illustrate monitoring of each prioritised action, the table below highlights the primary indicator to be measured for every action.

**Table 15:** Prime Indicators for Each Priority Action Item

KLCH'S PRIORITISED CLIMATE ACTIONS	PRIME INDICATOR
<b>Low Carbon Building Checklist Validation</b>	% of all building floor area complying to climate-related policies
	Benchmarking policy % of all new buildings to which the policy applies to
<b>Depave Public Space with the Community</b>	Temperature difference in °C between paved and depaved spaces
	% area / # neighbourhoods upgraded via depaving programmes
<b>Deploy Low Impact Development (LID)</b>	Volume of water retention capacity created (m <sup>3</sup> ) (public and private space)
	Number of LID measures installed
<b>Near Zero Emissions Building Roadmap</b>	% of buildings exceeding minimum specification / policy requirements
	# / % of homes/buildings retrofitted
<b>Solid Waste Reduction through a Waste Masterplan</b>	Collection efficiency
	Waste generated per capita (kg / person / year)
<b>Drought Management Plan and Response Plan</b>	% of city covered under the plan
	# of early warning systems in place for each hazard
<b>Flood Management and Response Plan</b>	% of city covered under emergency flooding response plan
	% of population aware of flood management and response campaigns
<b>Heat Management and Response Plan</b>	Length (km) of cooling routes established
	% of population within 15 minutes of a cooling centre
<b>Building Vegetation Covering</b>	# / % of developments with max. green covering building implemented
	# / % of developments covered by new green requirement codes
<b>Building Performance Benchmarking and Rating</b>	# of existing households undergoing retrofitting of low carbon green building measures
	# of building codes integrating benchmarking policy
<b>Street Design to Prioritise Active Mobility</b>	Total emissions from motorised transport (t CO <sub>2</sub> e)
	PM2.5 and PM10 concentrations
<b>Protect Parks and Increase Biodiverse Areas</b>	Area of shaded cover created (m <sup>2</sup> ) (disaggregated for public and private land)
	# of zoning changes to open space (focused on emissions reductions or climate vulnerability)
<b>Comfortable and Safe Pedestrian Networks</b>	# of km or % of streets with shaded pedestrian facilities (i.e. pavement/sidewalks)
	# of km of improved accessibility infrastructure (disaggregated for income level of communities)
<b>Accessible Affordable Housing in Priority Area</b>	Identified target # or % of new affordable housing units within walking distance (500m) of mass transit stations
	# / % of affordable housing units within 500m of frequent MT
<b>Upgrade &amp; Expansion of Existing Bus Lane Network</b>	% of low-income population within 500m walking distance of a stop
	# of km of bus priority lanes (disaggregated for city districts)

