

PUTRAJAYA CLIMATE ACTION PLAN

— 2030 —





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Dato' TPr. Fadlun Bin Mak Ujud
President of Putrajaya Corporation

FOREWORD

Greetings from Putrajaya, a Federal Government Administrative Centre (FGAC) that embodies elegance and functionality and is the pride of the nation!

Putrajaya has grown quite well since then. Important government buildings stand tall in the Government Precinct and along the ceremonial route in the Core Island, displaying the sovereignty of a modern and developing nation. Putrajaya, a garden city by design, is surrounded by a beautiful lake, parks, green areas, and recreational facilities. Numerous water-based activities are held at these natural tourist attractions. As a promising tourist destination, Putrajaya has so far drawn close to one million visitors annually.

My goal for Putrajaya is not just for it to experience quick economic growth and physical development, but also—and this is crucial—how it can improve the quality of life of its residents, the nation, and the entire world by mitigating the effects of climate change and developing sustainably. Therefore, it is important and appropriate for Putrajaya to join the Global Covenant of Mayors for Climate and Energy (GCoM) and to prepare this Climate Action Plan (CAP) with GCoM's support. The National Low Carbon Cities Masterplan (NLCCM) has set a mitigation target for Putrajaya which is 33% absolute GHG emissions reduction by 2030. Putrajaya Corporation (PJC) must therefore adopt the target for CAP to support this national target, as well as clear goals for achieving climate adaptation by that year. The 38 planned actions from the CAP are eagerly anticipated by the PJC in order to achieve the target and goals during the following ten years, which are constructively aligned with global climate change and sustainability responses including the Sustainable Development Goals (SDG) 2030.

The above target and goals have been established based on the GCoM Common Reporting Framework (CRF) compliant Greenhouse Gas Inventory (GHGI) and Climate Risk and Vulnerability Assessment (CRVA). Putrajaya is currently aggressively tackling climate change adaptation and mitigation alongside more than 12,000 cities globally. For their invaluable research efforts, thoroughness, support, and dedication in creating this Putrajaya Climate Action Plan 2030, I sincerely thank GCoM, the European Commission Joint Research Centre (JRC), the UTM-Low Carbon Asia Research Centre (UTM-LCARC), CDP, and my PJC team.

PREFACE

Cities are a key contributor to climate change, as urban activities are major sources of greenhouse gas emissions. Malaysia is facing the challenge of ensuring sustainable development in the cities by establishing a number of projects on low carbon societies. Specifically, cities are increasingly driving meaningful actions towards creating a sustainable environment through low carbon societies especially by adopting the culture of green technology through preventive and corrective measures to encourage the use of green technology and low carbon lifestyle

Putrajaya has achieved its first stage of development, building an elegant and functional Federal Government Administrative Centre (FGAC), the pride of the nation. Moving forward, the strength of Putrajaya as a Federal Government Administrative Centre with high-quality infrastructure and living environment has created opportunities for further growth. Nevertheless, Putrajaya also faces uphill challenges in order to create a multi-dimensional and vibrant economy, multi-ethnicity, improved public transport and a living environment. It is timely for the city to prepare a climate action plan to mitigate carbon emissions and minimize the impact of climate change.

In order to achieve the Putrajaya mitigation target of 33% by 2030 in terms of absolute (the base year 2021), the city needs to have decarbonization policy measures and formulate actions to achieve the adaptation goals. As a holistic plan, the Putrajaya CAP 2030 proposes 38 planned actions for implementation which are also in line with the Low Carbon Cities Framework (LCCF) Malaysia.

The potential reduction of absolute GHG emissions is expected to be up to 33% by 2030. Meanwhile, the climate adaption of the Putrajaya CAP 2030 is guided by the results of the climate risk and vulnerability assessment (CRVA). Three (3) adaptation goals have been proposed by the Corporation for Putrajaya to be more resilient and prepared for climate-related disasters, such as floods, tropical storms, storm surges and vector-borne diseases. First, The Corporation pledges to reduce property damage due to rainstorms and flooding by 50% by 2030 compared to 2010 levels. In terms of public health, Putrajaya aims to reduce the number of dengue cases by 50% by 2030 compared to the 2017 level. Last but not least, the city also aims to reduce the downtime of utilities caused by tropical storms by 30% by 2030 compared to 2017.

With a bottom-up approach, the Putrajaya CAP 2030 seeks to be a people's policy that is grounded in scientific research with practical implementation in mind. It will provide a strategic direction and clear framework for sustainability and climate change policies.

December 2022

UTM-Low Carbon Asia Research Centre (UTM-LCARC)
Faculty of Built Environment and Surveying
Universiti Teknologi Malaysia
Johor Bahru, Malaysia



PUTRAJAYA BASIC PROFILE



Function

Federal Government
Administrative Centre
Malaysia



Location

Strategically located within
Greater Kuala Lumpur/Klang
Valley and the Multimedia
Super Corridor
(2° 57' 7.2" N, 101° 42' 57.6" E)



Area

49 km² with Garden City
concepts with about 40%
open spaces



Population

134,391 (2021)



Administration

Putrajaya Corporation (PJC)



PUTRAJAYA

Thailand

Malaysia

Indonesia

Chapter 1.0 Introduction

Putrajaya Climate Action Plan is a primary document that lays out a detailed and strategic framework covering specific actions and measures for mitigating the city's greenhouse gas (GHG) emissions and adapting to the impacts of climate change.

The CAP is both a strategic and an operational document. It uses the results of the Baseline Emission Inventory (BEI) to identify the best fields of action and opportunities for reaching the local authority's greenhouse gases (GHG) emissions target. It is based on the climate change Risk and Vulnerability Assessment (RVA), which identifies the most relevant city climate hazards and vulnerabilities. The CAP defines concrete measures for climate mitigation and adaptation, with timeframes and assigned responsibilities, translating the long-term strategy into action. Signatories commit themselves to submitting their climate action plans by year 3 at the latest (following their commitment to the initiative).

This document aims at presenting the framework for the two pillars of the initiative and provides step-by-step recommendations for the entire process of elaborating a climate action plan (CAP), from initial political commitment to monitoring. Climate action planning is performed in four phases (refer to Figure 1):

- **Initiation phase**- preparing the ground: provides detailed guidance throughout the initiation phase on the commitment to address climate change mitigation and adaptation;
- **Planning phase**: including a Pre-assessment phase and a Development phase. Detailed guidance throughout the pre-assessment phase of elaborating a CAP is provided – from undertaking a Baseline Emission Inventory (BEI) and setting objective and targets, undertaking a Risk and Vulnerability Assessment (RVA) and setting targets, detailed guidance on the elaboration of the climate action plan throughout elaboration of the CAP mitigation measures ; key adaptation measures;
- **Implementation of the actions planned** in the plan and monitoring the progress towards the target set.

Putrajaya city is one of the four Malaysian pilot cities of the Global Covenant of Mayors (GCoM). This report outlines the Putrajaya Corporation's long-term vision of promoting and supporting voluntary actions to combat climate change and move to a low-carbon society. This CAP consists of emission inventory and climate risk and vulnerability assessment and planned actions to achieve carbon emission reduction target and climate adaptation goals.

The plan proposes 38 actions which, upon implementation, may potentially will reduce emissions of greenhouse gases, limit the impacts of climate change on Putrajaya residents. Among the six (6) main strategies are (i) Energy, (ii) Urban Planning and Buildings, (iii) Mobility, (iv) Blue and Green, (v) Community and (vi) Climate Resilience.

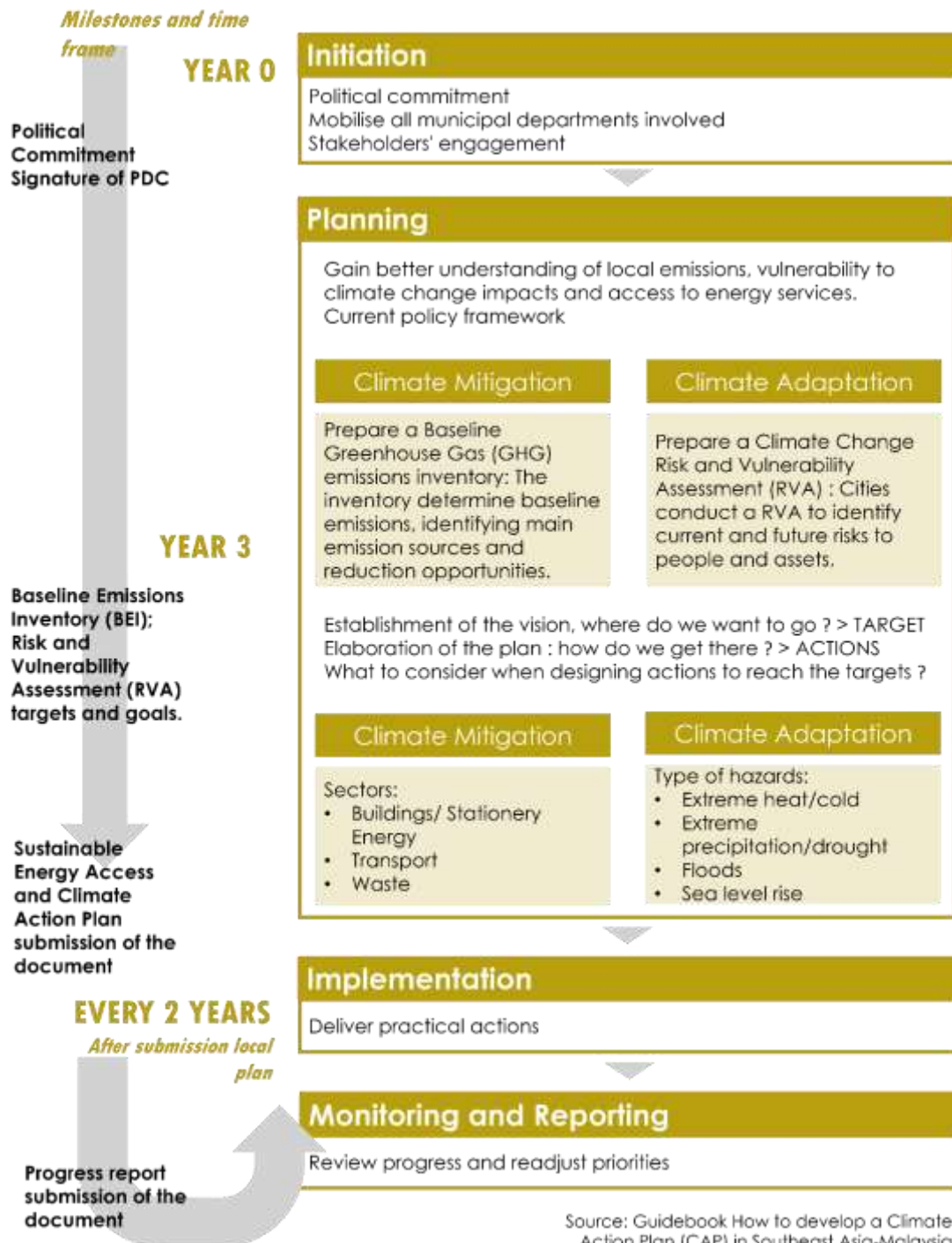


Figure 1 : The CAP process: main phases, milestones and timeframe

Chapter 2.0 Background

2.1 Putrajaya: The Basics

Covering an area of 49 km², Putrajaya (officially the Federal Territory of Putrajaya) is home to 134,391 people (2021). It is a planned city which functions as the Federal Government Administrative Centre Malaysia (refer to Figure 2). The seat of the Federal Government of Malaysia was shifted in 1999 from Kuala Lumpur to Putrajaya because of overcrowding and congestion in the former, whilst the seat of the judiciary of Malaysia was later shifted to Putrajaya in 2003. Kuala Lumpur remains as Malaysia's national capital city. Putrajaya became Malaysia's third federal territory, after Kuala Lumpur in 1974 and Labuan in 1984.



Figure 2 : Perdana Putra (Prime Minister's Office) in Putrajaya
Source: Stefan Fusan

As the Federal Government Administrative Centre, Putrajaya involves in several bilateral, regional and multi-lateral relations with foreign countries and organisations in various aspects particularly matters on politics and economic affairs. These provide international exposures and offer opportunities for Putrajaya to have an international branding and address to attract high net value investments, MICE (Meetings, Incentives, Conferences & Exhibitions) delegates and international tourists that will further propel Putrajaya's economy.

Putrajaya is a well-connected city, linked by highways, roads and rail to Kuala Lumpur, major towns within the Greater Kuala Lumpur/Klang Valley and the Kuala Lumpur International Airport (KLIA), high standard roads link all the precincts (refer to Figure 3). There is also a provision of park and ride facilities and rail link as part of Putrajaya's plan to have a modal split of 70:30 (Putrajaya Structure Plan 2025).



Figure 3 : Putrajaya and surrounding areas

2.2 Land use

True to its concept as a Garden City, more than a third of the total area (38.91%) of Putrajaya is reserved as open space and recreation (refer to Table 1). It has a total area of 1,918.66 hectare for open space and recreation which included large Metropolitan Park (refer to Figure 5), Urban Park and City parks, wetlands, buffer areas and water bodies. These open space and recreation area are not only supported the urban ecology but also provided attraction to local and foreign tourists. The water bodies consisted of primarily lake and wetlands. Wetland functioned as a natural filtration system for the lake. The lake was designed to cater for multi-functional uses including recreation, fishing, water sports, water transportation and provided opportunities for educational and research activities.

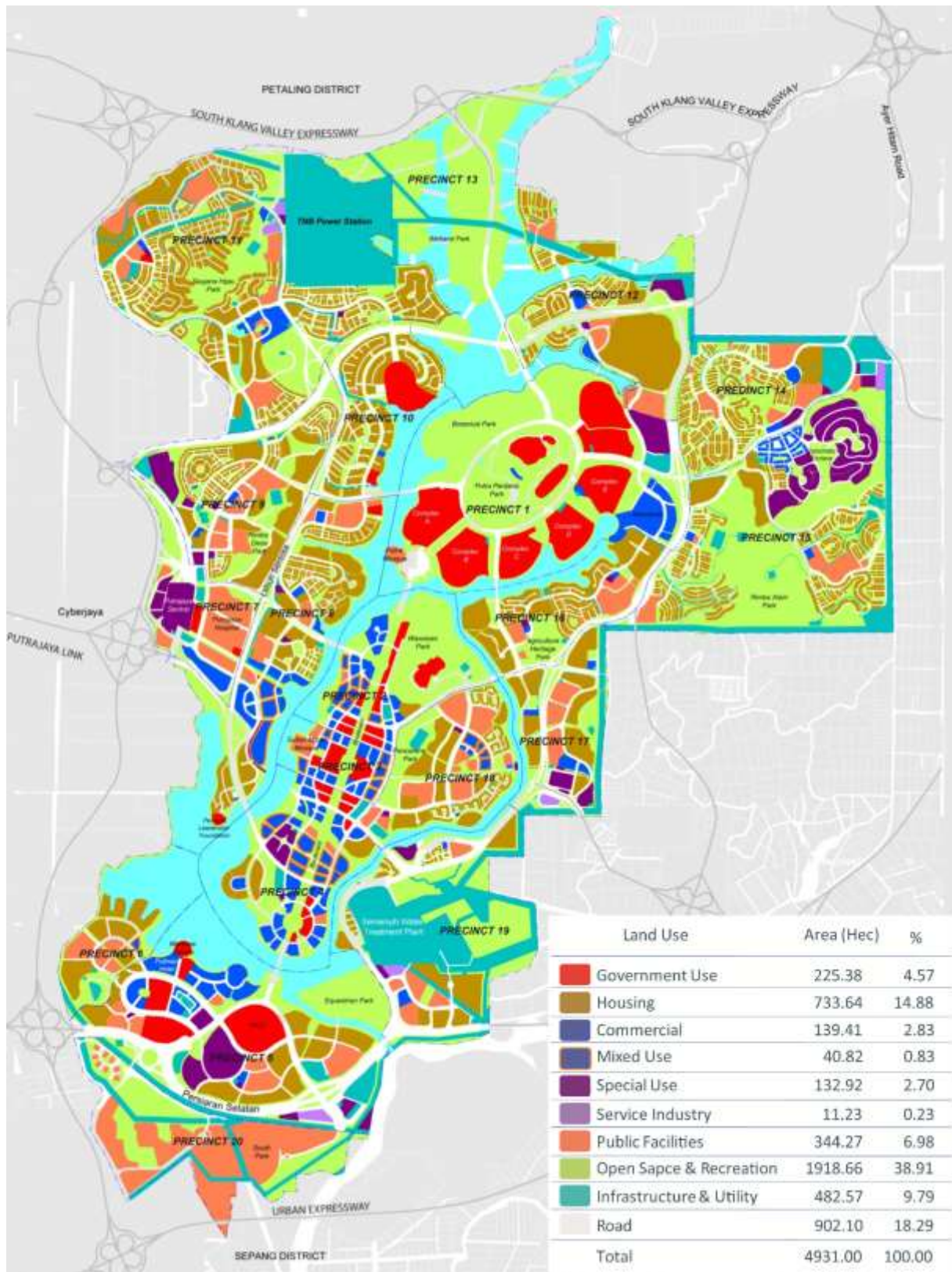


Figure 4 : Putrajaya land use map
 Source: Putrajaya Structure Plan 2025

Table 1 : Putrajaya land use (2008)

Land use	Total area	
	Hectare	%
Government Use	225.38	4.57
Housing	733.64	14.88
Commercial	139.41	2.83
Mixed Use	40.82	0.83
Special Use	132.92	2.70
Service Industry	11.23	0.23
Public Facilities	344.27	6.98
Open Space and Recreation	1,918.66	38.91
Infrastructure and Utility	482.57	9.79
Road	902.10	18.29
Total	4,931.00	100.00

Source: Putrajaya Structure Plan 2025



Figure 5 : Metropolitan Park in Putrajaya

Road land use was the second largest land use category with 18.29 % of the total area. Meanwhile, housing constituted the third largest land use category with 14.88 % of the total area, covering a total of 733.64 hectares which are capable of supplying about 67,000 dwelling units (Ali et al., 2015). This residential land is divided into 14 exclusive precincts in the periphery with some parcels within the Core area. A total of 52% of the total housing units will be allocated for Government servants and the remaining 48% for private sector. The infrastructure and facilities covered a total area of 482.57 hectares or 9.79 % of the total area. Meanwhile, public facilities constituted about 344.27 hectares or 6.98 % of the total land area. It is important to examine the distribution of the land use in order to achieve a balance and coherent urban structure.

2.3 Economy

Gross Domestic Product (GDP) of the Putrajaya in 2020 was RM 216,362 mil. ¹My Local Stats WP Putrajaya, 2020). The tertiary sector (government services) dominated while commercial and business services played a limited role. Commercial activities were still limited to retail, food and beverages as well as finance and banking services. Existing commercial spaces stand at a total of 439,400 square meters (Putrajaya Structure Plan 2025).

Putrajaya has a promising tourism sector having benefited from its function as Federal Government Administrative Centre with pristine lake, iconic buildings and bridges and lush parks (refer to Figure 6). To date, it has attracted close to 1 million tourists annually and has progressively improved the length of stay and the average tourist receipts that had reached RM 330 per day (Putrajaya Structure Plan 2025).

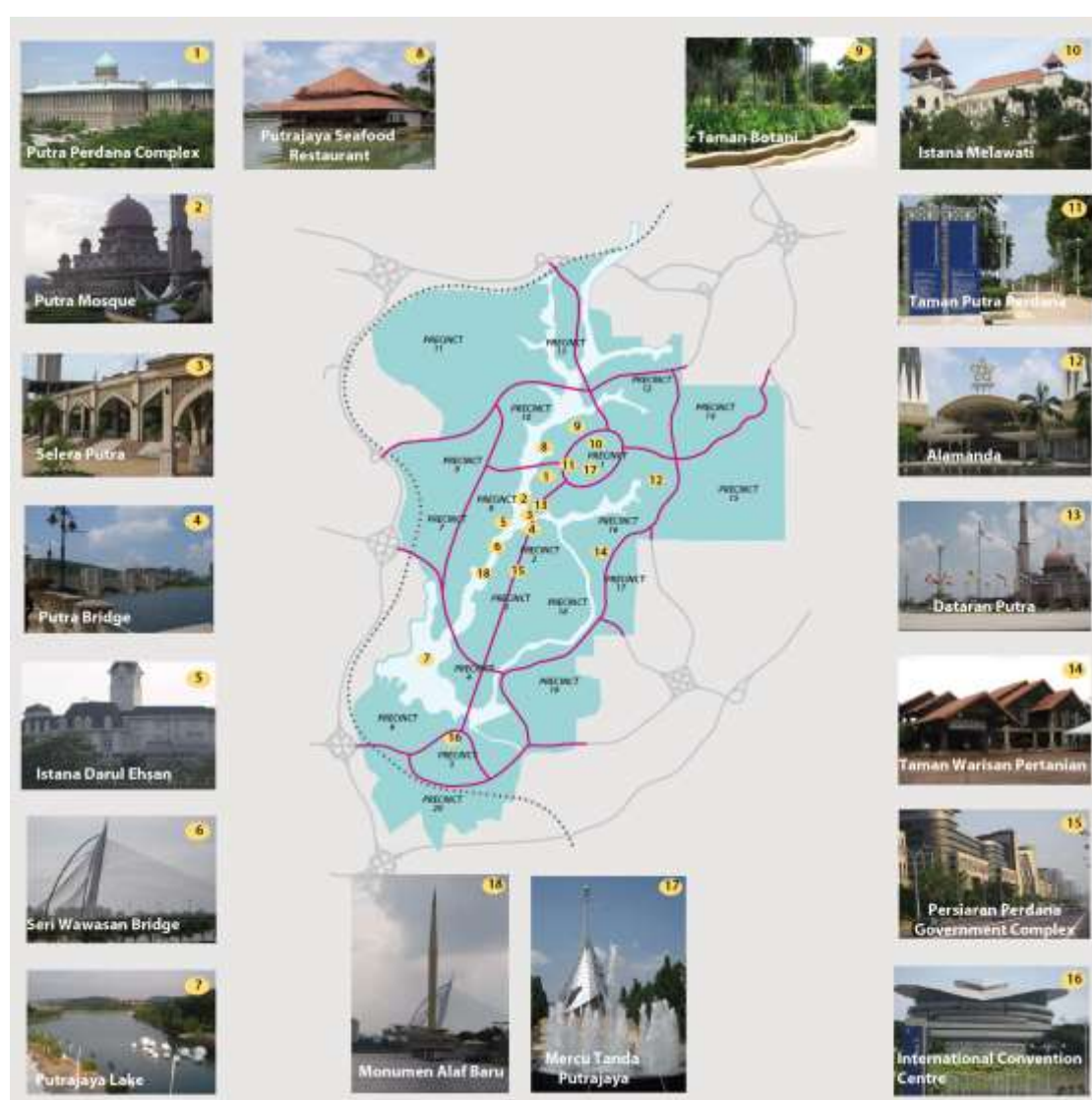


Figure 6 : Tourist attractions in Putrajaya
Source: Putrajaya Structure Plan 2025

¹ GDP for W.P. Putrajaya includes the GDP of W.P. Kuala Lumpur as reported by Department of Statistics Malaysia (DOSM). There is no official GDP reference for W.P. Putrajaya and there is insufficient data available that serves as a good basis for estimation of GDP of W.P. Putrajaya.