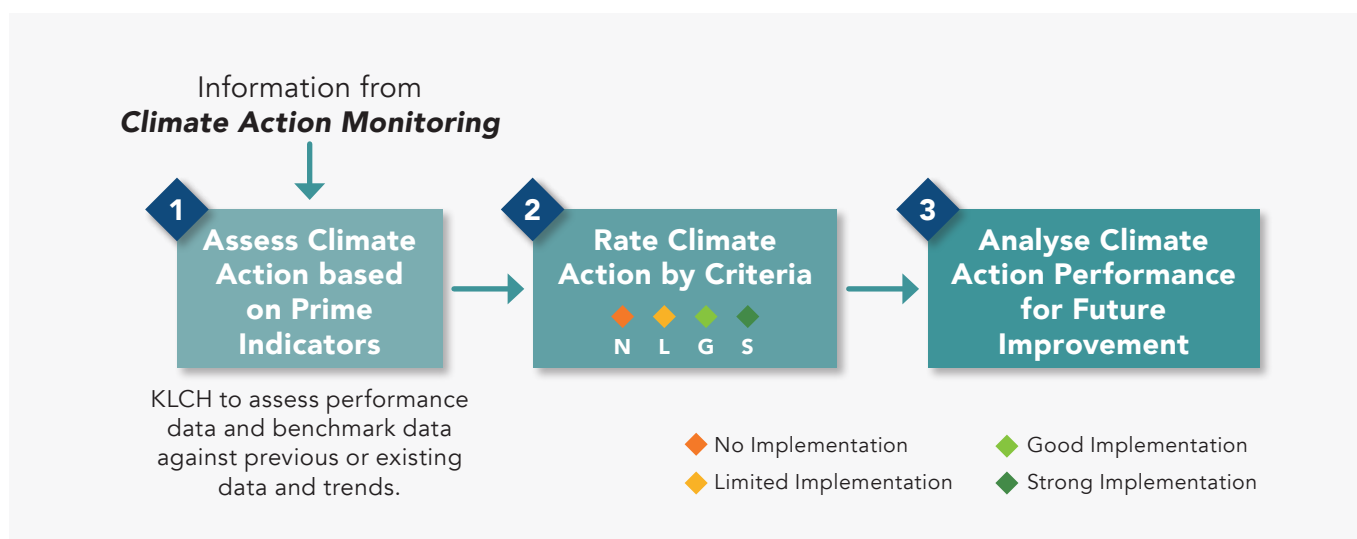
## Evaluation

In addition to monitoring progress, KLCH will evaluate the implementation of their climate actions. Evaluation of the prioritised actions will enable the council to assess performance through quantitative and qualitative methods, enabling the identification of any improvements required to enhance the progress of the action's implementation.

The most important aspect of evaluation is the ability to assess and understand the changes in the municipality as climate actions are implemented and their impacts observed. The evaluation process itself follows on from the Monitoring of actions, whereby KLCH will evaluate each action's progress based on the following criteria:

- **Relevance**—are the action's objectives and additional benefits met?
- **Coherence**—is the action understood by the implementers and is the required collaboration for delivery achieved?
- **Effectiveness**—was the action delivered as planned?
- **Efficiency**—was the action delivered on time, on cost, and with expected feasibility?
- **Impact**—how impactful was the action on carbon emissions, climate risk reductions and inclusivity targets?
- **Sustainability**—is the project sustainable?

The evaluation process for Kuala Lumpur can be seen below:



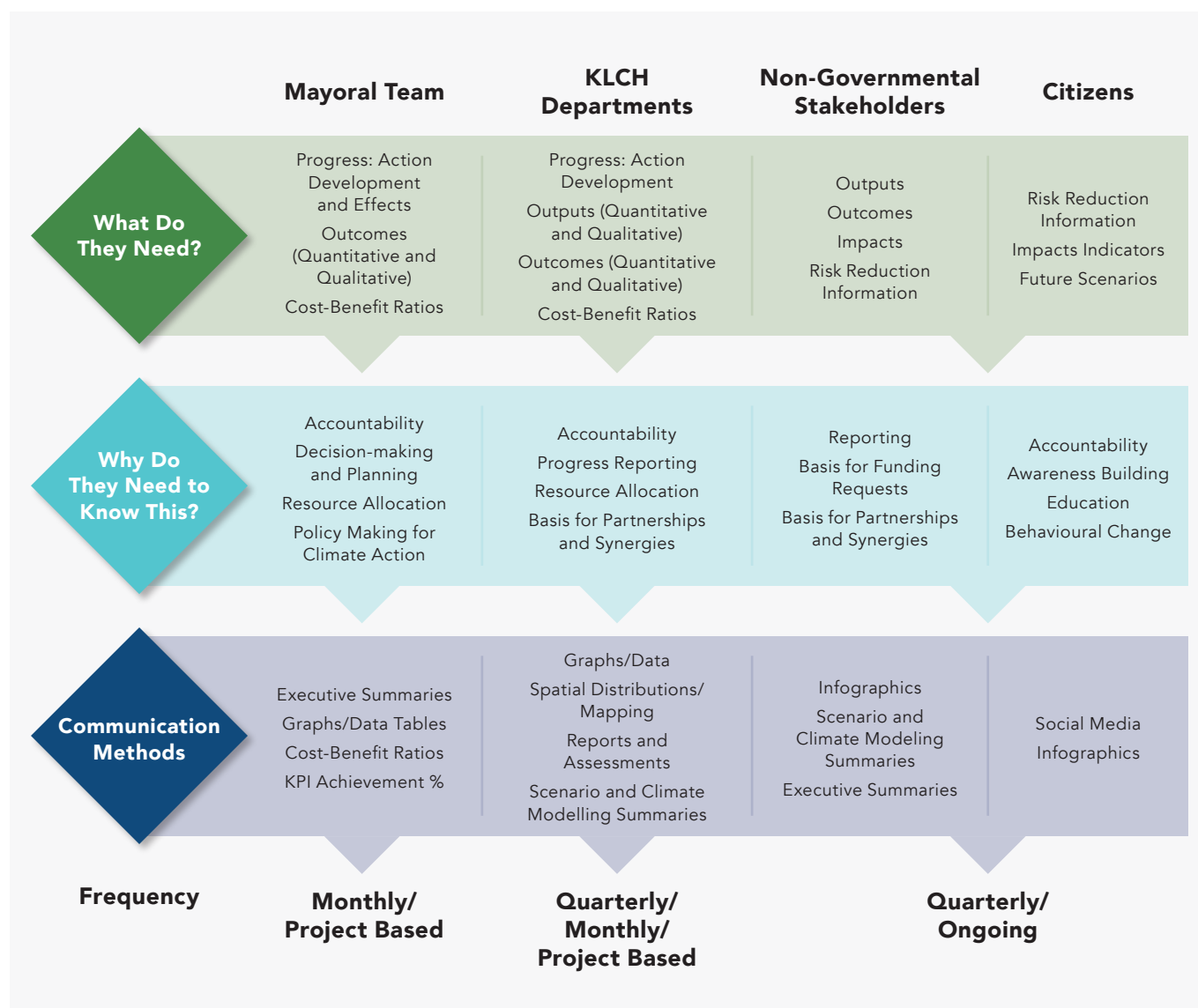
**Figure 40:** Evaluation Process for KLCH Climate Actions

## Reporting

A consistent and regular reporting process will allow KLCH to highlight their achievements in implementing climate action, while also identifying issues and opportunities to adapt and improve existing approaches.

The Low Carbon & Resilient Cities Secretariat will update progress and achievements on these actions in a manner that is comparable to the baseline year as well as the

goals identified. Monthly reporting meetings with the Mayor will be set, though different frequencies are recommended depending on the audience and the nature of actions being reported. The figure below highlights the reporting framework for Kuala Lumpur, with the established reporting requirements and findings from the Monitoring and Evaluation sections.



**Figure 41:** Outline of KLCH's Reporting Framework for Climate Action Planning

Reporting progress of climate actions, or in some cases sub-actions, provides visibility and objectivity to support the accountability and transparency of KLCH. It also provides opportunity for strategies and actions to be modified in response to changing circumstances and, if needed, provide the evidence for KLCH to adjust the strategy for implementation in order to better achieve their long-term goals and targets.



# Moving Forward

Despite the work put into developing plans, no action plan is perfect. This is why we have developed a plan that ties monitoring, evaluation and reporting into its process, not only for key climate actions but the entire KLCAP2050.

KLCH is committed to reporting updates annually at the action level, and full updates to the KLCAP2050 every five years. Below are several areas identified for KLCH to address over the next five years, in order to have an improved and updated Climate Action Plan.



## Data Quality and Collection

In Kuala Lumpur, despite good quality data being utilised wherever available, there were limitations to the datasets utilised. To illustrate this, Kuala Lumpur's data is estimated in its entirety by DOSM, not in district, zones or parliamentary area. Different sectors within KLCH use differing zones and boundaries.