2.4 Climate

Putrajaya is one of the wettest cities in Malaysia. It is warm with an average maximum of 30 degrees Celsius and receives heavy rainfall all year round, roughly more than 2,500 mm of average rainfall annually (refer to Table 2). The city has no particular true dry season, but June and July are the driest months. Mostly each month average rainfall receives more than 200 mm. Therefore, Putrajaya is experiencing severe wind and flood.

Table 2 : Climatic data for Putrajaya (2021)

Month	Mean Daily Minimum Temperature (°C)	Mean Daily Maximum Temperature (°C)	Mean Total Rainfall (mm)	Mean Number of Rain Days
Jan	22.3	29.0	231.0	15
Feb	22.4	30.0	188.0	13
Mar	23.1	30.1	263.0	17
Apr	23.5	29.9	297.0	19
May	23.8	29.9	226.0	18
Jun	23.6	29.8	148.0	16
Jul	23.4	29.7	155.0	16
Aug	23.3	29.6	189.0	17
Sep	23.2	29.5	225.0	18
Oct	23.2	29.4	307.0	19
Nov	23.0	28.7	413.0	20
Dec	22.7	28.7	318.0	18

Source: <https://en.climate-data.org/asia/malaysia/putrajaya/putrajaya-971597/>

2.5 Infrastructure

Infrastructure facilities including transportation facilities and public facilities in Putrajaya are of high quality and capacities that are able to support high technology operations. Each facility has service level agreement with the respective providers that assures uninterrupted. These infrastructure capabilities are at par with cyber cities like Cyberjaya. Such capabilities will be able to attract regional multinational companies and other high net worth organisations like oil and gas, information, and telecommunication companies.

The transportation facilities in Putrajaya are developed around the integrated bus and rail-based transit system complemented with highway network (refer to Figure 7). There are 8 utilities services planned for Putrajaya development namely water supply, drainage, wastewater, solid waste; electricity; telecommunication; gas and chilled water (gas district cooling).

Public facilities comprise of areas designated for education, religious, health, civic, postal facilities, library, public market, community halls, information centre, cemetery land, sport and recreational (including a golf course) and cultural uses (refer to Figure 8). These facilities are all planned within easy access of the region's ring road system and within walking distance of sub neighborhood.



Figure 7: Transportation facilities in Putrajaya



Figure 8: Public facilities (open space, mosque, school and hospital) provided in Putrajaya

Chapter 3.0 Vision and Goals

3.1 Broad vision

Putrajaya has made several commitments to reducing carbon emissions. This can be seen through the formulation of Putrajaya Green City 2025 (PGC2025) – Baseline and Preliminary Study, which consists of policy package for GHG reduction by 2025. This is in line with the national government's aspiration in reducing carbon emissions by up to 40% in terms of intensity of gross domestic product (GDP) by 2020 compared to 2005. For this purpose, seven (7) focus areas in Putrajaya Green City 2025 have been identified (refer to Figure 9).



Figure 9: PGC2025 seven (7) focus areas

A green city is defined as a city planned with the principles of sustainable development with programs and initiatives to preserve the environment and natural resources in the view to reducing the negative impact of human activities onto the environment. Other aspects that are often associated with the concept of green cities are management of renewable and non-renewable resources, management of waste and the reduction of the impact of greenhouse gases (GHG) such as carbon dioxide resulting from various human activities. With reference to the definition, it is clear that green city status to be achieved in Putrajaya is not limited solely to physical greeneries, but it also covers three (3) primary aims (refer to Figure 10).

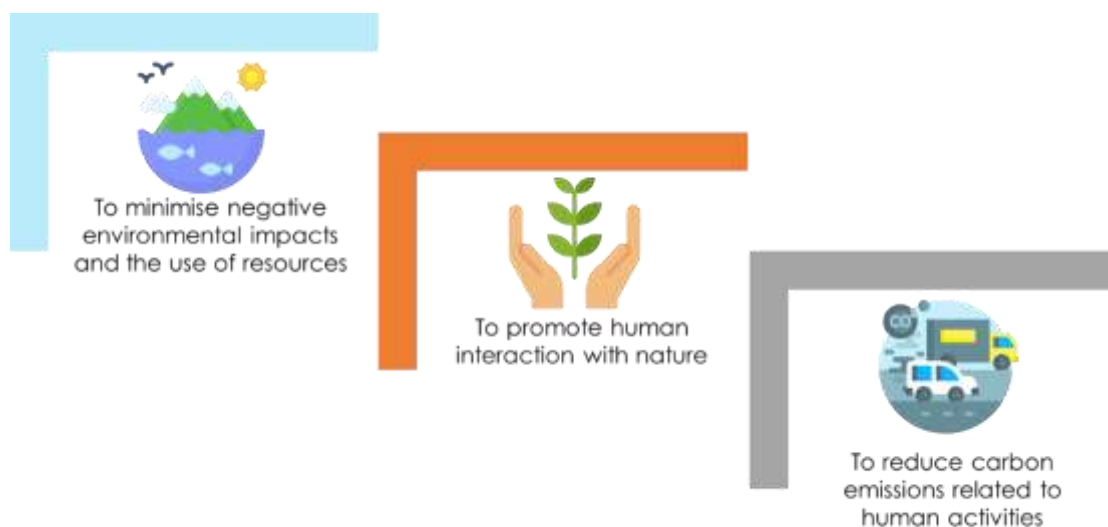


Figure 10 : Aims of Putrajaya Green City 2025 (PGC2025)

3.2 Mitigation target

The goal for PGC2025 in terms of quantitative environmental targets are outlined in three themes. The three themes are Low-carbon Putrajaya for climate change mitigation, 3R Putrajaya for recycle-based society and Cooler Putrajaya for mitigating urban heat environment (Refer to Figure 11).

The target for Low-carbon Putrajaya is reducing CO₂ emission intensity (CO₂ emission per economic activity) by 60% compared to the year 2007 level. This target was set in line with the National Target of 45% reduction of emission intensity by 2030 and also based on the future plan as stated in the Putrajaya Structure Plan (Laporan Pemeriksaan Rancangan Struktur Putrajaya, June 2009).

The National Low Carbon Cities Masterplan (2021) also has set a mitigation target for Putrajaya which is 33% absolute GHG emissions reduction by 2030. Therefore, the Putrajaya Corporation adopts this target for this CAP (refer to Figure 12).



Figure 11 : Three quantitative targets that have been recommended in the PGC2025

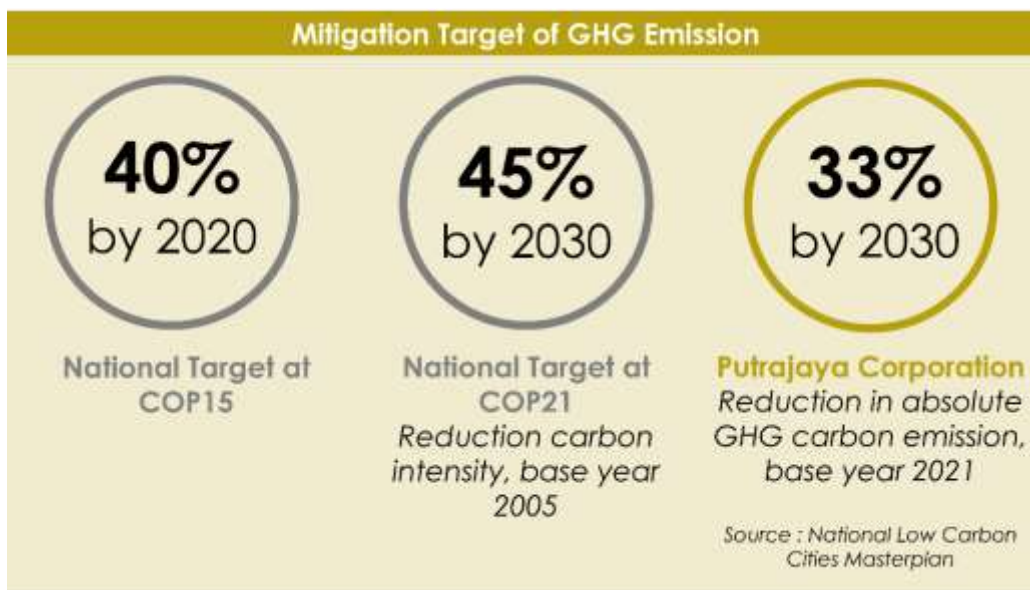


Figure 12 : Mitigation target for Putrajaya CAP 2030

3.3 Adaptation goals

Apart from the carbon emission reduction by 60%, transforming Putrajaya into a Low Carbon City, the study PGC2025 study also sets goals to reduce the peak temperature by 2 degrees Celsius, compared to the 2005 level (A Cooler Putrajaya).

The findings from the PGC2025 on Cooler Putrajaya shows that the daily maximum temperature in Putrajaya was over 30 degrees Celsius, and it exceeded 35 degrees Celsius from January to May 2011. Based on the findings of the research counter-measures were introduced to enable Putrajaya to lower the maximum temperature by 2 degrees Celsius.

Putrajaya should continue to pursue the Cooler Putrajaya target by carrying out low carbon initiatives such as tree planting, increasing water body and reducing heat island effect. With the global warming impact and expected increase in mean daily maximum temperature. It is recommended that Putrajaya puts in place a target to limit an increase in the mean daily maximum temperature to not more than 2 degrees Celsius by 2030 compared to 2021 (30.1 degrees Celsius) (refer to Table 2).

Mitigating urban heat and lowering the peak temperature are important for not only the comfortable life of Putrajaya residents and workers but also for reducing air-conditioning demand so that the goals of achieving a low carbon and cooler Putrajaya (i.e., reduction of the peak temperature) can be achieved.

Based on current issues identified during the Focus Group Discussion (FGD), there is a need to also set goals to reduce dengue cases and improve landscaping against the severe winds that have been observed and expected to increase in Putrajaya (refer to Figure 13).



Figure 13 : Adaptation goals for Putrajaya CAP 2030

Chapter 4.0 Organisational Structure

Putrajaya is governed by the Putrajaya Corporation, which is headed by the President of Putrajaya. Putrajaya operates according to the following structure in Figure 14.

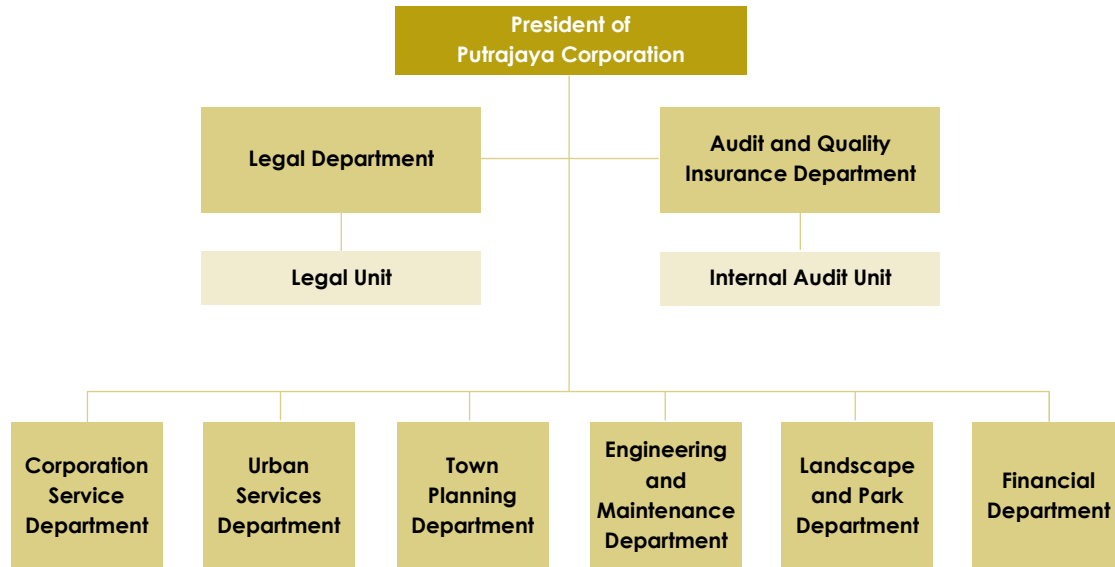


Figure 14 : Putrajaya Corporation's organisational structure

4.1 Climate Action Committee

Putrajaya's Climate Action Committee (CAC) has the following structure.

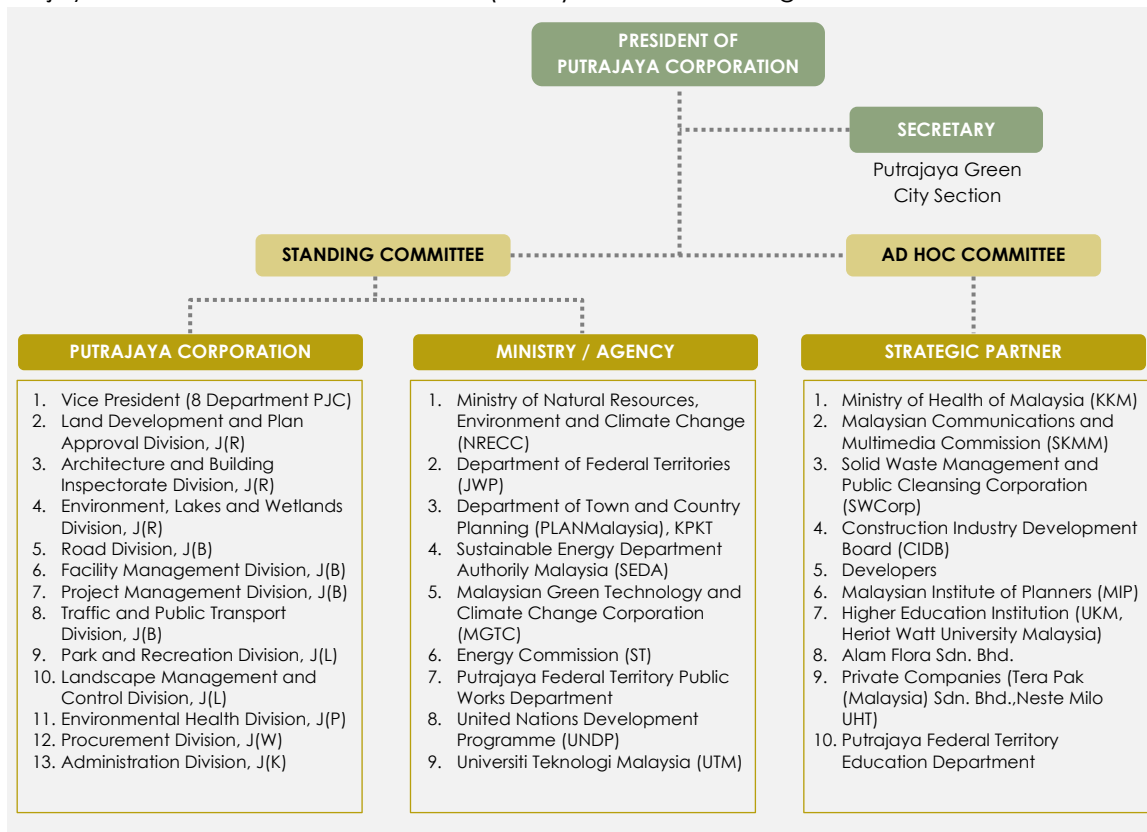


Figure 15 : Putrajaya's Climate Action Committee

4.2 Putrajaya Corporation Staff

The Corporation employees will be the primary staff members allocated towards implementing the Climate Action Plan. They will be responsible for coordinating between departments and monitoring progress. Specific responsibilities for actions can be found in the Planned Actions chapter.

4.3 Coordination with state/national authorities

Climate actions and strategies in Putrajaya will be carried out in coordination with the Putrajaya Green City Committee. The climate actions and strategies will also be incorporated and mainstreamed into the Putrajaya Corporation Strategic Plan 2021-2025, putting the Climate Action Plan in line with the Putrajaya Structure Plan 2025. Implementation of the Putrajaya Corporation Strategic Plan 2021-2025, and the climate actions and strategies mainstreamed within, will be closely monitored by Ministry of Federal Territory.

4.4 Involvement of International Alliance and Local Universities

The Putrajaya Climate Action Committee were assisted by GCoM, European Union – Malaysia staff members and UTM-Low Carbon Asia Research Centre throughout the process of filling out the Common Reporting Framework and compiling this CAP. These organizations will continue to support the CAC and local staff in implementing the policies and plans laid out in this document. The GCoM staffs have also provided considerable support and trainings.

Chapter 5.0 Climate Agenda and Policies: Global, National and State Levels

In 2016, the Malaysian government submitted its Nationally Determined Contribution (NDC) in accordance with decisions 1/CP.19 and 1/CP.20 of the UNFCCC. The document outlines Malaysia's intent to reduce greenhouse gas emissions intensity of GDP by 45 % by 2030 relative to the emissions intensity of GDP in 2005. 10% of this target is considered conditional upon receipt of climate finance, technology transfer and capacity building from developed countries.

The base year emissions calculations include land use, land use change and forestry (LULUCF), and the target covers carbon dioxide, methane, nitrous oxide and economy-wide emissions intensity of GDP. The NDC outlines the actions taken to reduce the use of fossil fuels since the Ninth Malaysia Plan (2006-2010), the barriers for implementation, and the vulnerabilities of the country to climate change.

Malaysia has a range of national, state and local-level policies instituted to help the country achieve these targets. Many, in fact, predate the Paris Agreement, demonstrating Malaysia's long-term commitment to climate action and sustainability. National-level formal policies include the 12th Malaysia Plan, the most recent of a series of 5-year comprehensive development plans, the Forth National Physical Plan (NPP-4) as well as strategies such as the National Policy on Climate Change, National Low Carbon Cities Masterplan (NLCCM) and Low Carbon Cities Framework (LCCF) and policy mechanisms such as the Green Technology Master Plan (refer to Figure 16). Putrajaya also has several regional-specific development blueprints and environmental policies. Relevant documents are outlined in the Appendix A.



Figure 16 : Relevant national and state policies

Chapter 6.0 Approach and Methodology

6.1 Global Covenant of Mayors for Climate & Energy (GCoM)

Putrajaya Corporation (PJC) has joined the Global Covenant of Mayors (GCoM), a coalition of cities and local governments from around the world committed to advancing climate resilience and lowering greenhouse gas emissions. Committing to GCoM requires the PJC to advance three (3) goals:

- i. Reducing greenhouse gas emission;
- ii. Prepare for the impacts of climate change;
- iii. Track progress towards these objectives

6.2 Tools used

The primary tool used in preparing this report is the GCoM Common Reporting Framework (CRF). This framework allows all cities joining GCoM to use one, standardized reporting system for compiling information on greenhouse gas emissions, climate hazards, targets, government setup, actions and more. The system is not just used in assessing the baseline state but can also be applied in planning and reporting. Using this universal system among all GCoM signatories allows local governments to compare and learn from other cities around the world facing similar challenges. Signatories of GCoM are required to fill out the CRF within two years of joining the Covenant, and to report every two years from then on.

The framework has three levels of reporting: mandatory, recommended and additional options that cities can choose to follow. At a minimum, the inventory covers carbon dioxide, methane and nitrous oxide. Compliance with GCoM CRF is by means of carrying out the Climate Risk and Vulnerability Assessment (CRVA) and Greenhouse Gas Inventory (GHGI) using standardized CRVA and CIRIS templates.

6.2.1 City Inventory Reporting and Information System (CIRIS)

This tool, which is based on the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC), will be used in the implementation and monitoring phase of this Climate Action Plan. The GPC was developed by the World Resources Institute, C40 Cities Climate Leadership Group and ICLEI - Local Governments for Sustainability in order to solve the problem of inconsistent greenhouse gas accounting systems for cities. Their framework covers the seven gases included in the Kyoto Protocol and is designed to calculate emissions for a single reporting year. The system requires two primary approaches for cataloging emissions.

The first details greenhouse gases from production and consumption within the city boundary, and the second measures emissions in three (3) different scopes: emissions from within the city boundary, emissions occurring as a result of the use of grid-supplied energy within the boundary, and all other emissions from outside the boundary as a result of activities within the boundary (refer to Figure 17). City activities emitting greenhouse gases are divided into six sectors: stationary energy, transportation, waste, industrial processes and product use, agriculture, forestry and other land use, and any other emissions occurring as a result of city activities. The last category is not always covered by the GPC but can be reported separately (refer to Figure 18).

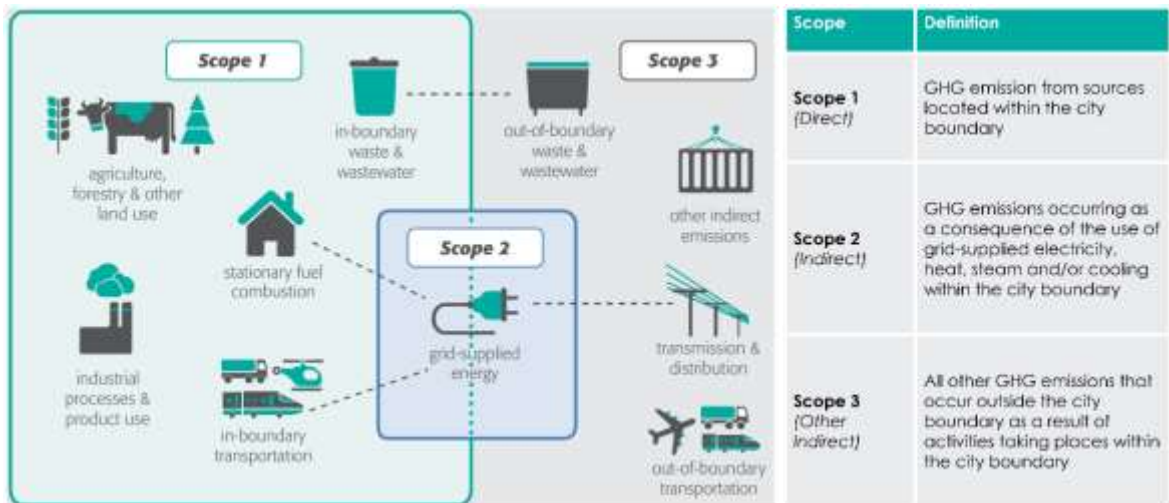


Figure 17: Three (3) scopes of GHG emissions



Figure 18: Sectors emitting greenhouse gases

6.2.2 Climate Risk and Vulnerability Assessment (CRVA)

This GCoM-compatible guidance document provides a framework to help cities complete their climate adaptation assessments. The guide provides context for why risk assessments are important, details methodology, and explains what essential components are required, as well as outlines best practices. The assessment checklist includes the following steps: introduction and general content; context, past climatic events, and trends; projected climate hazard and impact; and conclusion (refer to Figure 19).

The purpose of using Climate Risk and Vulnerability Assessment (CRVA) is to develop an understanding of the current and future climate risks facing the region. The CRVA will inform the inclusion of adaptation goals and actions in the regional climate action plan, which is a required deliverable as a member of the Global Covenant of Mayors GCoM.

The CRVA and GHGI (CIRIS) results are presented in Chapter 7 and 8 based on the data and feedback provided by the Putrajaya stakeholders. This will serve as the basis for formulation of climate mitigation and adaptation actions and strategies for Putrajaya in Chapter 9.

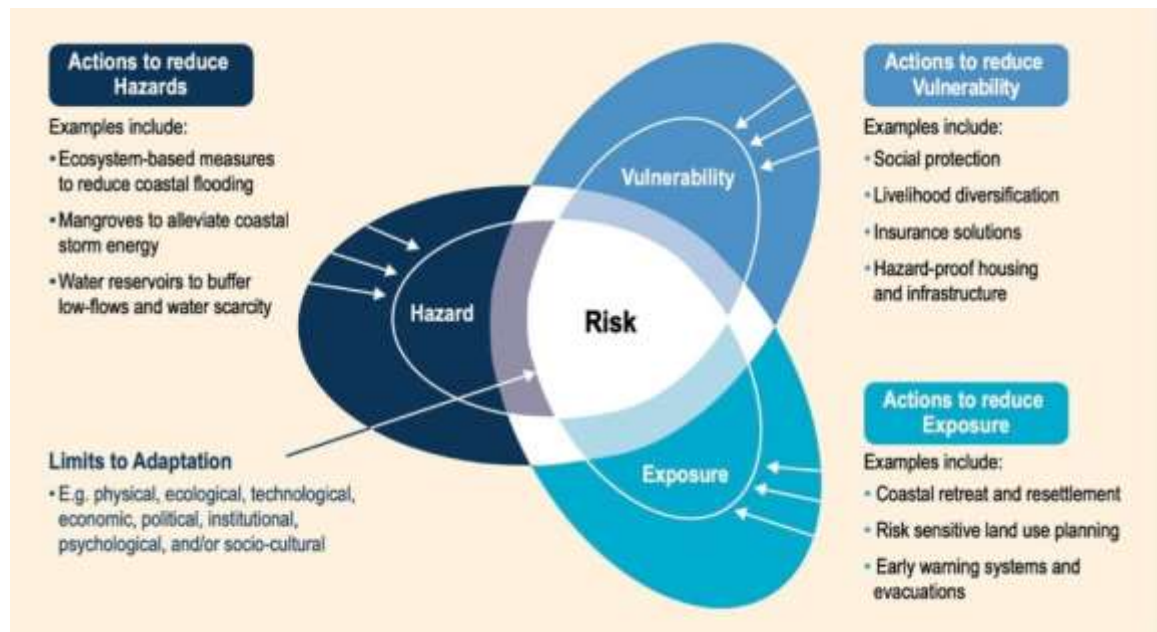


Figure 19 : Climate risk framework in accordance with IPCC 5th Assessment (IPCC, 2019)

6.3 Result and Findings of CIRIS and CRVA

In advance of the process of filling out the Common Reporting Framework and developing this document, representatives of the Putrajaya Corporation (PJC) participated in trainings organized by IUC-Asia and GCoM. These sessions covered adaptation, mitigation, target setting and climate action planning, and climate finance. Alongside the trainings, Putrajaya simultaneously held meetings to lay the foundation for the CAP process.

6.4 Stakeholders' Involvement

A total of three (3) major stakeholder discussions were carried out from May 2022 virtually to discuss the issues and possible low carbon measures for Putrajaya. Three (3) specific meetings with Putrajaya Climate Action Committee on presenting the mitigation (GHGI methodology, GHGI result) and adaptation (Climate Hazard, goal setting and possible planned actions). In addition, there are several meetings with Putrajaya CAC were held to finalise the CAP report. The list of stakeholders involved can be referred in Appendix F.

Chapter 7.0 Baseline Emissions Inventory

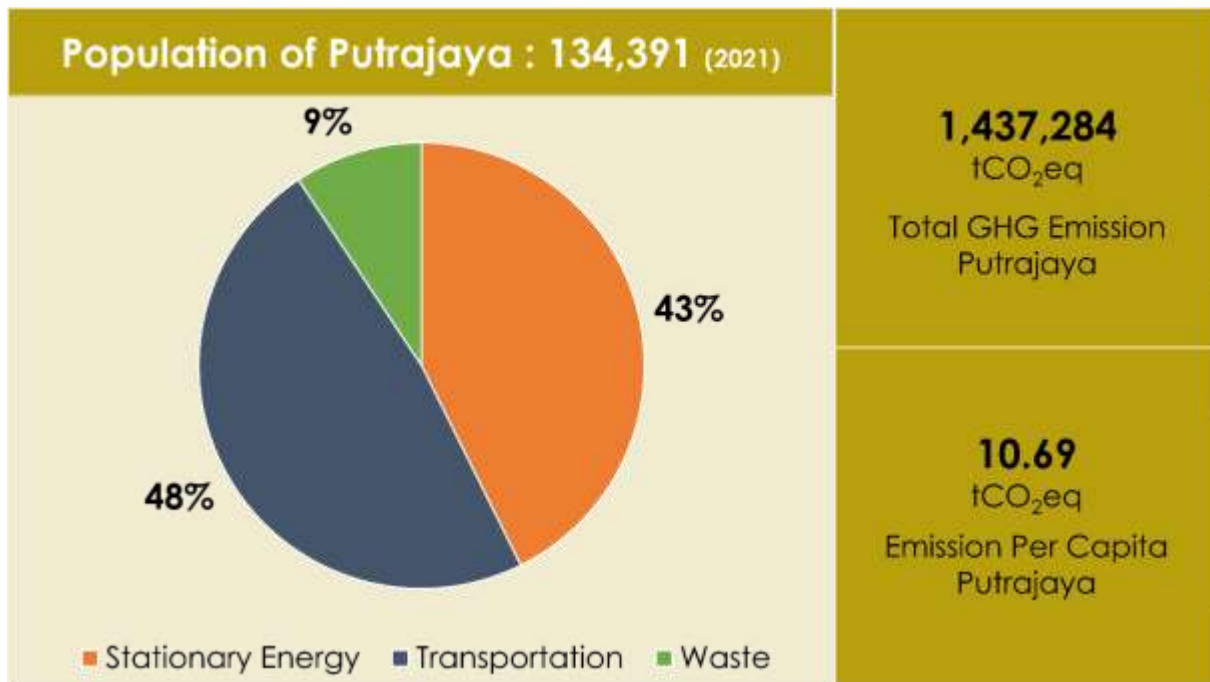


Figure 20 : GHG emissions profile of Putrajaya in year 2021

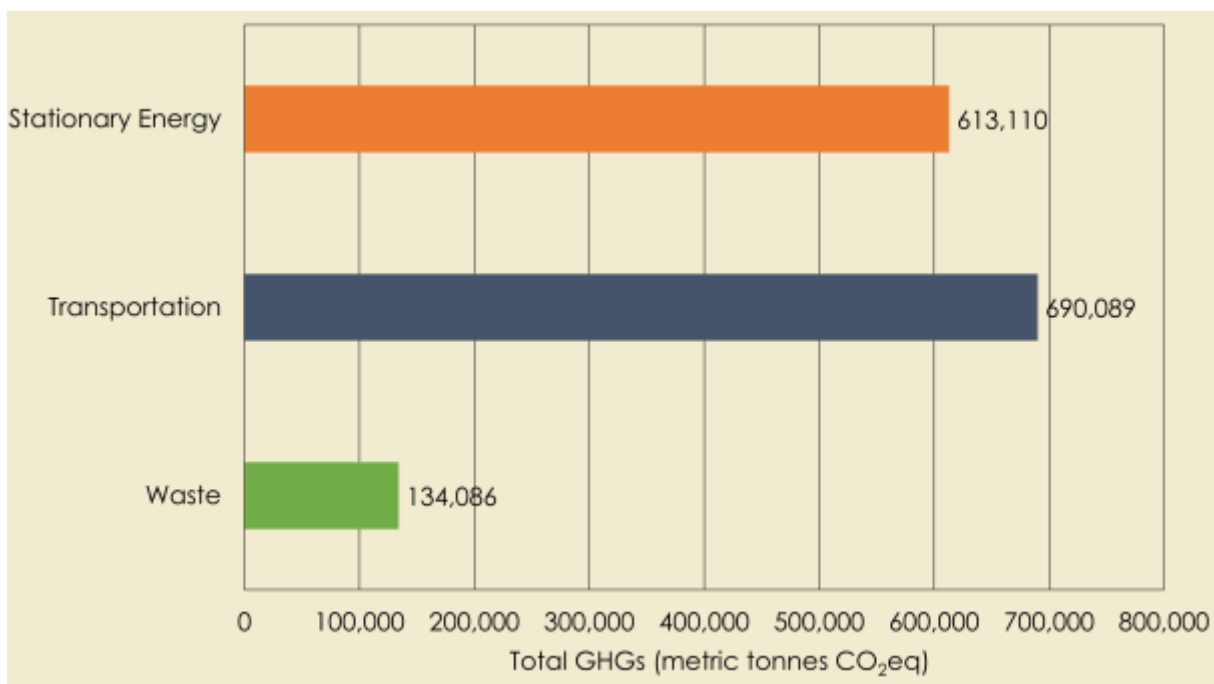


Figure 21 : GHG emissions profile of Putrajaya based on three (3) sectors in year 2021

The total GHG emissions of Putrajaya identified in the year of 2021 baseline emissions inventory were 1,437 ktCO₂eq. Based on the emission profile, the emission per capita for Putrajaya is 10.69 tCO₂eq and the emission per unit land area (km²) is 29,148 tCO₂eq. The proportion of total emissions contributed by each of the three sectors is depicted in Figure 20 and Figure 21. Transport makes up the largest portion of the GHG emissions for Putrajaya, which is 48.01 % (690 tCO₂eq), followed by Stationary Energy (42.66 %) and waste (9.33 %).

Figure 22 breaks down the emissions further by subsector and scope. The commercial and institutional subsector constitutes the largest portion of the total emissions, primarily from indirect emissions (Scope 2). Other significant subsector within stationary energy is residential, consisting primarily of indirect emissions (Scope 2), i.e. electricity consumption.

Within the transportation sector, emissions have not been further disaggregated by subsector due to a lack of availability of data. Hence, all transportation emissions are represented in the 'On-road' subsector. All transportation emissions are direct (Scope 1), primarily from petrol and diesel combustion. A local-level solid waste data was obtained from PJC, which is 45,890 tonnes and expected to emit 49,810 ktCO₂eq by 2021 (refer to Figure 22).

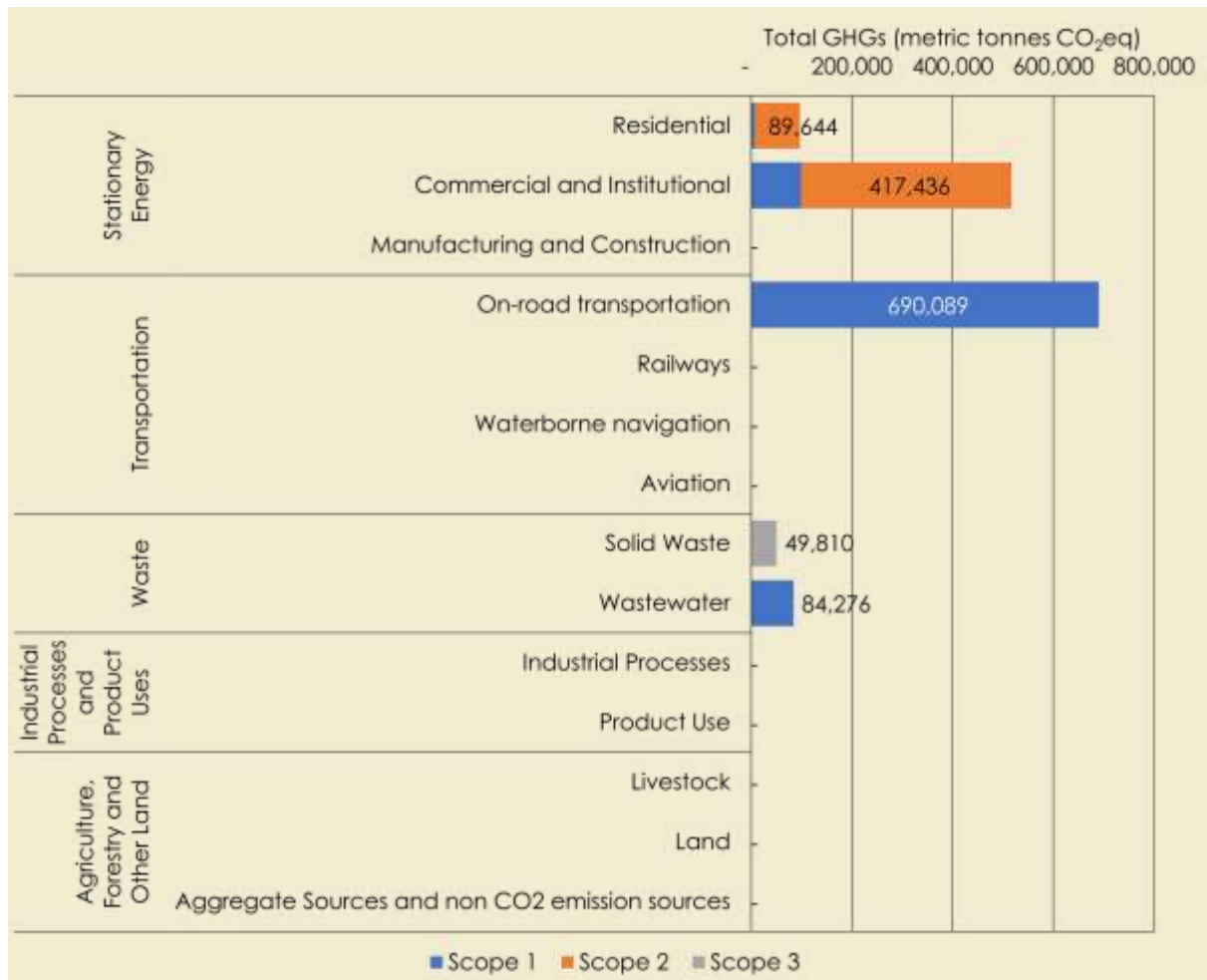


Figure 22 : GHG emissions by subsector and scope

Chapter 8.0 Climate Risk and Vulnerability Assessment

8.1 Past and Current Climate Hazards, Impacts and Risks

Figure 23 shows a summary of the main past and current climate hazards experienced in Putrajaya and their associated risk level posed to the city. The climate hazards posing a high level of risk have been identified as severe wind and dengue and the medium level of risk identified as heat wave and flash flood have been identified as low.










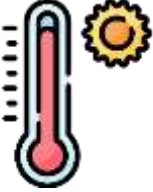
SUMMARY OF CLIMATE HAZARDS AND RISKS IDENTIFIED IN PUTRAJAYA CITY				
	Storm and Wind > Severe Wind	Extreme Hot Temperature > Heat Wave	Flood and Sea Level Rise > Flash Flood	Biological hazards > Vector-Borne Disease
Significant impact on the city before 2021				
Current probability of hazard	High	Medium	Low	High
Current magnitude of hazard	High	Medium	Low	High
Risk level	High	Medium	Low	High



Figure 23 : Summary of climate hazards and risks identified in Putrajaya

Table 3 shows the social impacts of the identified climate hazards in Putrajaya, as well as the most relevant assets and/or services and vulnerable populations affected. Increased demands for public services and healthcare services are seen to be the most widespread social impacts of the identified climate hazards whilst the assets and services affected range from food, water supply and sanitation, tourism, environment to biodiversity and forestry, and others. In terms of the vulnerable populations affected by these climate hazards, elderly have been identified to be particularly affected overall in Putrajaya.

Table 3 : Summary of climate hazards, impacts and vulnerable populations affected, and related action planned in Putrajaya

Climate Hazards	Social impact of hazard overall	Most relevant assets / services affected overall	Vulnerable populations affected	Action Planned
Storm and Wind > Severe Wind 	<ul style="list-style-type: none"> Fluctuating socio-economic conditions Increased risk to already vulnerable populations Increased resource 	<ul style="list-style-type: none"> Energy Transportation Environment, biodiversity, forestry 	<ul style="list-style-type: none"> Elderly Persons with disabilities Persons with chronic diseases 	<ul style="list-style-type: none"> D3: Identify potential spots and frequency of downed trees at housing and commercial areas D4: Improve tree selection

Climate Hazards	Social impact of hazard overall	Most relevant assets / services affected overall	Vulnerable populations affected	Action Planned
	demand			and landscape design to reduce the impact of wind
<p>Extreme Hot Temperature> Heat wave</p> 	<ul style="list-style-type: none"> • Fluctuating socio-economic conditions • Increased incidence and prevalence of disease and illness • Increased demand for public services • Increased demand for healthcare services • Increased risk to already vulnerable populations 	<ul style="list-style-type: none"> • Residential • Tourism 	<ul style="list-style-type: none"> • Elderly • Persons with disabilities • Persons with chronic diseases 	<ul style="list-style-type: none"> • B3: Protect cultural identity, precincts character and sense of place through sustainable urban design practices (TOD, compact development) • E1: Promote vertical gardens and green roofs in commercial buildings, schools and government buildings • E2: Conduct Tree Planting Campaign in Putrajaya in line with 100 Million Tree-Planting Campaign 2020-2025 • E3: Conduct Continuous Enhancement of Urban Biodiversity • E5: Promote Nature-Based Solution (NBS) to protect, restore and manage natural and semi-natural ecosystems • E6: Enhance

Climate Hazards	Social impact of hazard overall	Most relevant assets / services affected overall	Vulnerable populations affected	Action Planned
<p>Flood and sea level rise > Flash flood</p> 	<ul style="list-style-type: none"> • Increased demand for public services; • Increased demand for healthcare services; • Increased resource demand (e.g. food); • Others - Damage/loss of property (e.g. car, home); • Inconvenience - closure 	<ul style="list-style-type: none"> • Water supply & sanitation; • Food and agriculture; • Waste management; • Environment, biodiversity, forestry; • Emergency services; • Land use planning 	<ul style="list-style-type: none"> • Women & girls • Children & youth • Elderly • Persons with disabilities; • Low-income households 	<p>Putrajaya Lake Awareness Programme</p> <ul style="list-style-type: none"> • D5: Expand and improve monitoring systems through social media or other communication platforms to reduce outdoors activities due to heat wave • D6: Introduce programs or initiatives to reduce water consumption in commercial and residential areas
<p>Biological hazards > Vector-borne disease</p> 	<ul style="list-style-type: none"> • Increased demand for public services (e.g. fogging and prevention measures); • Increased demand for healthcare services; • Increased risk to 	<ul style="list-style-type: none"> • Industrial; • Commercial; • Residential; • Public Health 	<ul style="list-style-type: none"> • Children & youth; • Elderly; • Low-income households; • Persons living in sub-standard housing 	<ul style="list-style-type: none"> • D1: Raise community awareness and participation in prevention of dengue through a step-by-step guide such as BLOCK and

Climate Hazards	Social impact of hazard overall	Most relevant assets / services affected overall	Vulnerable populations affected	Action Planned
	already vulnerable populations			COMBI <ul style="list-style-type: none"> D2: Improve Enforcement by PJC to inspect potential mosquito breeding sites (constructions sites and residential neighbourhoods)

8.2 Future Impacts of Climate Hazards

Figure 24 below summaries the expected future impacts of the identified climate hazards in Putrajaya. Most of the hazards are expected to increase in both frequency and intensity with mostly high magnitude in the future. The majority of these changes are expected in the immediate future. Secondary data related to general and basic climate projections in Malaysia and Asia that provide base references to the discussion of future climate hazards are presented in Appendix B.





Climate Hazards	Future change in frequency	Future change in intensity	Future expected magnitude of hazard	When the city first expects to experience those changes
 Storm and Wind > Severe Wind	Increasing	Increasing	High	Immediately
 Extreme Hot Temperature > Heat Wave	Increasing	Increasing	High	Immediately
 Flood and sea level rise > Flash Flood	Increasing	Increasing	High	Immediately
 Biological hazards > Vector-Borne Disease	Increasing	Increasing	High	Immediately

Figure 24 : Summary of future impacts of identified climate hazards in Putrajaya

Chapter 9.0 Planned Actions

This chapter outlines the planned actions for mitigating and adapting to the impacts of climate change in Putrajaya taking into account the geo-physiological, institutional, social and development contexts as well as the CRVA and GHGI findings, and GHG reduction target and climate adaptation goals set in the previous chapters. The planned actions have been reviewed and refined through one (1) focus group discussion involving the Putrajaya Corporation to ensure the climate mitigation and adaptation actions proposed are in line with the Putrajaya Corporation's development vision, policy direction, priorities as well as institutional capacities. This is reflected in the arrangement of planned actions based on development themes that respond to Putrajaya's specific development contexts and scenario, as outlined below (refer to Appendix C).

As an attempt to align the planned climate actions with the Low Carbon Cities Framework (LCCF) as required by the original Terms of Reference of this project, the theme-based climate actions outlined herein have been coded to suit the LCCF's four main components of Environment (E), Transportation (T), Infrastructure (I) and Building (B). As the people and community are central to the development of a sustainable, low carbon society (LCS) in Putrajaya, this climate action plan also features actions that are society-based, thus necessitating the addition of the Society (S) component to the LCCF, resulting in the LCCF+S framework (refer to Figure 25) and Appendix D. At the same time, the planned climate actions are also aligned with PGC 2025 seven (7) focus areas (refer to Appendix E).

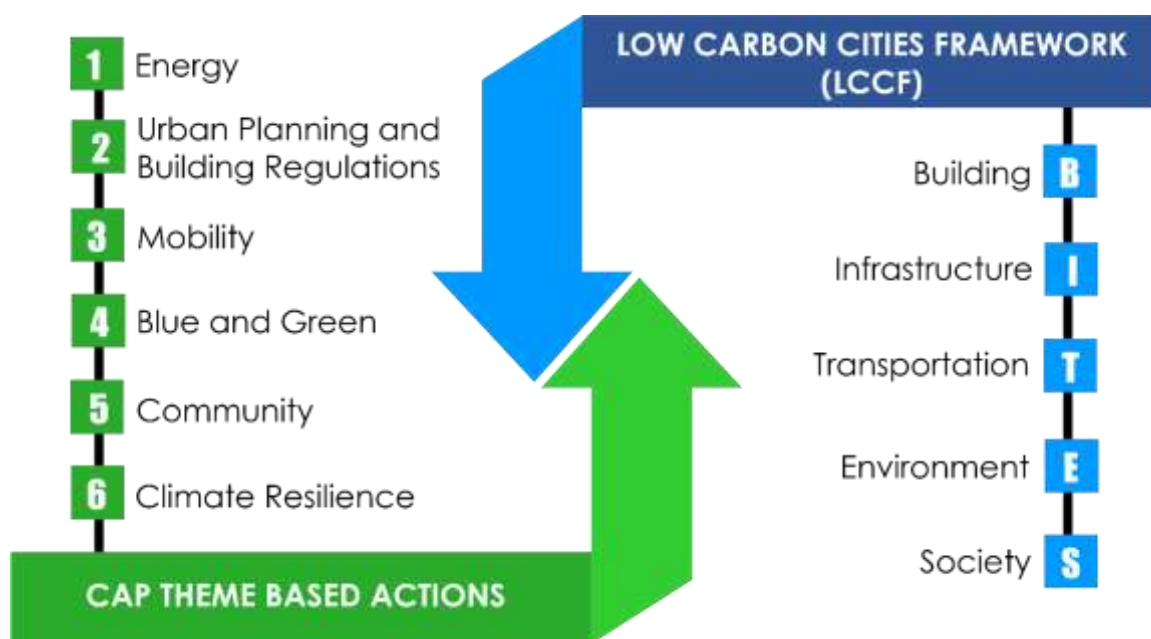


Figure 25 : Aligning Putrajaya City's climate actions with the national Low Carbon Cities Framework + Society (LCCF+S)

9.1 Theme 1: Energy

Planned actions in CAP should consider sustainable energy and energy efficiency as a key pillar for the Putrajaya development growth plan. These actions will make Putrajaya's economy progress for example residential and commercial sectors as well as industries are required to adopt cleaner and green technology. PJC can promote sustainable energy and energy efficiency practices such as promoting energy conservation, use of Solar PV lighting, use of smart infrastructures and facilities, and floating solar farm. Besides, Putrajaya community can adopt responsible production and consumption of natural resources lifestyle.