There is a need to review what has been measured in the baseline GHG inventory for the city, examine the data sources and assumptions which have been applied and developing new ways of sourcing data in order to establish a more detailed, accurate and complete quantification and understanding of the key sources of emissions from the city. This is addressable through better data collection process and can be improved over time, as KLCH moves forward with implementing the Climate Action Plan.

## Importance of Self-Evaluation

When the KLLCSBP2030 was produced in 2017, the first city-level GHG emissions profile compiled for Kuala Lumpur included forecasted growth rates for future carbon emissions based on population growth observed in the years leading up to the base year of 2010, which was high. The actual population of Kuala Lumpur has, in reality, only slightly increased since 2015.

In developing this KLCAP2050, it has therefore been possible to apply more conservative population growth trends, resulting in a lower level of forecast carbon emissions for 2030 than was seen in the KLLCSBP2030. On the other hand, economic projections in the form of the city's GDP that were utilised in the KLLCSBP2030 (in 2017) were very close to what we have seen in actual recorded economic data up to 2020, therefore resulting in similar economic projected data utilised.

This highlights the need for KLCH to evaluate and update data on an iterative basis, and for climate action-level data, KLCH intends to put in place measures to monitor data which will enable them to analyse and study trends. For example:

- Multi-hazard Platform, which observes weather patterns, analyses and predicts upcoming hazards in Kuala Lumpur
- Building energy consumption tracker, which will assist in future iterations of Kuala Lumpur's GHG inventory

## Unforeseen Circumstances

Similarly, unforeseen events place further emphasis on the importance of regular monitoring and evaluation of data and progress. Notably, the Covid-19 pandemic will have a longer lasting impact on Kuala Lumpur than we can currently understand or project in any scenario modelling exercise (as it will on Malaysia as a whole, and economies and societies all around the world). Figures included in the KLCAP2050 are conservative, though the growth pattern and the impact on climate action planning and implementation from how and when Kuala Lumpur as a city recovers from the pandemic will require continuous monitoring, impartial evaluation, and informed reporting.