B1: Collaborate with relevant agencies for promoting solar energy system (PV) and solar thermal system on buildings in Putrajaya

Putrajaya should initiate an effort in promoting the use of photovoltaic (PV) and solar thermal systems in building as they can contribute to cleaner power generation for electricity usage. A good way for Putrajaya to start is through collaboration with SEDA and other relevant agencies. This is to create a possible framework for incentives, subsidies or taxation related to solar energy systems (PV) and solar thermal systems.

PV modules consist of many arrays of PV which can be adjusted in many sizes from as large as a solar farm requiring 1 hectare of land to a single PV array of less than 0.0001 hectare. However, small PV systems are more suitable to be implemented within the Putrajaya area as long as the sunlight towards the location is not constantly overshadowed by buildings. The solar energy system (PV) and solar thermal system can be installed on the rooftop of open parking, bus stops and walkways. At the same time, the solar energy system for domestic water heating is becoming a common practice.



Photo 1: The use of photovoltaic (PV) and solar thermal systems on building in Putrajaya
Source: <https://www.ppj.gov.my>

11: More and more renewable energy

The More and More Renewable Energy Action focuses on enhancing the use of renewable energy in Putrajaya. PJC can also promote the diffusion of autonomous and grid-independent system for renewable energy generation while minimizing its influence on existent power systems. Solar power generators and wind power generators are equipped with energy storage devices, enabling stable electricity supply. A part of generated electricity is used for the hydrogen production, which in turn is supplied to fuel cells in residences and offices and even to fuel cell vehicles. In addition, beyond individual energy storage systems, some precincts should have their own electricity supply systems that adjust demand and supply of electricity within the precinct.

Floating solar systems are an innovative, reliable and suitable solar solution for Putrajaya where the lake area is available. In combination with rooftop solar PV, the proposed solar system for lake compound will potentially contribute to a more significant use of renewable energy in Putrajaya. Since the system efficiency is increased, higher electricity will be yielded by the solar panel, as water has a natural cooling effect on the solar panels, conserving valuable land, reducing water evaporation and algae growth as well as improving the water quality.



Photo 2: Example of floating solar farm in Singapore (Sembcorp Tengeh Floating Solar Farm)
Source: <https://www.futurarc.com>

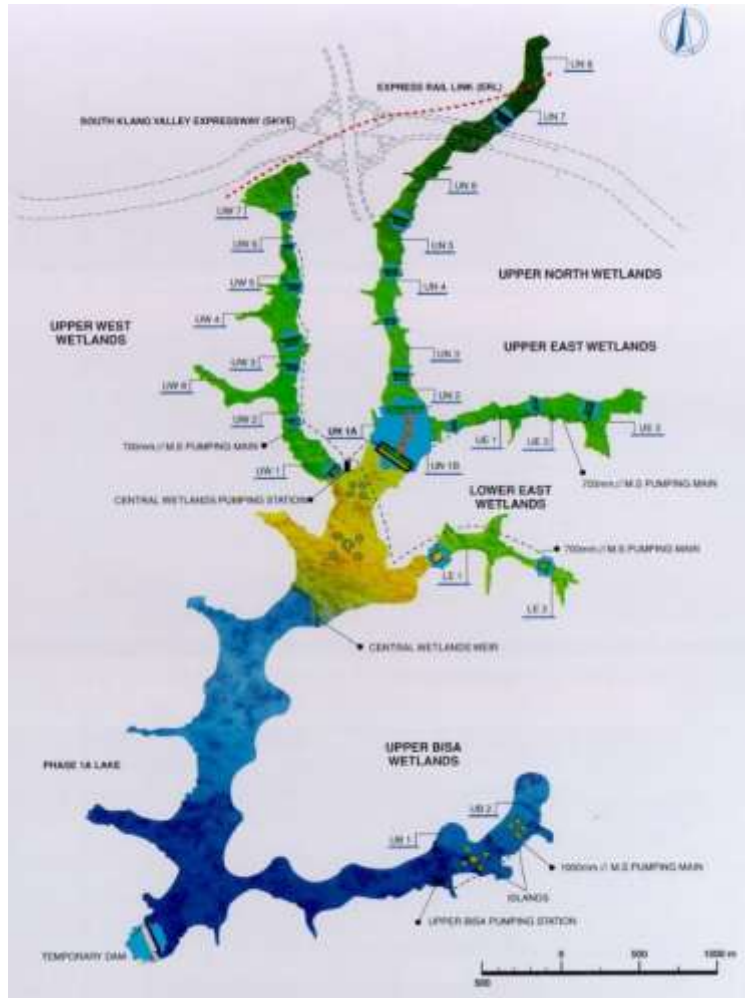


Figure 26 : Putrajaya constructed wetland
Source: <https://smart.putrajaya.my/project/putrajaya-lake-and-wetland>



Photo 3 : Putrajaya Lake and Wetland
Source: <https://smart.putrajaya.my/project/putrajaya-lake-and-wetland>

I2: Implement an online energy monitoring system

Implement an energy monitoring system in Putrajaya is crucial to understand the existing energy consumption pattern and track the energy usage. The online energy monitoring system consists of three (3) components;

- (i) Discrete metering devices;
- (ii) Online data compilation and management services; and
- (iii) Communication interface for displaying analysis outcomes.

Putrajaya is recommended to promote the online energy monitoring system to the main energy consumers. This could be done by helping them identify the available system suppliers and providing an incentive for eliciting the system purchase, installation and operation. Another strategy is to collaborate with the property developers to develop commercial buildings, residential premises and industrial buildings with inherently integrated online energy monitoring systems. This would allow a bulk procurement of technology at a lower rate (compared to the individual purchase).



I3: Adopt Energy Efficiency Infrastructures and Facilities (Energy Saving Street Light, Sensor on Site Facilities, Centralised Electronic Bulletin Board)

Energy efficiency infrastructures and facilities are necessary for Putrajaya to be able to leverage technology and smart solutions, thereby improving the day-to-day of its residents. The energy efficiency infrastructure and facilities include energy saving streetlights, sensors on site facilities and centralized electronic bulletin boards.

Putrajaya has adopted digital information boards at strategic areas for the latest news, event, and promotion (announced from the Putrajaya Corporation Complex) so the residents may check on the information anywhere and at any time. In addition, the smart street lighting system developed by Vectolabs for Precinct 15 is designed to manage all types of street lighting assets, which includes feeder pillars and all types of street lighting, from the smart-ready LEDs to the conventional High-Pressure Sodium (HPS) luminaires. The system helps Putrajaya resolve faulty street lighting proactively with the automated notification system, and quickly use the information provided, such as possible faulty components, the exact location of the luminaire, and the feeder pillar, circuit, and phase the luminaire where it is connected to. Putrajaya will also be able to track work orders for faulty street lighting to ensure high quality of service to its community.





Photo 4: Smart Street lighting will be the first application Putrajaya Corporation rolls out in Putrajaya, starting with Precinct 15, a commercial hub
Source: <https://www.vectolabs.com>



Photo 5: Centralized electronic bulletin board in Putrajaya

Source:
<https://smart.putrajaya.my/project/centralized-electronic-bulletin-board-cebb/>

B2: Install energy efficiency (EE) equipment and smart meters for PJC assets and commercial buildings

Using equipment that complies with energy efficiency standards and smart meters contributes to the great potential of energy saving which results in carbon emission reduction. A smart meter from TNB for instance is a device that records electricity usage and communicates this information automatically to TNB via radio-frequency waves for monitoring and billing. It reads the daily energy usage and provides more accurate bills for a smarter, greener and more energy efficient future. This smart meter can help the users to keep an eye on how much energy they are using at their premises. Hence, PJC can install energy efficiency (EE) equipment and smart meters for their assets (including government offices, community halls, and markets) and commercial buildings to manage and control the growth in energy consumption.





Photo 6: Smart meter
Source: <https://www.mytnb.com.my/smart-meter>

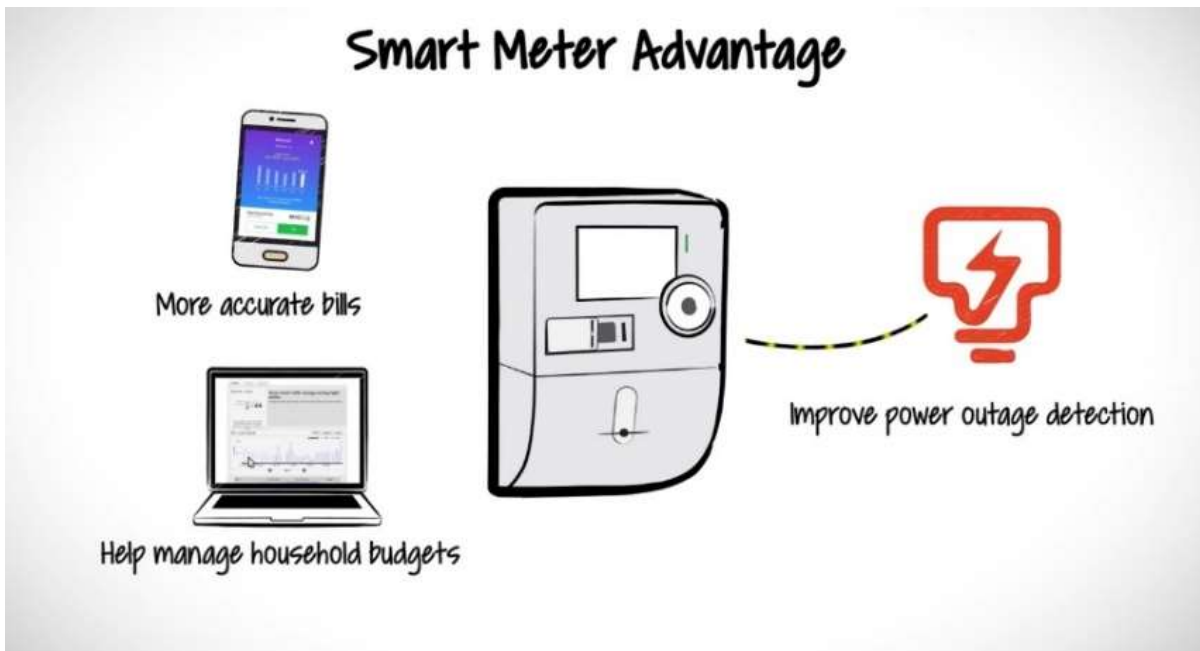


Photo 7: Smart meter advantage
Source: <https://www.mytnb.com.my/smart-meter>

9.2 Theme 2: Urban Planning and Building Regulations

Sustainable urban planning and building regulations can help reduce carbon emission in Putrajaya. Urban planning can potentially reduce people's travel demand and energy consumption in the city, meanwhile building regulations can increase the resource efficiency and relatively reduce negative impacts on the environment and human health within the entire lifecycle of a building. PJC can promote the adoption of passive architecture and safe city practices as well as incorporate green building design and certification in development control. Moreover, PJC can promote the adoption of rainwater harvesting system in Putrajaya.

14: Adopt and implement Safe City practices to promote active mobility and use of public transport

According to the Ministry of Housing and Local Authority (MHLA), a safe city is defined as a city that must be free from all physical, social and mental traits. The environment must not generate an atmosphere that will encourage incidents that threaten local prosperity. A safe and comfortable city will have an impact on the economy and national stability.

In planning towards a green city, adopting and implementing Safe City practices in Putrajaya are important to promote active mobility and the use of public transport. Active mobility involving walking and cycling is highly encouraged as a mode of travelling through the provision of an integrated network of pedestrian paths. These integrated networks are planned comprehensively to link together the use of public transport. Even though currently Putrajaya already has a network for pedestrians and cyclists, the ease and security of using these facilities should be enhanced. This is to encourage residents to shift from automobile usage to walking or cycling around Putrajaya.

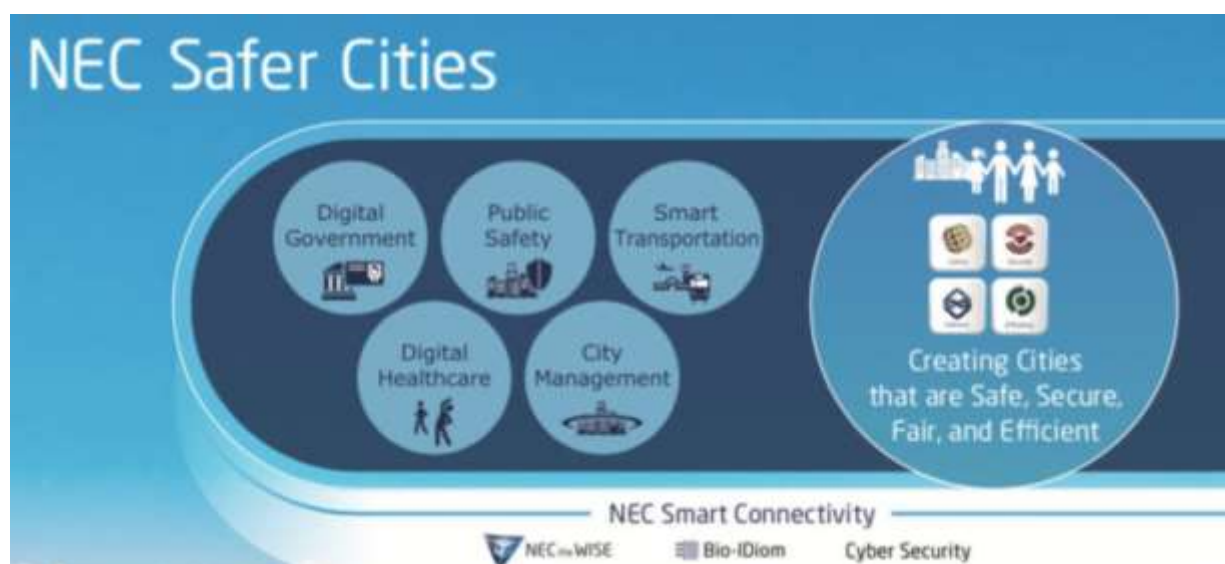


Photo 8: The element of safer cities by NEC
Source: <https://safecities.economist.com>

B3: Protect cultural identity, precincts character and sense of place through sustainable urban design practices (TOD, compact development)

Cultural identity refers to a person's sense of belonging to a particular culture or group. This process will involve learning and accepting traditions, heritage, language, aesthetics, thinking patterns, and social structures of culture. Place Identity 'and 'Sense of Place' are some concepts that can define the quality of people's relationships with a place.

PJC should protect cultural identity, precincts character and sense of place for Putrajaya through sustainable urban design practices such as Transit Oriented Development (TOD) and Compact Development. Transit Oriented Development (TOD) is a concept of development that involves compact and walkable neighbourhoods built around or centred on a rapid transit system station. Apart from encouraging people to walk and then building a 'Sense of Place' (appreciating the city), due to the urban form and design that emphasises compactness and closeness, it also advocates high-density development near the transit station, making trains and light rail transit a convenient mode to travel and encouraging ridership and improve the modal split in Putrajaya. Therefore, in order to materialise the concept of a green city in Putrajaya, developments in precincts should be planned and designed according to sustainable urban design practices including TOD and Compact development.

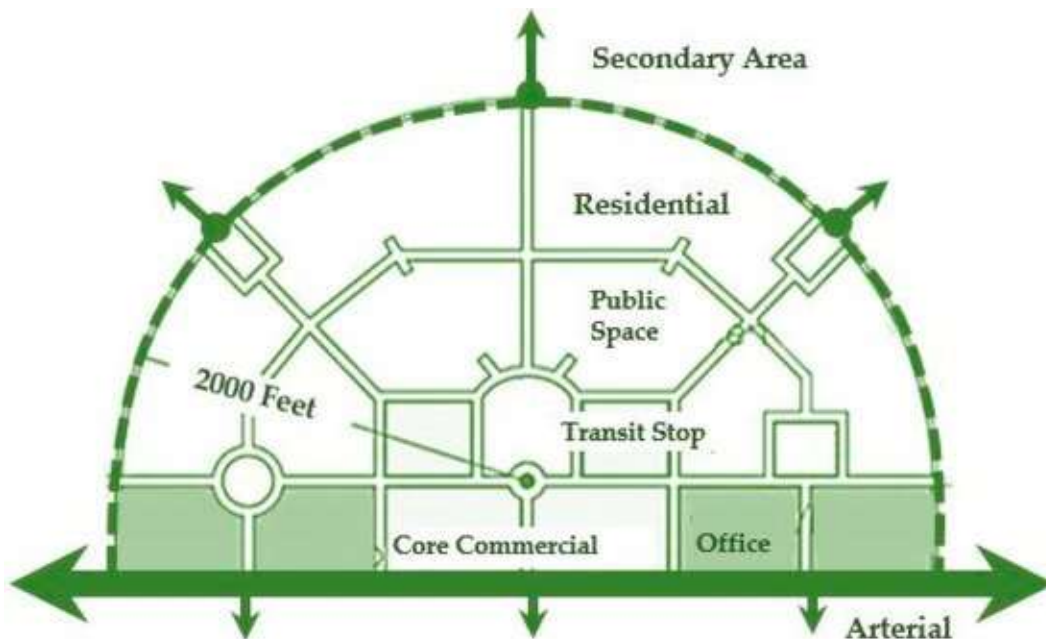


Figure 27: Illustration of transit-oriented development (TOD)
 Source: <https://www.mdpi.com>

B4: Incorporate the Latest Green Building Designs and Certification in Development Control

Putrajaya should recognise and encourage various latest green building assessments and ratings from both the public and private sectors in order to stimulate the emergence of certified green buildings. To assist and monitor the construction of green buildings in Putrajaya, different low carbon green building assessments and grading tools such as Green Building Index (GBI), MyCREST (CIDB-JKR), GreenRE (REHDA), Penarafan Hijau (JKR), and CIS 20 - GreenPASS (CIDB) is recognised. This can be done through development control where the green building assessments and ratings such as GBI must be complied with for planning permission or *Kebenaran Merancang* (KM).

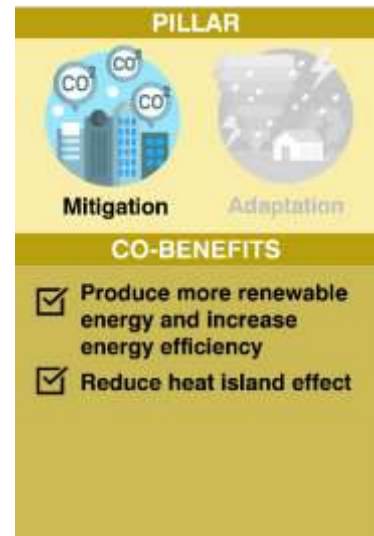


Photo 9: Zenith Putrajaya Hotel (left) and Menara PJH at Lot 2C2 (right) are two of the buildings applied Green Building Index in Putrajaya

Source: <https://www.greenbuildingindex.org>

B5: Promote Adoption of Passive Architecture in New Buildings via Natural Ventilation, Shading and Lighting

Putrajaya is located in the hot-humid tropical region, thus it shall demonstrate its sensitivity and identity as a tropical metropolis towards achieving low carbon society. Consequently, building design for new buildings should consider a passive architectural design, which is an effective solution to achieve low carbon green buildings with a minimum additional cost. The passive architecture includes natural ventilation, shading and lighting.

Natural ventilation reduces building energy use by cutting down the usage of air-conditioning in the buildings. Using the natural forces of wind and buoyancy, it can deliver fresh air and air change and ventilate building indoor spaces (refer to Figure 28). Daylighting alone can save up to 10-40% of building energy consumption for lighting while providing comfortable and healthy indoor environments. Passive architecture can reduce their dependence on mechanical and electrical equipment that requires much energy to achieve indoor comfort.

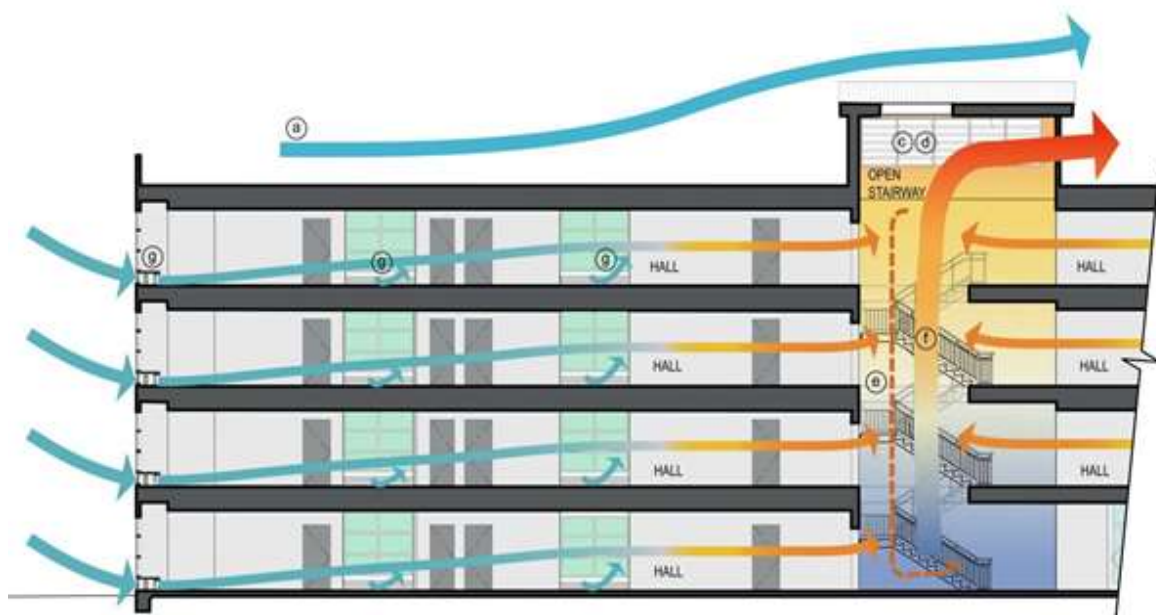


Figure 28: Comfortable Airflow in a Building by using Natural Ventilation
Sources: econaur.com

15: Expand the Adoption of Rainwater Harvesting System and Promote Periodical Maintenance of It

Towards becoming a sustainable high-income nation, the Government has efforts to focus on Water harvesting technology, specifically on Rainwater Harvesting Systems (RHS) in the Green Technology Master Plan Malaysia 2017-2030. Rainwater Harvesting (RWH) systems are the optimisation of available water resources, encompassing water collection, storage, treatment and harvesting techniques. Water resources include rainwater, surface water (such as runoffs), groundwater, treated effluent or grey water (refer to Figure 29).

Rainwater is collected, filtered and fed back into the property through a robust treatment system ensuring that only the cleanest water is utilised for non-potable purposes like landscape maintenance (watering), vehicle washing, toilet flushing and irrigation. A rainwater harvesting system also is suitable for businesses where there is adequate roof space to harvest sufficient water to achieve a good return on investment.

The rainwater harvesting system has been adopted in Putrajaya through Planning Permission (KM) for residential. Hence, it is important to expand the system to the commercial in Putrajaya. Meanwhile, periodical maintenance of the system is vital to ensure the system function well and protect water quality (prevent leaves and debris from entering the system).



Figure 29: Rainwater harvesting system with hose roof water runoff, underground piping, filtering, collecting in tank for domestic use.

Source: <https://www.treehugger.com>

9.3 Theme 3: Mobility

The concept of a walkable city is a popular alternative of green urban mobility that fits well into sustainable development and sustainable transportation. To become a walkable city, Putrajaya should focus on pedestrians and cyclists first. Implementation of a walkable city in hot tropical conditions like Putrajaya is challenging due to the hot sun and heavy rain.

Hence the supporting facilities and amenities such as pedestrian zone, safe walkways, covered or tree shading and safe crossing are important. Pursuing a shift from private vehicles to public transport will also help the promotion of public transport which will improve the modal split of Putrajaya where the usage of private vehicles is currently very high. Improving the quality of bus services such as online bus real-time information on arrival can be useful to reduce carbon emissions in the transport sector.

T1: Promote Pedestrian and Cycling as mode choice in home to work's travel in Putrajaya

Promoting walking and cycling as a mode choice in travelling home to work travel in Putrajaya is seen as one of the important strategies to decelerate the increase in car use. This car-centred approach has caused an increasing in CO₂ emissions and heavy traffic vehicles in the city. Putrajaya should advocate gradual progression (from leisure to utility walking and cycling) to help pedestrians and cyclists gain enough confidence to eventually start walking and cycling on trafficked routes to and from their workplace.



Photo 10: Walking as mode choice in Putrajaya
Source: <https://www.humanresourcesonline.net>

T2: Maintain Comfortable & Safe Pedestrian Networks

In order to make walking and cycling attractive options, Putrajaya should focus on safety, convenience and comfort for people on bikes and foot. This includes maintaining street planting for shades and street furnitures. Apart from absorbing CO₂ emissions and giving a natural feel to the existing landscape, trees can be used as natural shades along the interconnected pedestrianised public realms. Among the widely used street trees in Malaysia include *Filicium Decipiens* (Fern Tree), *Tabebuia rosea* (Pink Poui) and *Lagerstroemia* (Crape Myrtle). Proper selection of tree types should be emphasised to offer the maximum shading effect. Trees with little shading effect, such as palm trees, should be avoided. Besides, street trees also provide walking path directions, serve as a natural physical barrier from vehicular traffic, as well as a natural healer to the environment by consuming CO₂ through photosynthesis.

Street furnitures such as street signs, benches, bollards, streetlamps and waste containers help guide pedestrians as they move through the pathway. However, Putrajaya should limit the number of signs, poles and road markings to create a less cluttered appearance with fewer obstacles. Street furnitures for people with a disability shall also be considered for proper planning and design.



Photo 11 : Comfortable and safe pedestrian networks in Putrajaya
 Source: <https://www.ppj.gov.my/en/second-page/pengangkutan-dan-mobiliti>



Figure 30: The upgrading of cycling and walking infrastructure initiative in Putrajaya
 Source: <https://www.ppj.gov.my/storage/bandar/185/185.pdf>

T3: Rebrand Existing Car Free Day Event into Monthly Active Mobility Program

Car-Free Day Putrajaya is a green initiative to promote a healthy lifestyle among both locals and tourists in Putrajaya through recreational sports, arts and cultural activities (refer to Figure 31). Car-Free Day Putrajaya also strives to encourage healthy living, sustain eco-friendliness, and strengthen national unity and family bonding. This is aligned with Malaysia's commitment to reduce carbon emissions – as part of a global drive to protect the environment and support the ideals of the Paris Agreement and the UN Sustainable Development Goals of 2015.

The rebranding of the existing Car-Free Day event into a monthly program serves to reinforce and instill higher awareness and adoption of active mobility among the community in Putrajaya.





Figure 31: Car-Free Day Putrajaya Poster
Source: <https://www.ppj.gov.my>

T4: Promote a shift from private vehicles to public transport

Presently the general choice of mobility in Putrajaya is still very much centred around cars and motorcycles (private vehicles). Residents in Putrajaya depend so much on their private vehicles to move around and commute, and this has contributed to the increase in greenhouse gas emissions. Hence, in order to reduce the environmental impact caused by these vehicles, pursuing a shift from private vehicles to public transport is essential. It reduces the number of people driving single occupancy vehicles hence more fuel is conserved, air pollution decreases, and Putrajaya's carbon footprint is reduced.



Photo 12: Public transport in Putrajaya
Source: <https://paultan.org>

T5: Provide more environmentally friendly public bus services by using clean and green fuel

Putrajaya should provide more environmentally friendly public bus services, especially using clean and green fuel. These environmentally friendly public buses are important to the Putrajaya community, especially in improving urban air quality, increasing energy security through reducing oil dependency and ensuring efficient use of energy resources. Putrajaya also may consult with the federal government, such as the Ministry of Transport of Malaysia (MOT) and Ministry of Finance of Malaysia (MOF) to provide incentives or subsidies to bus operators and support for the investment to make an environmentally friendly public bus such as hybrid or electric buses viable. Putrajaya will provide stage bus services using EURO 5 diesel as a clean and green fuel until 2027.



T6: Install digital display board for real time information on public transport

Real time information benefits passengers with respect to improved public transport availability and usability. The most prevalent medium used for the distribution of real-time bus information is the electronic sign, also known as the Dynamic Message Sign (DMS), located at bus stations, bus stops, and rail stations. The real time information may display the current time and date, route number, final destination of transport, waiting for time and service disruption or other important service messages. A total of 6 real time information for public transportation will be provided at the Putrajaya Sentral Terminal and this will make the terminal a Smart Bus Stop by 2025.



Photo 13: Example of real time information digital display board
Source: <https://www.hmetro.com.my>

T7: Promote sharing green economy and the future of personal mobility (e.g partnering with EV Car Sharing Companies)

As keeping a car in the city can be expensive and finding a place to park can be difficult, car sharing is an efficient and convenient option for people who use a car infrequently. Putrajaya should promote and consider the program of partnering with car ride-sharing companies, especially using electric vehicles (EVs).

Putrajaya may facilitate the expansion of car sharing by enabling electric shared vehicles to be stationed at main activity centres. A key part of this program is therefore to collaborate (multiple partnerships) and build commitment, for example with EV car producers like Mitsubishi and Nissan. Multiple partnerships ensure rapid growth in the use of EV cars. Putrajaya also should consider the program of partnering with e-hailing vehicles. Since then, many e-hailing customers have taken use of the services offered to further utilise the connection of the transportation networks in order to reach their destinations quickly and affordably.

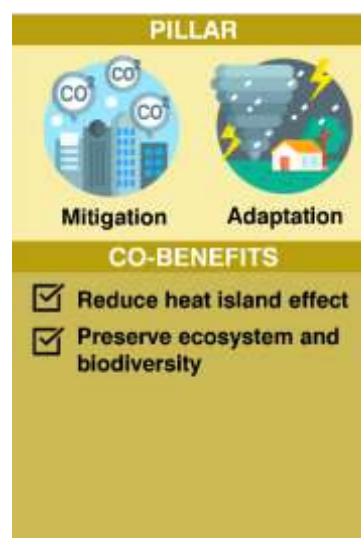


9.4 Theme 4: Blue and Green

Green space planning and management in Putrajaya focus on minimising the impact of flooding. The provision of conservation areas such as wetlands will help to reduce the impact of floods and drought. Protection of existing green areas that are linked with one another can be useful for effective retention ponds to mitigate flooding and make recreational areas more functional. Green parks can and water bodies (wetlands or lakes) can also protect fauna and flora in urban areas.

E1: Promote vertical gardens and green roofs in commercial buildings, schools and government buildings

The first step toward making Putrajaya healthier is to plan for green spaces wherever possible. Adding a layer of vegetation to rooftops and creating green roofs, for example, has been shown to reduce the urban heat island effect. Meanwhile, vertical greening, also known as facade greening, green wall, vertical garden, or living wall, is a living and self-regenerating cladding system that could be applied onto the interior and exterior walls of buildings. Soil, plants, and greenery on building envelopes (roof and walls) would reduce surface temperature while also acting as insulation for the structures below, lowering the amount of energy required to heat and cool the buildings. Green roofs and vertical walls can also help to absorb carbon dioxide and regulate rainwater by catching it as it falls and filtering it to remove pollutants. As such, it is important to promote vertical gardens and green roofs in commercial buildings, schools and government buildings in Putrajaya.



E2: Conduct Tree Planting Campaign in Putrajaya in line with 100 Million Tree-Planting Campaign 2020-2025

In conjunction with the 100 million trees campaign organised by the Ministry of Energy and Natural Resources (KeTSA) (the name of the ministry is recently changed to Ministry of Natural Resources, Environment and Climate Change (NRECC)) as part of the program to make Malaysia green, it is important for Putrajaya to support the greening campaign as 400 000 trees are intended to be planted in Putrajaya. As such, tree planting campaigns should be held in parks and schools of Putrajaya. This can create awareness among school children and teachers which is an important step towards a low carbon society. Apart from providing attractive greenery views in Putrajaya, tree planting has multiples benefits as it helps provide shade and promote walkable communities, reducing air pollution and air temperature, sequestering atmospheric CO₂ and lastly providing a natural habitat to animals.

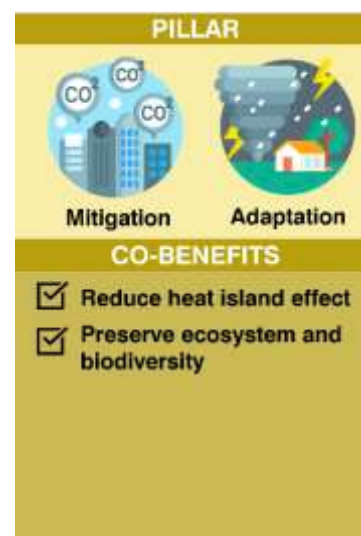




Photo 14: 100 million tree planting campaign
Source: <https://www.astroawani.com>

E3: Conduct Continuous Monitoring and Updating on Existing Tree Inventory

In order to effectively manage and care for landscape trees as well as understand the current situation of green covers, Putrajaya needs to conduct continuous monitoring and updating of an existing tree inventory including Sistem Inventori dan Pengurusan Pokok (SIPP), MyBis and Putrajaya GeoInfo.

Information such as tree species, number of trees, location and position of trees, tree size, current health status and maintenance requirements of each tree is useful and should be kept up to date. As such, inventory and fieldwork are essential for obtaining such information. Information gathered from the inventory activities is useful in planning and making decisions regarding landscape trees. Computer technologies applications such as GPS, GIS and RFID can assist in the monitoring and updating of inventory systems.

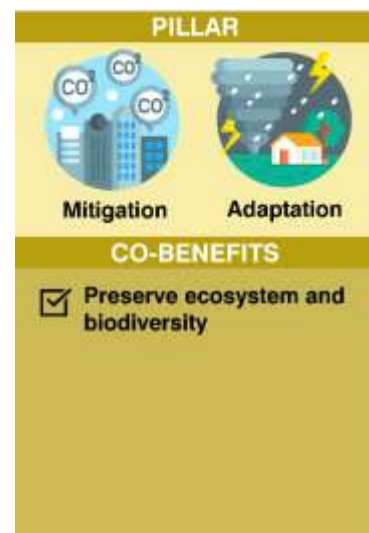




Photo 15: Sistem Inventori dan Pengurusan Pokok (SIPP) in Putrajaya
Source: Putrajaya Corporation

E4: Conduct Continuous Enhancement of Urban Biodiversity

Biodiversity (flora and fauna) in urban spaces is usually conserved in forests and large parks. Biodiversity is important to ensure a healthy city environment. Well protected green covers through local masterplans or studies (such as Kajian Biodiversiti Bandar Putrajaya and Program Konservasi Fauna Putrajaya) in Putrajaya can gradually enhance the natural biodiversity. According to Kajian Biodiversiti Bandar Putrajaya, Putrajaya has 14 species of amphibians, 21 species of reptiles, 13 species of mammals and 104 species of birds (refer to Figure 32). The study has been conducted since 2001 with collaboration between Putrajaya Corporation, Kementerian Alam Sekitar dan Air (KASA) (the name of the ministry is recently changed to Ministry of Natural Resources, Environment and Climate Change (NRECC)) and Universiti Kebangsaan Malaysia. Such studies can be continuous conduct to further enhance urban biodiversity in Putrajaya.

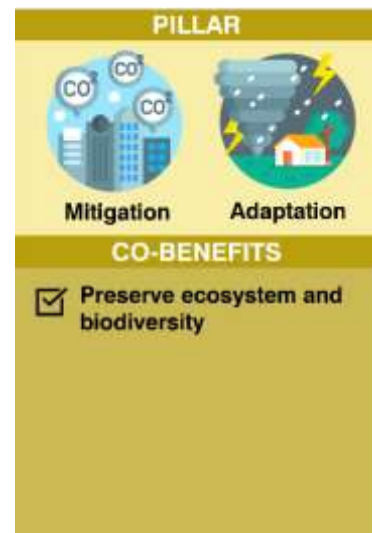




Photo 16 : Birds in Putrajaya
Source: <https://wacana.my>

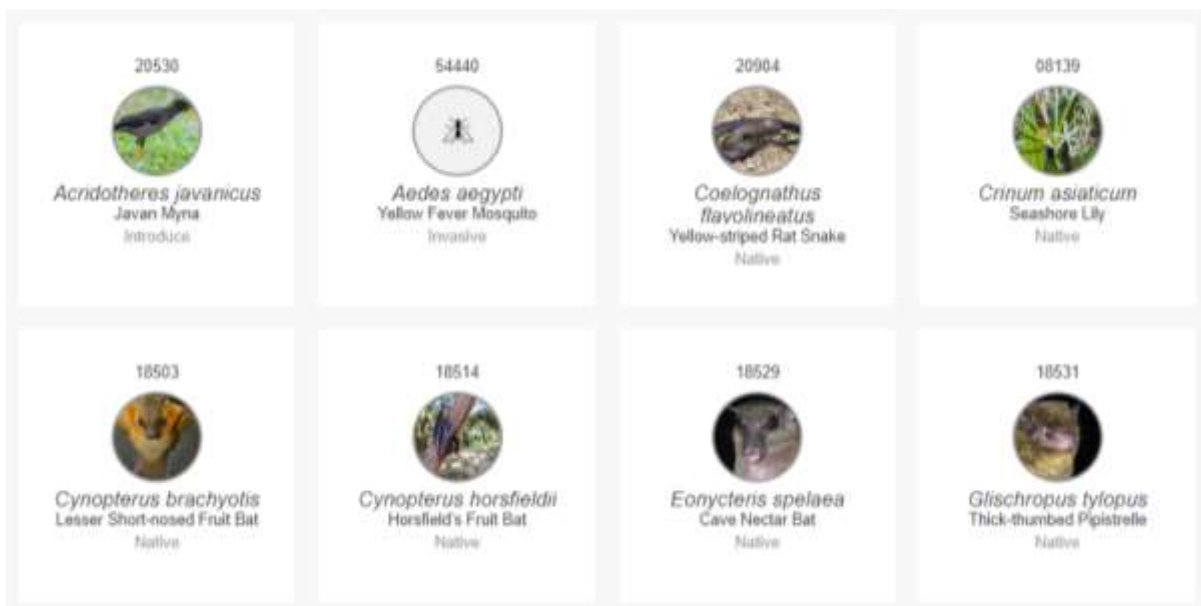


Figure 32: Species in Putrajaya
Source: <https://www.mybis.gov.my/pb/3333>

E5: Promote Nature-Based Solution (NBS) to protect, restore and manage natural and semi-natural ecosystems

Nature-based Solutions (NBS) are defined as actions to protect, sustainably manage and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits.

The goal of NBS is to support the achievement of sustainable development goals and safeguard human well-being in ways that reflect cultural and societal values and enhance the resilience of ecosystems. Hence, aside from mitigating GHGs, NBS are primarily designed for addressing major societal challenges, such as food security, climate change, water security, human health, disaster risk, social and economic development. Hence, Putrajaya should promote NBS as sustainable management and the use of natural features to tackle social and environmental challenges.

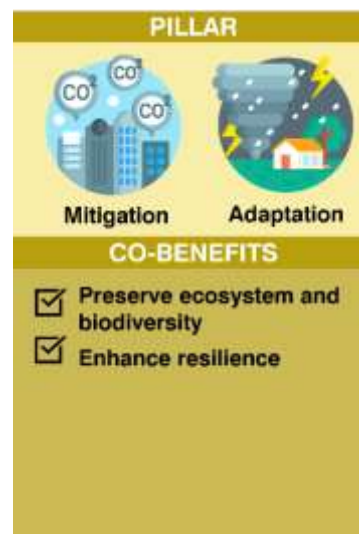


Figure 33: Nature-based solutions

Source: <https://www.iucn.org/news/ecosystem-management/201901/informing-global-standard-nature-based-solutions>

E6: Enhance Putrajaya Lake Awareness Programme

Man-made wetland and lakes that are unique features in the built environment of Putrajaya have a great potential to generate new economic opportunities, as well as offering a great venue for water sports including international-level competitions. Successful implementation of wetland protection for better lake water quality offers an opportunity for Putrajaya Wetland to become a research and development centre for wetlands and related studies. Hence, it is important to protect wetlands and lakes in Putrajaya by organizing and enhancing Putrajaya Lake Awareness Programme. This can be done through educational workshops, talks and educational tours at the wetlands and lakes.

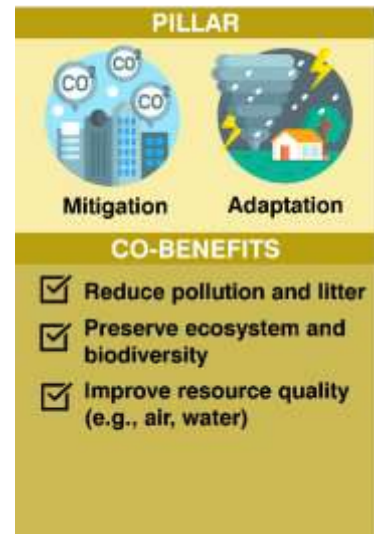


Photo 17: Putrajaya lake and wetland
Source: <https://www.holidayfy.com>



Photo 18: Water sport in Putrajaya
Source: <http://blog.malaysia-asia.my>

E7: Monitor and Protect Lake Water Quality

It is crucial to keep the man-made wetlands and lakes in Putrajaya clean all the time by monitoring the diversity index and protecting the lake water quality. Currently, Putrajaya has adopted the Putrajaya Lake Water Quality Management System (refer to Figure 34) to monitor and assess the water quality (rivers and lakes) or its suitability based on compliance the National Water Quality Standards for Malaysia (NWQS)(DOE). The system can provide various data and parameters including early warning system, temperature, turbidity, salinity, biochemical oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids (TSS), pH, chlorophyll, pollutants trending, and continuous capturing the effluent discharge. Continuous monitoring and assess the water quality is important to protect lake water quality in Putrajaya.

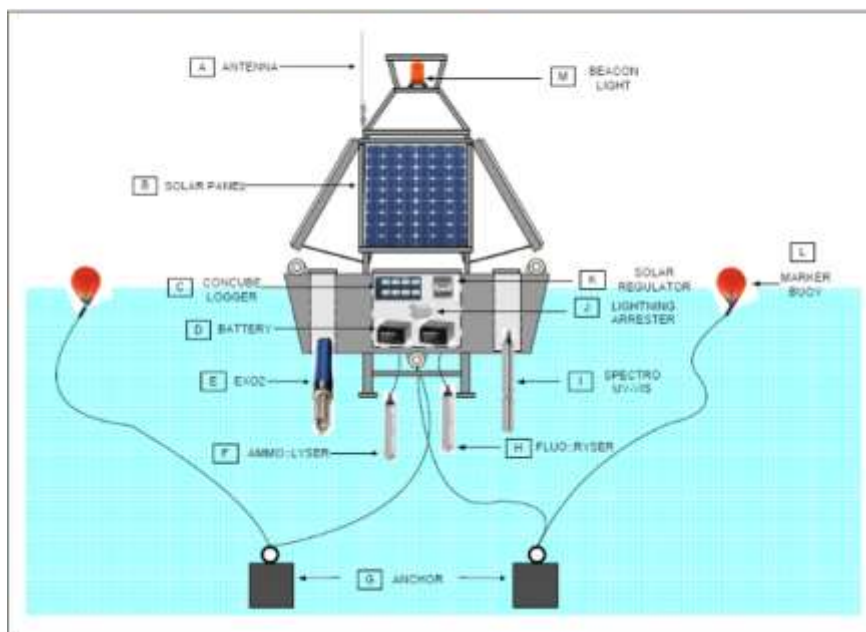
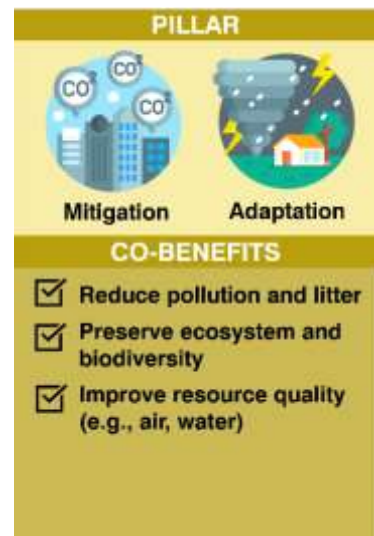


Figure 34: Putrajaya lake water quality management system

Source: <https://smart.putrajaya.my/project/putrajaya-lake-water-quality-management-system>

9.5 Theme 5: Community

Mobilising community actions towards a low-carbon future calls for the development of a low-carbon society (LCS) for Putrajaya that involves the local authority, local residents, NGOs and the business community. This needs to be done systematically through stakeholder engagement such as focus group discussions (FGDs) during the Local Plan preparation process. Residents can be mobilised by setting up Low Carbon Clubs involving Residents Associations and through the promotion of LCS activities like 3R, community farming as well as economic activities such as the production of eco-friendly agriculture products. PJC should also strengthen the governance system to improve monitoring and development control, particularly in reducing dengue cases and developing and maintaining a smart solid waste management system.