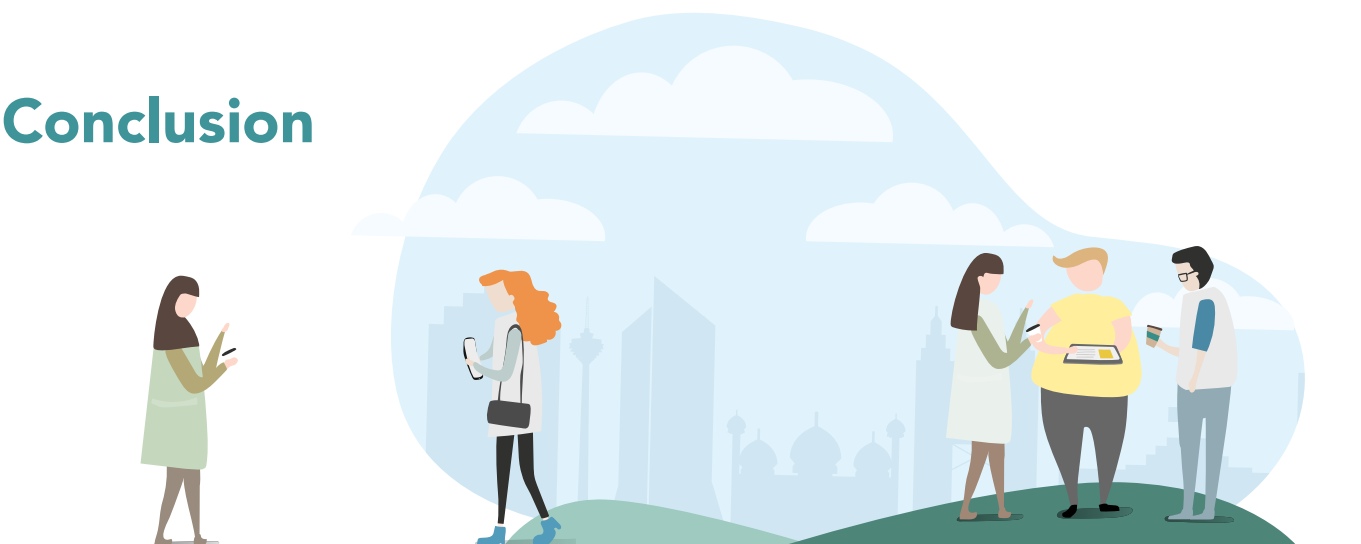
## Mitigating Barriers

Despite the political, social, economic, technological and other barriers, KLCH must remain resilient and push ahead toward its goals to make Kuala Lumpur 'A City For All' by 2040. KLCH will always strive to ensure the betterment of the city, despite the threat of climate hazards; maximising its current capacity and striving for greater collaboration with other ministries and partners.

KLCH has a crucial leadership role in implementing this KLCAP2050. Though barriers may reduce the speed at which KLCH and the city's residents are able to implement the plan, KLCH will always work, as far as its powers allow, to overcome barriers and create a future which embraces integrated, successful and inclusive climate action.



# Conclusion



In the face of rising global temperatures and more frequent extreme weather events over recent decades due to man-made climate change, KLCH has intensified its focus on combatting climate change and increasing the climate resilience of Kuala Lumpur. To this end, KLCH has established several actions and roadmaps which outline the city's strategies and actions to tackle this pressing global and local crisis.

The development of this KLCAP2050 builds upon previous city commitments and goes beyond, creating a pathway for Kuala Lumpur to transform into a climate neutral and resilient city by 2050. For this goal to be realised, collaboration and cooperation across all stakeholders is required. While the public sector strives to reduce carbon

emissions and improve resilience through the provision of sustainable public infrastructure and the introduction of stringent environmental requirements, private actors can provide the technology, financial instruments that will be needed for city-wide climate action. Residents of Kuala Lumpur have a great opportunity to incorporate climate considerations into everyday choices on personal lifestyles that will support multiple KLCAP2050 actions as well.

KLCH is determined that through coordinated and effective implementation, good climate governance and relentless monitoring, evaluation and reporting as the implementation of the KLCAP2050 moves forward, Kuala Lumpur can become a sustainable, liveable city that continues to thrive in a changing world.





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# KLCAP2050 Project Team

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## **Kuala Lumpur City Hall (KLCH)**

Datuk Seri Haji Mahadi bin Che Ngah, Mayor of Kuala Lumpur

Datuk Sulaiman bin Mohamed, Executive Director of Planning Sector

## **City Planning Department Representatives**

Datuk Zulkurnain bin Hassan

Haji Rosli bin Nordin

Nor Hashida binti Harun

Nurul Hidayah binti Zawawi

Siti Rushiah binti Rani

Siti Hajar Madina binti Mohd Zin

Nor Wahidah binti Abd. Wahid

## **Other Department Representatives**

Masitah binti Salleh

Ts M. Faizal bin Zulkarnaini

Mohd Shahrul Hafizi bin Abdul Raawi

Noor Haida binti Haji Hashim

## **C40 Cities Climate Leadership Group**

Alissa Raj

Rebecca Claire Chan Mun Cheng

Devni Acharya

Ingrid Simon

## **Sweco, CAS & Deltares Consortium**

Enrico Moens

Jelmer van de Ridder

Arjen Koekoek

Romee Prijden

Sien Kok

Huey Yee Yoong

George Parsons

## **Deloitte Risk Advisory**

Cashreyn Maisara binti Mohd Azlan

Lorraine Jiang Gordon

Rafiqah Azira binti Mohd Razeq

Lim Wei Ren

## **Carbon Trust**

Paul Wedgwood

Robert Hatcher

Frances Bean