S1: Transform existing Residents' Association, Local Businesses and Industries into Low Carbon communities

One of the best approaches to engage with the communities is through their residents' association, local businesses and industries. PJC should engage and encourage them to set up a low carbon association unit or portfolio in the existing associations. Creating the associations is crucial to ensure effective implementation of low-carbon and climate change programs. With the cooperation from the residents' association, local businesses and industries, it is easier to convince and involve the local community to participate in planned activities and therefore collective action (or community of practice) is enhanced.

With the low carbon residents' association, local businesses and industries, it aims to foster awareness among community on the importance of preserving the environment and thus reducing pollution. It is vital to attract and empower the community to adopt a low-carbon lifestyle by organising attractive and fun low carbon programs such as logging activities in some selected areas and neighbourhoods. The implementation of this proposal will foster community awareness on the aspects of cleanliness, social well-being, and the importance of protecting the local environment.



S2: Strengthen Putrajaya Urban Farming Program (Program Pertanian Bandar 'PUF') by increasing participation and involvement of residents

Putrajaya Urban Farming (PUF) Program is a pilot project of a smart partnership between PJC, MARDI and residents' associations under Putrajaya's Local Agenda 21 program as one of the sustainable development programs in Putrajaya. Among others, a method of growing fruits and vegetables using the integrated farming-fertigation technique is introduced to garden participants.

The four objectives of the PUF Program:

- Guarantee the safety of agro-food (food security)
- Community preparation for climate change
- Community food production for local consumption
- Educate the younger generation in fresh food production technology

Planting edible plants, such as fruit trees and vegetables, will help to increase the greenery of the neighbourhood and provide organic food to the communities. In addition, these parks or gardens can function as educational and learning grounds for students and as touristic or attractive places for non-local visitors. In order to increase participation and involvement in strengthening PUF, all residents in Putrajaya should be encouraged to involve in these community urban farming programs within their neighbourhoods.



Photo 19: Putrajaya Urban Farming at Precinct 9 and Precinct 14
Source: <https://www.kosmo.com.my> and PJC

S3: Expand Food Waste Composting Programme for the purpose of Community Farming

Food waste has a great potential to be converted into fertiliser. These organic wastes can be utilised in a wealth creation program rather than being sent to a landfill. In order to promote compost from the food of commercial and residential units (waste to wealth), PJC with the collaboration of residents initiated a food waste composting project. PJC provided a food waste anaerobic digestion composting machine that can support up to 100kg of food waste each day. Through this activity, less money is spent by PJC on managing and discarding waste at the landfill, and more interestingly, residents get extra income as they can sell liquid compost and biogas for urban farming. The project will be implemented in phases in the selected communities (landed residences).

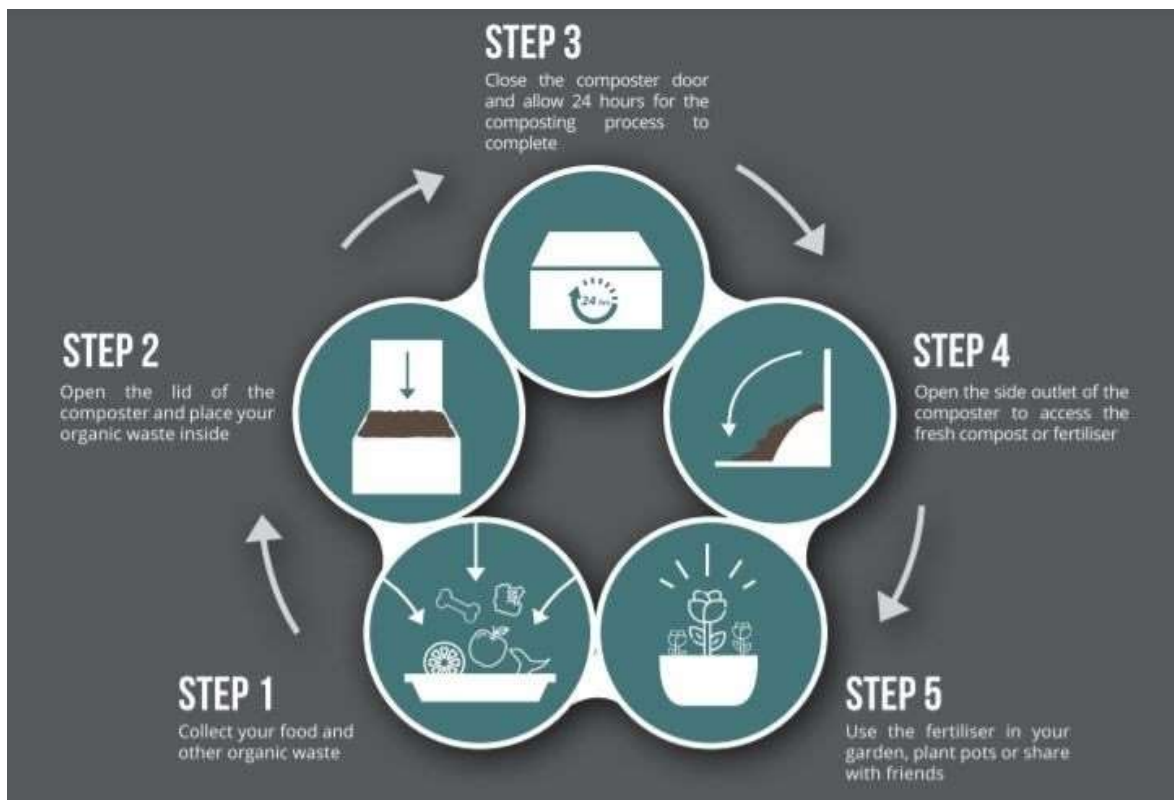


Figure 35: The process of food waste composting

Source: <https://www.weforum.org/agenda/2021/04/food-waste-composter-start-up/>

16: Further Expand Waste-to-Wealth program (e.g., CAREton@Putrajaya) by collaborating with other private companies

One of the programs that can reduce the amount of waste from housing and commercial activities is the concept of waste-to-wealth. The concept of waste-to-wealth is defined as the transformation of waste from an exhausted utility to a valuable commodity. Food waste and used beverage boxes have a great potential to be converted into fertilizer and polyal boards and fibre paper. These organic wastes can be utilised in a wealth creation program rather than being sent to a landfill.

Utilising the fertiliser produced from locally generated organic waste can provide twofold benefits. On one hand, it can contribute to effective organic waste disposal and can prevent open burning which is conducted to dispose of organic waste, especially garden waste. Putrajaya has conducted waste-to-wealth programs such as CAREton@Putrajaya. Hence, further, expanding the waste-to-wealth program by collaborating with other private companies is needed.

PILLAR	
	
Mitigation	Adaptation
CO-BENEFITS	
<input checked="" type="checkbox"/>	Reduce pollution and litter
<input checked="" type="checkbox"/>	Support cost saving
<input checked="" type="checkbox"/>	Promote circular economy



Figure 36: The process of waste to wealth by Milo
 Source: <https://www.milo.com.my/the-milo-careton-project-latest-happenings>

S4: Enhance community awareness on 5R, Proper Disposal and Illegal Dumping

Awareness is a process that aims to inform and educate people about a topic to influence their behaviours and beliefs towards the achievement of a set purpose or goal. It is important to promote an understanding of waste management issues such as 5R (Refuse, Reduce, Reuse, Recycle dan Recovery), proper disposal and illegal dumping.

Waste management is a serious issue that we are facing nowadays. If we are not aware of sustainable waste management, it leads to serious impacts like air pollution, water pollution, and soil pollution. By doing small practices in our daily life, we can make a huge difference. For that, PJC should enhance community awareness of the benefits and importance of 5R and proper disposal as well as legal and social-environmental consequences of illegal dumping and increase and improve recycling facilities in the city.



Photo 20: Recycling facilities in Putrajaya
Source: Putrajaya Corporation

17: Cultivate Recycling Behaviour of the Public through FIKS (Fasiliti Inovasi Kitar Semula)

Fasiliti Inovasi Kitar Semula (FIKS), launched on 25th July 2020 at Precinct 5 Putrajaya, is a recycling education centre for the public to learn about the recycling process and waste recovery. It aims to promote 5R (refuse, reduce, reuse, recycle and recovery) to Malaysians (especially Putrajaya residents), as well as to help reduce recyclable waste sent to landfills (refer to Figure 37). There are six (6) FIKS's facilities prepared by Alam Flora Sdn. Bhd. namely (i) Knowledge Hub (ii) 3R Butik (iii) Buy Back Center (iv) KOC Ilmu (v) KOC Kreatif and (vi) Integrated Recycling Facility (IRF) (refer to Figure 38). Hence, it is important to launch more FIKS at other precincts to cultivate the recycling behaviour of the public in Putrajaya.



Figure 37: The mission of FIKS

<p>Knowledge Hub Knowledge Hub is a learning and information hub on recycling and its processes.</p>	<p>3R Butik A boutique that collects used clothes for sale with proceeds donated to charitable organisations.</p>	<p>Buy Back Centre A Buy Back Centre that buys recyclable goods before sending them to the Integrated Recycling Facility (IRF). Earn cash and rewards points as an incentive, in return.</p>
		
<p>KOC Ilmu A library equipped with books on environment and general knowledge.</p>	<p>KOC Kreatif An activity area for kids to play and learn. It includes fun and interactive games and learning tools.</p>	<p>Integrated Recycling Facility (IRF) Integrated Recycling Facility (IRF) is a facility where recyclable items are collected, sorted and baled before being sent to major recyclers for recovery processes.</p>
		

Figure 38: List of FIKS's facilities and details

Source: <https://www.facebook.com/alamflorasdnbhd/posts/kenali-fasiliti-inovasi-kitar-semula-fiks-presint-5-putrajaya/5044492638895917/>

9.6 Theme 6: Climate Resilience

Creating a sense of community awareness is the first step in fostering the prevention of dengue among the residents in Putrajaya. An accurate yet accessible information channel for disseminating information related to dengue is vital in creating awareness and empowering the community to prevent the widespread of dengue. The distribution of information can be done via using mass media, social marketing approach and collaboration with relevant stakeholders in educating the public.

D1: Raise community awareness and participation in prevention of dengue through a step-by-step guide such as COMBI

Creating a sense of community awareness is the first step in fostering the prevention of dengue among the residents in Putrajaya. More effective step-by-step guides such as COMBI (Communication for Behavioural Impact) can be channelled to locals via using mass media, social marketing approach and collaboration with relevant stakeholders.

The Ministry of Health of Malaysia (KKM) has undertaken several activities to raise awareness of the disease and curb the spread of dengue among the public. Education on prevention of the disease, which includes the COMBI (Communication for Behavioural Impact) (refer to Figure 40). Five (5) fundamental concepts should be practised in order to implement the COMBI program, and they are (i) Administrative Mobilisation / Public Relations / Advocacy; (ii) Community Mobilisation; (iii) Advertising; (iv) Interpersonal Communication and (v) Point-of-Service Promotion. Meanwhile, the '10 minute a day' campaign urging members of the public to set aside ten minutes a week to clean their houses and remove possible mosquito breeding areas around the house, was organised in a big way (refer to Figure 39).



Figure 39: '10 minute a day' campaign by the Ministry of Health of Malaysia

Source: <https://kpkesehatan.com/2017/03/05/kenyataan-akhbar-kpk-5-mac-situasi-semasa-demam-denggi-zika-dan-chikungunya-di-malaysia/>



Figure 40: Ways to preventing dengue using the COMBI program
Source: <https://idengue.mysa.gov.my/combi.html#page=1>

D2: Improve Enforcement and Inspection of PJC on Potential Mosquito Breeding Sites (Constructions Sites and Residential Neighbourhoods)

Among various ways of preventing the widespread of dengue, effective enforcement of periodical inspection by Putrajaya officers on potential mosquito breeding sites involving all levels from individuals, families, communities, and schools and supported by Local Authorities and all relevant government agencies is crucial. PJC may impose fines or other forms of penalty on violators especially in public and residential areas. Several ways or activities as follows can prevent Aedes mosquitoes from breeding are:

- Collect all unwanted containers that can hold water (such as cans and bottles) and dispose of them in a way that they would not continue to collect water.
- Change the water and scrub the insides of flower vases once a week
- Clean plant pot plates and scrub thoroughly to remove Aedes mosquito eggs once a week
- Cover all water containers

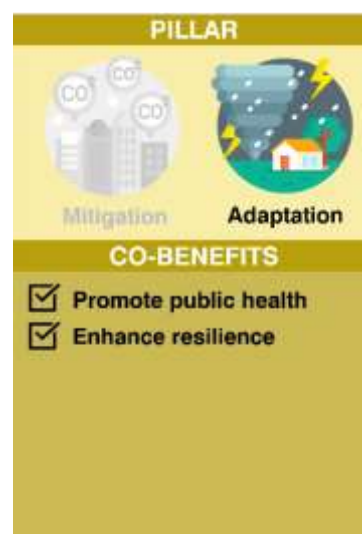




Photo 21: Examples of potential mosquito breeding sites

Source: <https://www.semanticscholar.org>

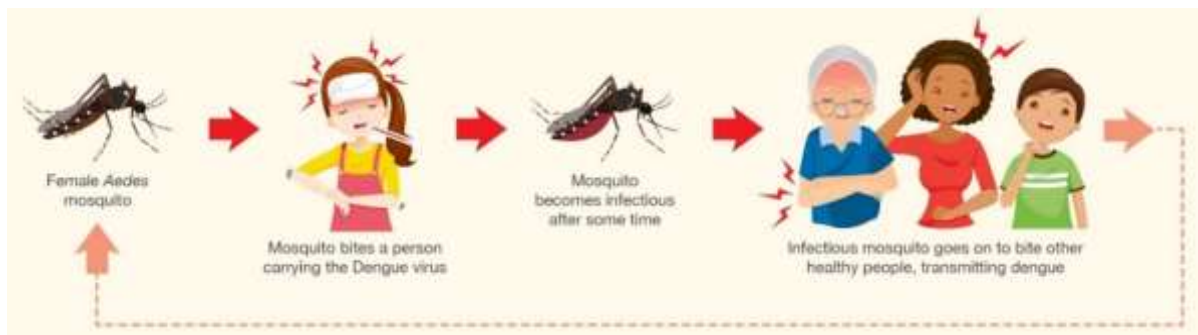


Figure 41: How is dengue transmitted by Aedes Mosquitoes?

Source: <https://www.nea.gov.sg/dengue-zika/stop-dengue-now>

D3: Identify potential spots and frequency of downed trees at housing and commercial areas

Currently, the severe wind hazard in Putrajaya has caused many fallen trees and therefore damaged both public and private property such as vehicles, roads and landscapes. Therefore, PJC should identify potential spots of trees that may frequently fall due to severe wind or storm, especially in housing and commercial areas. A system or database to record those spots may also be needed. Early trimming before the heavy raining season in October to December (refer to the rainfall data in Table 2) as pre-caution action can also be considered to reduce fallen trees in Putrajaya.





Photo 22: The storm severely damaged Putrajaya's residential areas and infrastructure.
Source: Putrajaya Corporation

D4: Improve tree selection and landscape design to reduce the impact of wind

It is important to review the existing design for buildings, roads, drainage and transportation systems to incorporate climate change factors. The designing of critical infrastructures should consider being more resilient and durable. In addition, more technically advanced design methodologies need to be developed to enhance the safety and durability of roads and landscaping in housing and commercial areas. PJC should also improve tree selection and landscape design to protect it against disease, be climatically adapted and reduce the impact of wind. The planting space (landscape reserve) above and below the ground should be large enough for the trees to reach their mature root extension, hence it will become more resilient and durable to the severe winds and at the same time, damage to sidewalks, pavement and curbs will be reduced.

Besides, a tree inventory should be conducted to understand current conditions and species composition of trees. The inventory system also serves as a valuable database for PJC and the public to identify, monitor, maintain and report any incidents to the trees.



D5: Expand and improve monitoring systems through social media or other communication platforms to reduce outdoors activities due to heat wave

Due to the extremely hot weather phenomenon of the city, Putrajaya is at risk of experiencing disasters like heat waves. Limiting outdoor activities of communities especially young children and the elderly is one of the effective strategies for adapting to a heat wave. Expanding and improving monitoring systems through the websites of the meteorological department and sharing information about the current hot temperature is important to reduce heat stress or heat stroke. Information shared on the various social media platforms such as Facebook, and WhatsApp on the heatwave should also feature heatwave adaptation strategies, response and recovery plans.



Photo 23: Example of platforms provided by MET Malaysia
Source: <https://m.met.gov.my/info/inforakanmet?lang=en>

D6: Introduce programs or initiatives to reduce water consumption in commercial and residential areas

Communities of Putrajaya should be aware of the impact of their daily life activities on the environment, especially in terms of water and electrical consumption. Saving or conserving water not only saves up money, but it also helps the community adapt better to drought.

To motivate and obtain the community's active participation after the awareness campaigns programs such as competitions with two categories (individual or collective) can be organised for the community.



D7: Improve maintenance of drainage system in Putrajaya

The main cause of flooding in Putrajaya is attributed to the poor maintenance of drainage systems. The water flow got stuck because of the garbage that clogged up the drain. Putrajaya should focus on spot such as drainage sumps and improve the maintenance of the drainage system e.g., via periodical inspection and use of high-pressure water jetting, a technique of cleaning and unblocking drains, to reduce flooding. Putrajaya should also consider integrating the concept of sustainable development into its development policies towards curbing the flood hazard reduction. People, especially disaster victims, need to be engaged and empowered to be more resilient.

PILLAR

Mitigation

Adaptation

CO-BENEFITS

- Reduce pollution and litter
- Increase safety
- Enhance resilience

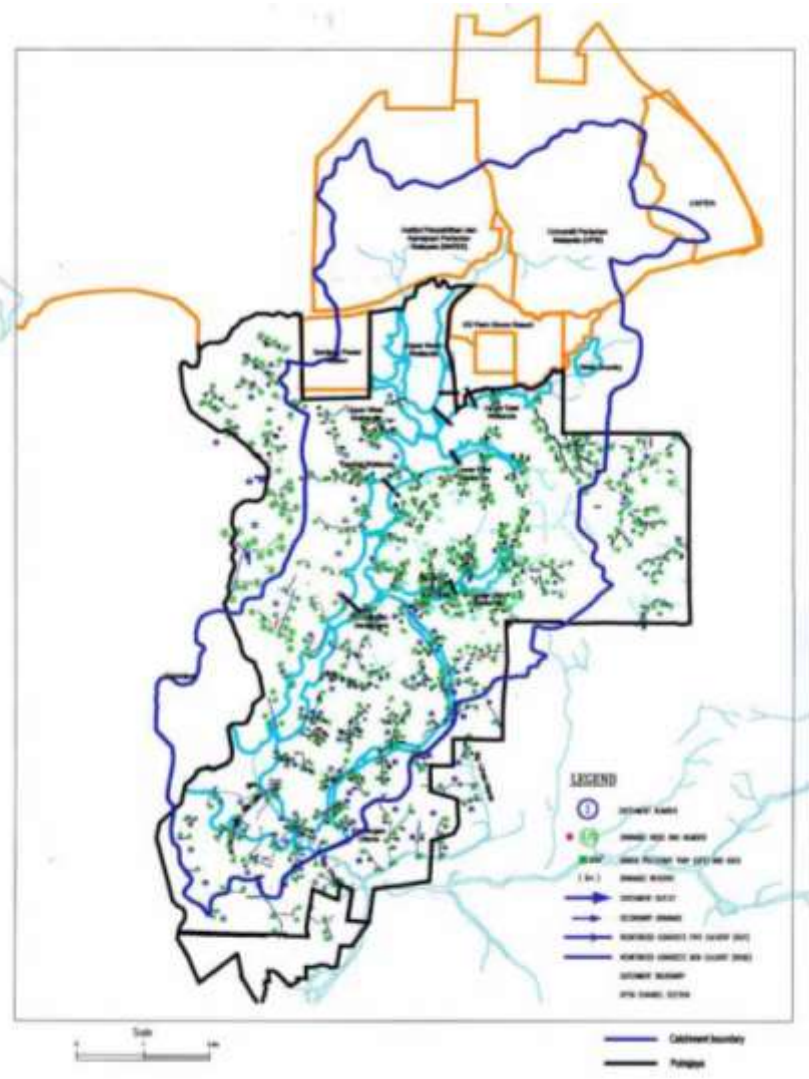


Photo 24: Drainage system in Putrajaya
Source: Drainage Masterplan Study



Photo 25: Putrajaya should focus on spot such as drainage sumps to reduce flooding
Source: Putrajaya Corporation

D8: Improve early warning systems through Multi-Hazard Platforms such as social media, newspaper, public announcement and other applications

Early warning systems are one of the adaptation initiatives in the flood response and management plan. Early warning systems using integrated communication systems to help communities prepare for climate-related events. The systems can be provided through a Multi-Hazard Platforms such as social media, newspapers, public announcements and other applications.

To be effective, early warning systems need to actively involve people and communities at risk, disseminate messages and warnings efficiently and ensure that there is a constant state of preparedness, and that early action is enabled. The significance of an effective early warning system lies in the recognition of its benefits by local people.



9.7 Relationships Between Planned Actions of GHG Mitigation and Climate Hazard Adaptation

This chapter illustrates the relationship between planned actions of GHG mitigation and climate hazard adaptation for Putrajaya (refer to Figure 42). The planned actions are obtained from the series of stakeholder engagements with PJC, technical agencies and NGOs. Based on focused acceleration guidance proposed by C40, the targeted reduction potential from the planned action formulated is based on 43% reduction from stationary energy sector, 48% from transportation and 9% from waste sector.

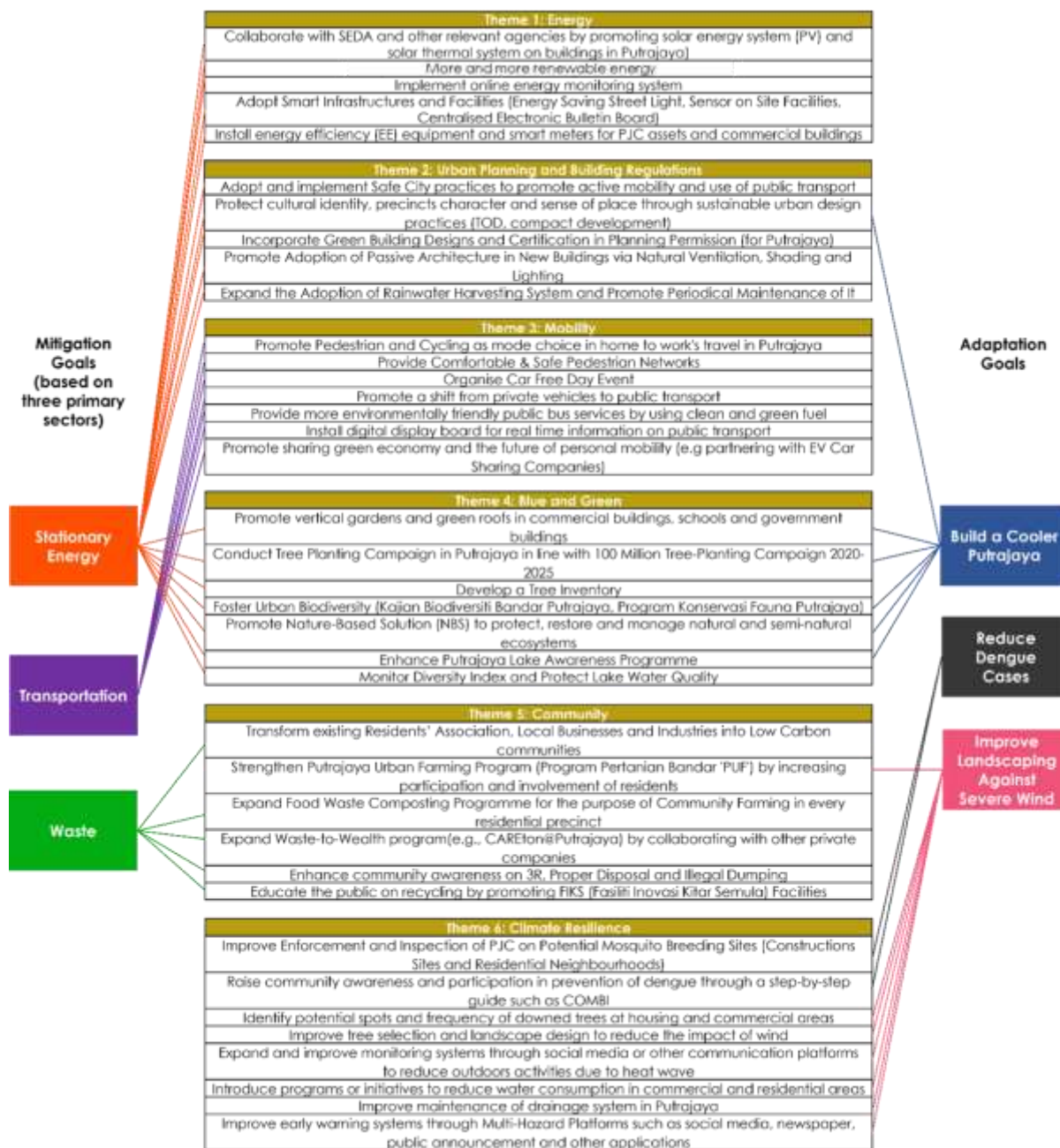


Figure 42: Relationships between planned actions of GHG mitigation and climate hazard adaptation

Chapter 10.0 Financing

Putrajaya aims to seek local, national and international funding sources in order to finance this Climate Action Plan. The Corporation itself will fund local-level projects such as tree planting, drainage maintenance, street lighting, building of pedestrian walkways, and solid waste management. Federal funding will be sought for larger infrastructure projects, and the Corporation will apply for national and international co-financing for more ambitious initiatives. Climate finance may be sourced internationally and/or domestically from both the public and private sectors (refer to Figure 43).

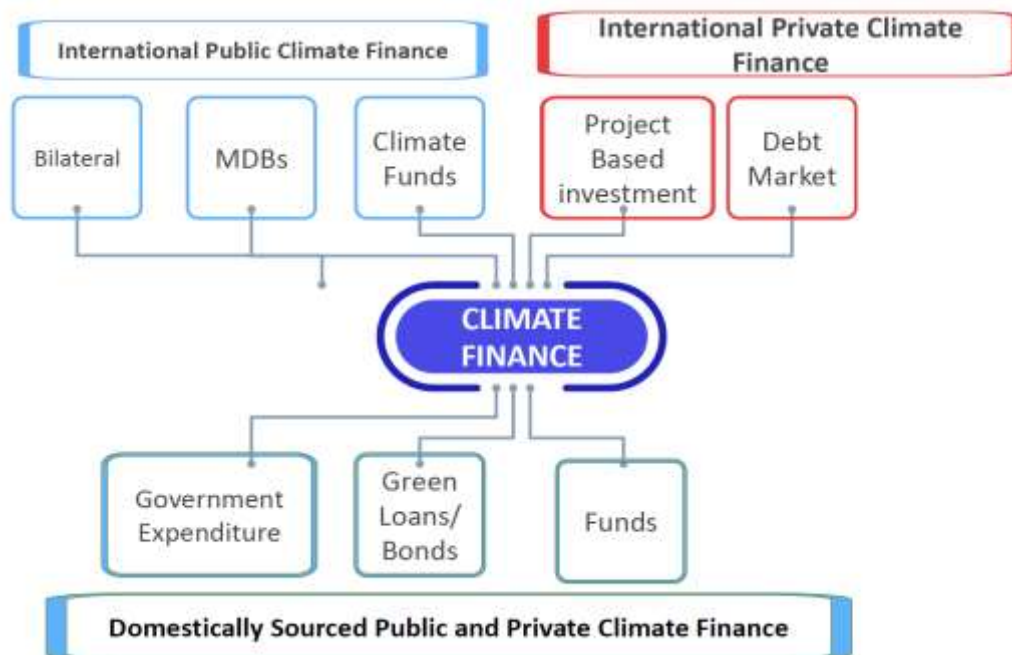


Figure 43: Domestic and international climate finance framework in Malaysia

Source: Ministry of Environment and Water, 2022 (the name of the ministry is recently changed to Ministry of Natural Resources, Environment and Climate Change (NRECC))

The Ministry of Natural Resources, Environment and Climate Change (NRECC) acts as the National Designated Authority (NDA) or Operational Focal Point for various international climate funds, including the Green Climate Funds (GCF; www.greenclimate.fund), the Global Environmental Facilities (GEF; www.thegef.org) and the Adaptation Fund (AF; www.adaptation-fund.org).

At the international level, many Project Preparation Facilities (PPF) aiming at providing technical assistance to cities in terms of strengthening the cities' readiness in undertaking projects that aim at mitigating and/or adapting to climate change are also available. Table 4 shows some examples of PPF, including the City Climate Finance Gap Fund and the Transformative Actions Program (TAP) to which GCoM is partner and application by member cities are supported by the GCoM Secretariat of the relevant region.

Table 4: Examples of Project Preparation Facilities (PPF) that are available for application

Project Preparation Facilities (PPF)	Offer
Green Climate Fund Project Preparation Facility (Readiness Program)	Technical assistance, grants and scale up financing instruments
ASEAN Catalytic Green Finance Facility	Technical assistance, scale up financing

Project Preparation Facilities (PPF)	Offer
Asian Infrastructure Investment Bank	Technical assistance, grants, scale up financing
ADB Asia Pacific Project Preparation Facility (AP3F)	Technical assistance, grants and scale up financing instruments
GEF UrbanShift (Global Platform for Sustainable Cities/Sustainable Cities Impact Program)	Technical assistance and investments
Asia Investment Facility (EIB)	Technical assistance, blended finance, scale up financing instruments
City Climate Finance Gap Fund – GCoM Partner	Technical assistance
Transformative Actions Program (TAP) – managed by ICLEI & CCFLA (GCoM Partner)	Technical assistance
Cities Development Initiative for Asia (CDIA)	Technical assistance
C40 Cities Finance Facility	Technical assistance
Transformative Urban Mobility Initiative	Technical assistance, grants and financing
Global Fund for Cities Development (FMDV)	Technical assistance
UN Habitat Sustainable Urban Development Project Investment Pipeline Facility/Cities Investment Facility	Technical assistance and access to scale-up financing
Canada's Asia Pacific Project Preparation Facility	Technical assistance

Source: GCoM Southeast Asia Secretariat, 2022

The Transformative Actions Program (<https://tap-potential.org/>) is an example of a global initiative to support local and regional governments transform their net-zero emission and resilient development infrastructure concepts into mature, robust and bankable projects ready for financing and implementation. Annual calls for application are open between May and December. Projects that exhibit high transformative potential get increased visibility to potential investors and are connected to relevant PPF and financial partners. Figure 44 shows the general Transformative Actions Program process which involves three stages.

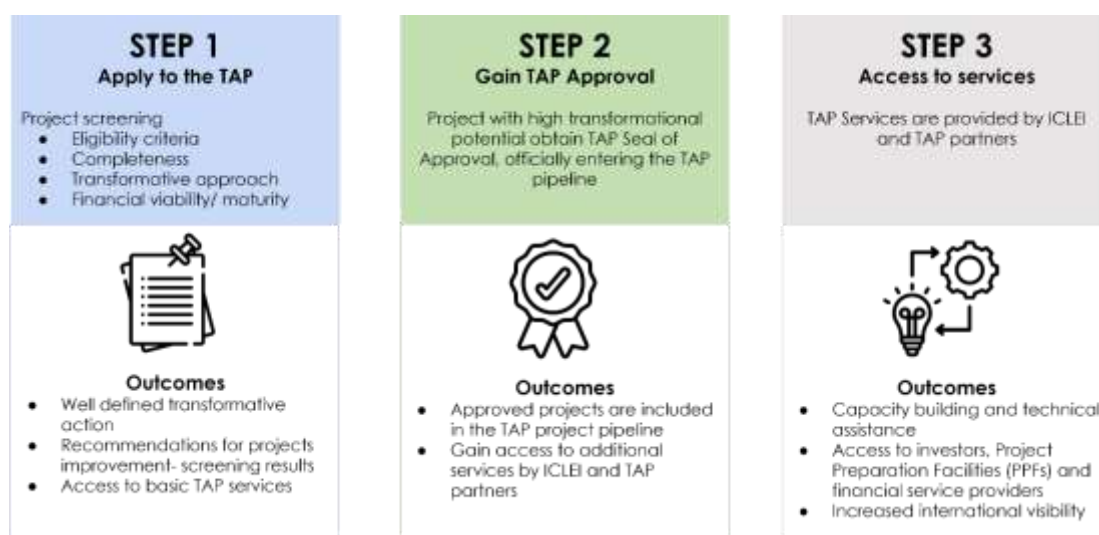


Figure 44: The three-step Transformative Actions Program (TAP)

Source: GCoM Southeast Asia Secretariat, 2022

It is recommended that Putrajaya Corporation, via a specific the Climate Action Committee (see Section 4.1), acts as the city-level focal point to reach out to and consolidate information on domestic and international climate finance, as well as facilitating and coordinating the application for such finance with the relevant international and national agencies.

Chapter 11.0 Implementation and Monitoring Roadmaps

The implementation and monitoring process will utilize the GCoM CRF and GPC tools (described previously) in order to track changes greenhouse gas emissions in Putrajaya. The CAC will meet annually in order to review and approve each year's climate-related programs and budget, and more frequently-approximately four times a year-in order to monitor progress.

Accordingly, with GCoM's requirements, the CAC will report any updated targets and major changes in city governance as soon as possible, as well as submit an updated greenhouse gas inventory and risk and vulnerability assessment biennially. Progress towards the climate action plan and details on specific actions and their costs will also be reported on a two-yearly basis, which is in line with GCoM requirement, although taking inventories on an annual basis may be recommended. Meanwhile, the planned actions proposed in the CAC are outlined according to the given priority or importance level (low, medium, high) based on potential reduction contribution, timeline and related responsible agencies as well as key partners for 2022-2025 and 2022-2030 periods. For the purpose of guiding the CAP's implementation, two (2) terms; 2022-2025 (short term) and 2022-2030 (long term) timelines have been proposed for each planned actions in Table 5 to Table 10. Furthermore, potential quick win projects (for immediate implementation by 2023) are also proposed among projects that fall within the 2022-2025 timeline.

Table 5 : Actions on Energy

Action	Pillar	Responsible Department	Key Partners	Timeline		Importance Level
				2022-2025	2022-2030	
B1: Collaborate with relevant agencies for promoting solar energy system (PV) and solar thermal system on buildings in Putrajaya	Mitigation	Engineering and Maintenance Department Corporate Services Department	Building owners, Solar PV technology suppliers, TNB, SEDA, NRECC		▶▶▶	High
I1: More and more renewable energy	Mitigation	City Planning Department	Solar PV technology suppliers, TNB, SEDA, NRECC		▶▶▶	High
I2 Implement online energy monitoring system	Mitigation	Corporate Services Department Engineering and Maintenance Department	JKR, SEDA, Building Owner & Facility Manager		▶▶▶	Low
I3 Adopt Energy Efficiency Infrastructures and Facilities (Energy Saving Street Light,	Mitigation	Engineering and Maintenance Department	TNB, JKR, EPU	▶▶▶ (Quick Win;		Medium





Action	Pillar	Responsible Department	Key Partners	Timeline		Importance Level
				2022-2025	2022-2030	
Sensor on Site Facilities, Centralised Electronic Bulletin Board)				2023)		
B2: Install energy efficiency (EE) equipment and smart meters for PJC assets and commercial buildings	Mitigation	Corporate Services Department Engineering and Maintenance Department	Building Owners, TNB	»»»		High

Table 6 : Actions on Urban Planning and Building Regulations

Action	Pillar	Responsible Department	Key Partners	Timeline		Importance Level
				2022-2025	2022-2030	
I4: Adopt and implement Safe City practices to promote active mobility and use of public transport	Mitigation	City Planning Department Engineering and Maintenance Department	MOT, PLAN Malaysia, MIROS, Developers, Building owners,		»»»	Low
B3: Protect cultural identity, precincts character and sense of place through sustainable urban design practices (TOD, compact development)	Mitigation and Adaptation	City Planning Department	Badan Warisan, Developers, Building owners	»»»		Medium
B4: Incorporate the Latest Green Building Designs and Certification in Development Control	Mitigation	City Planning Department	Developers, Building owners		»»»	High
B5: Promote Adoption of Passive Architecture in New Buildings via Natural Ventilation, Shading and Lighting	Mitigation	City Planning Department	Developers, Building owners		»»»	High

Action	Pillar	Responsible Department	Key Partners	Timeline		Importance Level
				2022-2025	2022-2030	
I5: Expand the Adoption of Rainwater Harvesting System and Promote Periodical Maintenance of It	Mitigation	City Planning Department	Developer, Building Owners			Low
				(Quick Win; 2023)		

Table 7 : Actions on Mobility

Action	Pillar	Responsible Department	Key Partners	Timeline		Importance Level
				2022-2025	2022-2030	
T1: Promote Pedestrian and Cycling as mode choice in home to work's travel in Putrajaya	Mitigation	City Planning Department Engineering and Maintenance Department	NRECC, JKR, PLAN Malaysia, MIROS			High
				(Quick Win; 2023)		
T2: Maintain Comfortable & Safe Pedestrian Networks	Mitigation	City Planning Department Engineering and Maintenance Department	MIROS, JKR, APAD			Medium
				(Quick Win; 2023)		
T3: Rebrand Existing Car Free Day Event into Monthly Active Mobility Program	Mitigation	City Planning Department Engineering and Maintenance Department Landscape and Park Department City Services Department	-			Medium
				(Quick Win; 2023)		
T4: Promote a shift from private vehicles to public transport	Mitigation	Engineering and Maintenance Department	MIROS, APAD			High

Action	Pillar	Responsible Department	Key Partners	Timeline		Importance Level
				2022-2025	2022-2030	
T5: Provide more environmentally friendly public bus services by using clean and green fuel	Mitigation	Engineering and Maintenance Department	NRECC MGTC, APAD	▶▶▶		High
T6: Install digital display board for real time information on public transport	Mitigation	Engineering and Maintenance Department Corporate Services Department	RAPIDBUS	▶▶▶		Low
T7: Promote sharing green economy and the future of personal mobility (e.g partnering with EV Car Sharing Companies)	Mitigation	Engineering and Maintenance Department Corporate Services Department	NRECC, MGTC, Industrial player		▶▶▶	High

Table 8 : Actions on Blue and Green

Action	Pillar	Responsible Department	Key Partners	Timeline		Importance Level
				2022-2025	2022-2030	
E1: Promote vertical gardens and green roofs in commercial buildings, schools and government buildings	Mitigation and Adaptation	City Planning Department Landscape and Park Department	-		▶▶▶	High
E2: Conduct Tree Planting Campaign in Putrajaya in line with 100 Million Tree-Planting Campaign 2020-2025	Mitigation and Adaptation	Landscape and Park Department	NRECC, JWP, Residents, NGOs		▶▶▶	High
E3: Conduct Continuous Monitoring and Updating on Existing Tree Inventory	Mitigation and Adaptation	Landscape and Park Department	JWP		▶▶▶	Medium

Action	Pillar	Responsible Department	Key Partners	Timeline		Importance Level
				2022-2025	2022-2030	
E4: Conduct Continuous Enhancement of Urban Biodiversity	Mitigation and Adaptation	Landscape and Park, City Planning Department	-		▶▶▶	High
E5: Promote Nature-Based Solution (NBS) to protect, restore and manage natural and semi-natural ecosystems	Mitigation and Adaptation	Landscape and Park, City Planning Department	-		▶▶▶	High
E6: Enhance Putrajaya Lake Awareness Programme	Mitigation and Adaptation	City Planning Department	UNESCO, Relevant Institution, JPS		▶▶▶	Low
E7: Monitor and Protect Lake Water Quality	Mitigation and Adaptation	City Planning Department			▶▶▶	Low

Table 9 : Actions on Community

Action	Pillar	Responsible Department	Key Partners	Timeline		Importance Level
				2022-2025	2022-2030	
S1: Transform existing Residents' Association, Local Businesses and Industries into Low Carbon communities	Mitigation	City Planning Department Landscape and Park Department	Workers, Local residents		▶▶▶	Medium
S2: Strengthen Putrajaya Urban Farming Program (Program Pertanian Bandar 'PUF') by increasing participation and involvement of residents	Adaptation	Landscape and Park Department	Local residents, farmers		▶▶▶	Medium
S3: Expand Food Waste Composting Programme for the purpose of Community Farming	Mitigation	City Services Department	Local residents, NGOs		▶▶▶	Medium
I6: Further Expand Waste-to-Wealth program (e.g., CAREton@Putrajaya)	Mitigation	City Services Department City Planning	Alam Flora, Local residents,		▶▶▶	Medium

Action	Pillar	Responsible Department	Key Partners	Timeline		Importance Level
				2022-2025	2022-2030	
by collaborating with other private companies		Department	NGOs, private sectors			
S4: Enhance community awareness on 3R, Proper Disposal and Illegal Dumping	Mitigation	City Services Department City Planning Department	Alam Flora, Local Residents, Building Owner		▶▶▶	Medium
I7: Cultivate Recycling Behaviour of the Public through FIKS (Fasiliti Inovasi Kitar Semula)	Mitigation	City Services Department City Planning Department	Alam Flora		▶▶▶	Medium

Table 10 : Actions on Climate Resilience

Action	Pillar	Responsible Department	Key Partners	Timeline		Importance Level
				2022-2025	2022-2030	
D1: Raise community awareness and participation in prevention of dengue through a step-by-step guide such as COMBI	Adaptation	City Services Department City Planning Department Engineering and Maintenance Department	Local residents, NGOs, Pej Kesihatan WP Putrajaya, JPWPP		▶▶▶	High
D2: Improve Enforcement and Inspection of PJC on Potential Mosquito Breeding Sites (Constructions Sites and Residential Neighbourhoods)	Adaptation	City Services Department	Local residents, NGOs, Pej Kesihatan WP Putrajaya, JMB, JKR Putrajaya, BPH-JPM		▶▶▶	High
D3: Identify potential spots and frequency of downed trees at housing and commercial areas	Adaptation	City Planning Department Engineering and Maintenance Department Landscape and Park Department	Jabatan Landskap Negara, BPH-JPM		▶▶▶	Medium

Action	Pillar	Responsible Department	Key Partners	Timeline		Importance Level
				2022-2025	2022-2030	
D4: Improve tree selection and landscape design to reduce the impact of wind	Adaptation	Landscape and Park Department	Jabatan Landskap Negara	▶▶▶		Low
D5: Expand and improve monitoring systems through social media or other communication platforms to reduce outdoors activities due to heat wave	Adaptation	City Planning Department Corporate Services Department	MET Malaysia, JPS	▶▶▶		High
D6: Introduce programs or initiatives to reduce water consumption in commercial and residential areas	Adaptation	City Services Department City Planning Department	DOE, Air Selangor	▶▶▶ (Quick Win; 2023)		Low
D7: Improve maintenance of drainage system in Putrajaya	Adaptation	City Services Department	SWCORP, Alam Flora, Maintenance Contractor	▶▶▶		High
D8: Improve early warning systems through Multi-Hazard Platforms such as social media, newspaper, public announcement and other applications	Adaptation	City Planning Department Corporate Services Department	DOE	▶▶▶		High

Chapter 12.0 Conclusion

In the face of rising global temperatures and more frequent extreme weather events over recent decades due to man-made climate change, PJC has intensified its focus on combatting climate change and increasing the climate resilience of Putrajaya. To this end, PJC has established 38 planned actions to tackle this pressing global and local crisis.

The development of this Putrajaya CAP 2030 creates a pathway for Putrajaya to transform into a low carbon and resilient city by 2030. Collaboration and cooperation between all parties are necessary to achieve this goal. Private actors can provide the technology and financial instruments required for city-wide climate action. At the same time, the public sector works to reduce carbon emissions and improve resilience through the provision of sustainable public infrastructure and the introduction of strict environmental requirements. Residents of Putrajaya have an excellent opportunity to incorporate climate considerations into everyday choices on personal lifestyles that will also support multiple Putrajaya CAP 2030 actions. PJC is adamant that Putrajaya can become a sustainable, liveable city that thrives in a changing world through coordinated and effective implementation, excellent climate governance, and persistent monitoring, evaluation, and reporting as the implementation of the Putrajaya CAP 2030 progresses forward.

APPENDICES

Appendix A: Relevant National, State and Local Policies

A. 12th Malaysia Plan

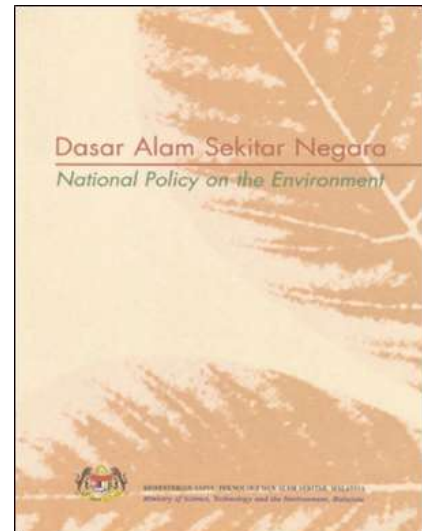
The Twelfth Malaysia Plan, 2021-2025 will be formulated to set the way forward for national development agenda along with the implementation framework over the next decade. This is to ensure an inclusive and meaningful socioeconomic development towards a more prosperous society. Aligned with the shared prosperity initiative, there are three (3) dimensions to be emphasized.

Of the dimensions, environmental sustainability will be part of the national development agenda. Under this dimension, there are various components that will be included such as (1) Climate change mitigation and adaptation, (2) Carbon tax, (3) Sustainable consumption and production, (4) Disaster risk management, (5) Green technology, (6) Biodiversity conservation, (7) Renewable energy (RE), (8) Energy efficiency (EE), (9) Integrated water resource management and the list goes on. This shows that the formulation of the Putrajaya Climate Action Plan is in lined with the national development agenda where environmental sustainability encompassing climate change mitigation and adaptation actions, as well as exploration of green technology in terms of RE and EE related initiatives will be one of the priorities.



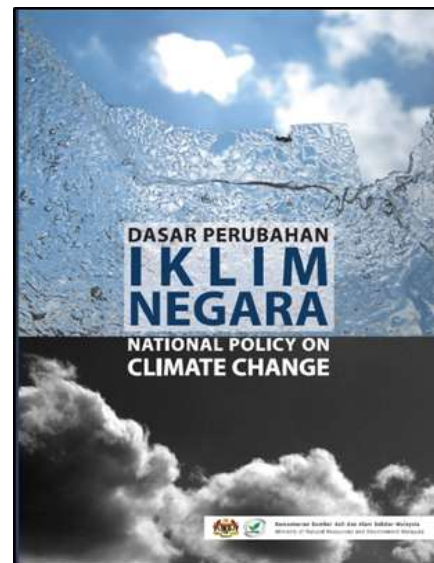
B. National Policy on the Environment

Established in 2002, the National Policy on the Environment details strategies for sustainable exploitation of Malaysia's natural resources in order to foster increased economic growth and improve quality of life. The policy details measures for conserving natural areas, particularly to protect indigenous flora and fauna, sustainable energy production and water and forest management. 35 principles are centered: stewardship of the environment, conservation of nature's vitality and diversity, continuous improvement of the quality of the environment, sustainable use of natural resources, integrated decision-making, role of the private sector, commitment and accountability, and active participation in the international community.



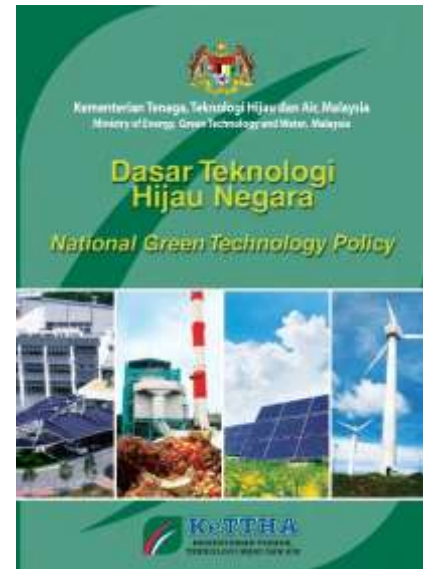
C. National Policy on Climate Change

The National Policy on Climate Change, enacted in 2009, provides a system for government agencies and other stakeholders to address climate impacts. This legislation aims to mainstream climate concerns and mitigation efforts into all national policies and plans, as well as to enhance institutional capacity for climate policy responses. The policy relies on five key principles: development on a sustainable path; conservation of environment and natural resources; coordinated implementation; effective participation; and common but differentiated responsibilities and respective capabilities. Key actions include prioritizing climate change in the National Development Planning Council, establishing an inter-ministerial committee on climate change, developing national carbon accounting systems, investing in research and development, and others.



D. National Green Technology Policy

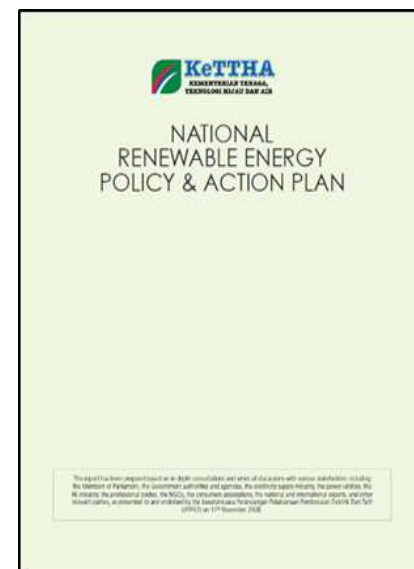
The National Green Technology Policy was launched in 2009 in order to minimize energy consumption while maximizing economic development, facilitate the growth of green technology industry and increase national capacity and competitiveness for green technology innovation. The legislation also aimed to ensure sustainable development and spread public awareness. Key actions under the Policy include the formation of a government and legal mechanisms for the advancement of green technology, providing access to financing and supporting partnerships between the government, industries and research institutions. The GTFS falls under this legislation.



E. National Renewable Energy Policy and Action Plan

The National Renewable Energy Policy and Action Plan (NREPAP) was introduced in 2009 to address renewable energy market failures and devise a coherent set of renewable energy policies in order to stop sending mixed signals to the business community. The NREPAP identified existing implementation issues in increasing renewable energy usage in Malaysia and analyzed policy solutions with a target of 34% renewable capacity by 2050, which would avoid the emission of 16 million tons of carbon dioxide.

The stated objectives of the policy are to increase RE contribution in the national power generation mix; facilitate the growth of the RE industry; ensure reasonable RE generation costs; conserve the environment for future generations; and enhance awareness on the role and importance of RE. The strategic thrusts of the policy include introducing a regulatory framework, providing a conducive environment for businesses, developing human capital, investing in research and development and implementing a renewable advocacy program.



F. Policy and Mechanism on National Disaster and Relief Management

Following a series of disasters that struck Malaysia in the 1990s, National Security Council Directive No. 20, also known as the Policy and Mechanism on Disaster and Relief Management, was put into force. The directive aims to outline policy on land-based disaster relief by establishing mechanisms for all stages of disaster management, and coordinating responsibilities between government agencies, the private sector and voluntary bodies. Directive No. 20 applies to all kinds of disasters, not just natural ones, but does have important applications for climate-related calamities, such as floods and haze. In 2015, following devastating floods in the state of Kelantan, the Malaysian government established the National Disaster Management Agency (NADMA) to take over from the National Security Council and fully focus on disaster relief. NADMA's primary objective is to carry out Directive No. 20, and the agency has proceeded to develop early warning systems and disaster response mechanisms.



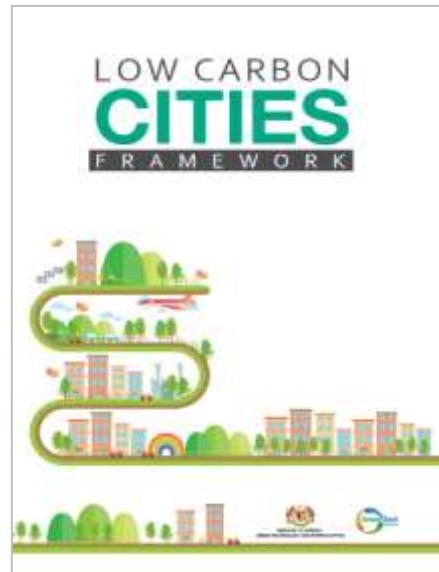
G. Green Technology Master Plan

The Green Technology Master Plan (GTMP), created for the years 2017-2030, builds on the Eleventh Malaysia Plan's emphasis on green growth. The primary goal of the plan is to mainstream green technology into the country's development. The GTMP focuses on six sectors: energy, manufacturing, transportation, building, waste and water. The policy develops targets for each of these sectors and aims to mainstream them into Malaysia's National Development Plans. Implementation relies on several key strategic directions: the government leading the way in adopting green technology; mainstreaming green technology in markets; nurturing research, development and commercialization; and human capital development.



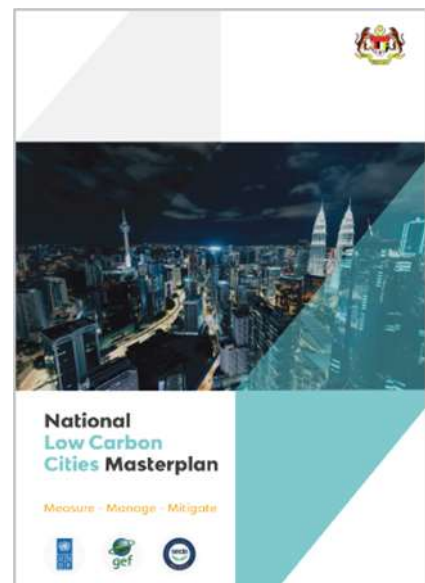
H. Low Carbon Cities Framework

Powered by GreenTech Malaysia, a government agency promoting sustainable technological solutions, the Low Carbon Cities Framework (LCCF) is an information portal providing guidance for Local Authorities, universities, and other small-scale entities on how to reduce greenhouse gas emissions. The framework addresses emissions in four main categories: urban environment, urban infrastructure, urban transportation and urban buildings. Several cities, such as Seberang Perai, Hang Tuah Jaya and Subang Jaya, have already implemented the framework and used it to make their cities more sustainable through action such as installing solar panels and replacing indoor lights.



I. National Low Carbon Cities Masterplan (NLCCM)

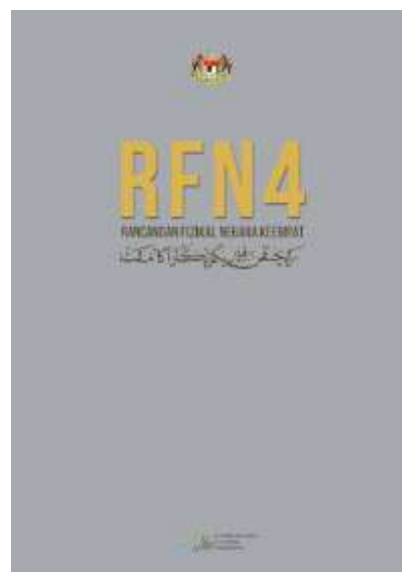
The National Low Carbon Cities Masterplan is developed as a policy document to guide policymakers at all levels of government- federal, state and local authorities in the implementation of low carbon cities. This document is prepared to address the gaps in policies to meet the country's GHG reduction goals in mitigating climate change. This document is an extension of the National Climate Change Policy formulated in 2009. The master plan outlines absolute GHG reduction targets for the 33 biggest cities and regions in Malaysia in 3 different phases of implementation. The ambitious GHG reduction target of Putrajaya which exceeds Malaysia's GHG reduction commitment is intentional to drive more impactful GHG mitigation projects in meeting the targets.



J. Forth National Physical Plan (NPP-4)

After a 15 year of implementation of the National Physical Plan (NPP) and having undergone three reviews (NPP-1, NPP-2 and NPP-3), the approach taken in the NPP-4 was not to introduce new spatial planning policies but, rather, to refine and detail out existing policies into strategic directions, strategies and actions to enhance their implementation.

The NPP-4 Strategic Planning Concept adopts the concept of Comprehensive Spatial Ecosystem (CSES) with emphasis on achieving optimal land use, economic development in key growth areas, enhancing inter-regional connectivity through integrated networks, preserving and conserving ecological along with agricultural assets. NPP-4 has formed a planning framework that provides synergy to the country's physical planning landscape. Aiming for a Prosperous and Resilient Nation to ensure continuous Well-being, this document will act as an instrument in rationalising the aspirations of the Shared Prosperity Vision 2030, the 12th Malaysia Plan and sectoral strategic policies.



K. Green Building Index

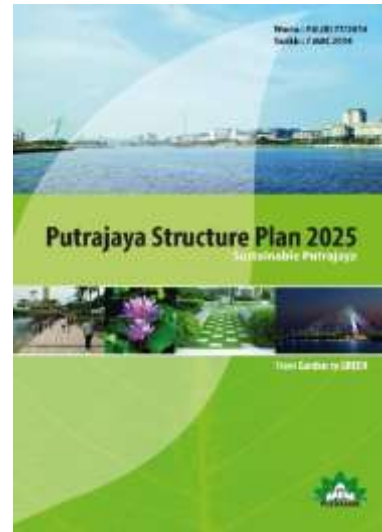
The Green Building Index (GBI) is a rating system used across Malaysia to promote the design and construction of water-efficient and energy-saving buildings that improve human health and are built with sustainable materials. Project designs are assessed, ideally before construction, and graded according to the GBI score sheet; following completion, buildings are verified and given a final award. Projects are then reassessed every three years in order to preserve their rating.



L. Putrajaya Structure Plan

Structure Plan is a document that prepare a planning framework that will guide and control state's physical development. This is stated in Act 172 Section 8 Town and Country Planning Act.

The current Putrajaya Structure Plan 2025 had been gazette in 2012. It had outlined 32 initiatives which based on eight (8) new policies name (i) Elevating Putrajaya as an Excellent Federal Government Administrative Centre (ii) Building a Progressive and Diverse Urban Economy (iii) Strengthening Tourism as Key Economic Function (iv) Enhancing Community Living Environment (v) Moving Putrajaya Towards Green City (vi) Implementing Integrated Transportation System (vii) Employing Adaptable and Responsive Land Use Management and (viii) Adopting Effective Partnership and Good Governance. It is being reviewed to align state's development plan with the new policies that had been implemented at the national and international level.



M. Towards Putrajaya Green City 2025

Towards Putrajaya Green City 2025, is an updated publication comprising analysis results from Putrajaya Green City 2025 (PGC2025), a summary of the initiatives that has been implemented under seven (7) focus areas as well as an updated 2012 interim carbon emissions inventory for the city.












Seven (7) focus areas highlighted are (1) Planning, urban design and building, (ii) Integrated nature into the urban fabric, (iii) Transportation & Mobility, (iv) Energy Usage, (v) Water Usage, (vi) Solid Waste Management and (vii) City Administrative and Management. It is an important document to Putrajaya Corporation in reviewing its existing green city initiatives and formulating new plan to ensure the achievement of the three (3) environmental targets set for the year 2025, namely (i) Low Carbon Putrajaya, (ii) Cooler Putrajaya and (iii) 3R Putrajaya.



Appendix B: Climate Projections

Climate Change 2014: Impacts, Adaptation, and Vulnerability represents the most recent assessment of the Intergovernmental Panel on Climate Change (IPCC) of the literature on the expected impacts of global warming. The report builds on its previous iteration, Climate Change 2007, and notes that the amount of relevant research more than doubled in between the release of the two editions. One can assume that publication of work on climate impacts, adaptation and vulnerability has continued to grow in the years since Climate Change 2014 was published, with the next assessment due in 2021. As a result, we have considered the findings from the latest assessment, analyzed some literature published since then, and will await the findings of the next report. We have also examined more targeted research of the sort that would not be covered in the Impacts, Adaptation and Vulnerability text.

The IPCC report finds that climate change is already having considerable effects on natural systems, and impacts of less magnitude on human systems. Key risks for Asia as a whole include increased flooding, sea level rise, heat-related mortality and drought-related water and food shortages. The phenology, growth rate and distribution of plant species are expected to shift across the continent, and there is high confidence that coastal and marine systems will experience increasing stress from both climatic and non-climate drivers. More frequent extreme climate events and rapid urbanization, industrialization and economic development are likely to exacerbate the challenges Asia already faces. Overall, more research, especially using high-resolution climate models, is needed in order to create more detailed predictions due to the high localization of climatic phenomena in the region.

Asia				
Key risk	Adaptation issues & prospects	Climatic drivers	Timeframe	Risk & potential for adaptation
Increased riverine, coastal, and urban flooding leading to widespread damage to infrastructure, livelihoods, and settlements in Asia (<i>medium confidence</i>) [24.4]	<ul style="list-style-type: none"> Exposure reduction via structural and non-structural measures, effective land-use planning, and selective relocation Reduction in the vulnerability of lifeline infrastructure and services (e.g., water, energy, waste management, food, biomass, mobility, local ecosystems, telecommunications) Construction of monitoring and early warning systems; Measures to identify exposed areas, assist vulnerable areas and households, and diversify livelihoods Economic diversification 			Very low Medium Very high
			Present	
			Near term (2030–2040)	
Increased risk of heat-related mortality (<i>high confidence</i>) [24.4]	<ul style="list-style-type: none"> Heat health warning systems Urban planning to reduce heat islands; Improvement of the built environment; Development of sustainable cities New work practices to avoid heat stress among outdoor workers 			Very low Medium Very high
			Present	
			Near term (2030–2040)	
Increased risk of drought-related water and food shortage causing malnutrition (<i>high confidence</i>) [24.4]	<ul style="list-style-type: none"> Disaster preparedness including early-warning systems and local coping strategies Adaptive/integrated water resource management Water infrastructure and reservoir development Diversification of water sources including water re-use More efficient use of water (e.g., improved agricultural practices, irrigation management, and resilient agriculture) 			Very low Medium Very high
			Present	
			Near term (2030–2040)	
			Long term (2080–2100)	
			4°C	

a. Temperature

According to the assessment, temperatures throughout Southeast Asia have been climbing by 0.14 - 0.20 C per decade since the 1960s, and the number of hot days and warm nights is on the rise. By the end of this century, median temperature increases for the highest emissions scenario tested are likely to exceed 3 C. Under the lowest emission scenario, that amount is less than 1 C.71 Downscaling General Circulation Models, the global simulations used to create large-scale climate projections, to regional climate models of Peninsular Malaysia demonstrates that mean annual temperatures over watersheds, including the Muar basin, may increase 2.50-2.95 C during the 21st century.

b. Precipitation

Annual total wet-day rainfall in Southeast Asia has been increasing by 22 mm per decade, and by 10 mm per decade for extreme rain days, with a rising ratio of rainfall in the wet to dry seasons between 1950 and 2005; this varies, however, geographically and by season. In Peninsular Malaysia specifically, where precipitation is largely dependent on the Maritime continent monsoon, changes are observed to vary based on the season. Total rainfall and frequency of wet days appears to be decreasing during the southwest monsoon, with increasing rainfall intensity. During the northeast monsoon, on the other hand, rainfall, the frequency of extreme rainfall events and rainfall intensity are all on the rise. The downscaled regional climate models previously cited confirm that mean annual precipitation is expected to increase over watersheds, including the Muar basin.

c. Freshwater resources

Water demand is expected to increase throughout Asia due to population growth and rising standards of living and consumption per capita. As a result, even historically water-abundant regions are projected to experience water stress. Johor is no exception. Water has been plentiful in the past, but in recent years, the state has been forced to request water supplies from Singapore, ration water usage and undertake extensive water infrastructure projects, including near Iskandar Puteri.

d. Biodiversity

Changes in drought frequency and intensity are expected to have impacts on flowering patterns in lowland rainforests in Southeast Asia. Research predicts declines in bat species richness, northward shifts for many species, and reductions in the distributions of most species. Increases in water temperature, sea level rise and saltwater intrusion threaten inland water-dwelling organisms; coastal erosion may also spread. Forests may become vulnerable due to more frequent droughts, temperature highs, logging, fragmentation, fire, tree mortality, and deforestation and smoke aerosols. There is also high confidence that coral reefs in the region are declining due to increased water temperatures. Temperature changes may lead to increased biodiversity of marine life in tropical areas of Asia, but tropical biodiversity overall is likely to fall. Other impacts due to shifts in climate beyond the current normal range are expected but details can be difficult to anticipate.

e. Agriculture and fisheries




Crop production is likely to experience generally negative impacts due to climate change in Asia. Sea level rise, high temperatures and flooding in particular are likely to hurt yields. Possible positive outcomes are possible, however, in some regions due to higher atmospheric CO₂ concentrations enhancing photosynthesis. Fisheries in the tropics are likely to decline due to higher water temperatures, changing flow regimes and the vulnerability of coral reefs. Under high emission scenarios, average maximum body weight of marine fish is likely to decline by 14-24% by 2050. While rice yield is likely to decline across Asia, Southeast Asia is not one of the most vulnerable regions. If, however, temperatures increase by 2 degrees C or more, rice yields in Malaysia could drop by 13 percent, and floods and droughts early in the growing season could lead to a drop of 80 percent. Rubber crops are at risk, with annual temperatures above 30

C leading to a 10 percent yield reduction, and precipitation interfering with tapping activities, although further study is needed. The primary concern for cocoa farmers is drought, as production could decrease drastically if annual rainfall falls below 1500 mm. High rainfall, on the other hand, can increase fungus incidence. And, should temperatures increase by 2 degrees C and rainfall decrease by 10 percent, oil palm yields could decrease by 30 percent.

f. Public Health

Climate change-exacerbated flooding is expected to worsen human health risks in Asia due to poor water quality and increased exposure to pathogens. Climbing temperatures and air pollution are expected to increase mortality in the region, and in Southeast Asia specifically, droughts are predicted to cause wildfires and smoke exposure. Increased temperatures and precipitation may worsen the toll of both water-borne and vector-borne disease. Mosquitoes' ability to transmit malaria is shown to increase with temperature, with a 15% increase in malaria cases expected to result from 1.5 C temperature jump. Dengue cases are also expected to increase with temperature, and food and water-borne diseases may increase due to lack of clean water access during droughts. In addition, traumatic experiences caused by weather events such as drought and flooding are likely to have negative impacts on mental health.

Appendix C: Summary of Planned Actions

 <p>1. ENERGY</p>	<p>Renewable Energy</p> <p>B1 Collaborate with relevant agencies for promoting solar energy system (PV) and solar thermal system on buildings in Putrajaya</p> <p>I1 More and more renewable energy</p> <p>Energy Efficiency</p> <p>I2 Implement an online energy monitoring system</p> <p>I3 Adopt Energy Efficiency Infrastructures and Facilities (Energy Saving Street Light, Sensor on Site Facilities, Centralised Electronic Bulletin Board)</p> <p>B2 Install energy efficiency (EE) equipment and smart meters for PJC assets and commercial buildings</p>
 <p>2. URBAN PLANNING AND BUILDING REGULATIONS</p>	<p>Urban Design</p> <p>I4 Adopt and implement Safe City practices to promote active mobility and use of public transport</p> <p>Protect cultural identity, precincts character and sense of place</p> <p>B3 through sustainable urban design practices (TOD, compact development)</p> <p>Building</p> <p>B4 Incorporate the Latest Green Building Design and Certification in Development Control</p> <p>B5 Promote Adoption of Passive Architecture in New Buildings via Natural Ventilation, Shading and Lighting</p> <p>I5 Expand the Adoption of Rainwater Harvesting System and Promote Periodical Maintenance of It</p>
 <p>3. MOBILITY</p>	<p>Active Mobility</p> <p>T1 Promote Pedestrian and Cycling as mode choice in home to work's travel in Putrajaya</p> <p>T2 Maintain Comfortable & Safe Pedestrian Networks</p> <p>T3 Rebrand Existing Car Free Day Event into Monthly Active Mobility Program</p> <p>Public Transport</p> <p>T4 Promote a shift from private vehicles to public transport</p> <p>T5 Provide more environmentally friendly public bus services by using clean and green fuel</p> <p>Mobility Technology</p> <p>T6 Install digital display board for real time information on public transport</p> <p>T7 Promote sharing green economy and the future of personal mobility (e.g partnering with EV Car Sharing Companies)</p>



4. BLUE AND GREEN

Planting and Green Spaces

- E1 Promote vertical gardens and green roofs in commercial buildings, schools and government buildings
- E2 Conduct Tree Planting Campaign in Putrajaya in line with 100 Million Tree-Planting Campaign 2020-2025
- E3 Conduct Continuous Monitoring and Updating on Existing Tree Inventory
- E4 Conduct Continuous Enhancement of Urban Biodiversity
- E5 Promote Nature-Based Solution (NBS) to protect, restore and manage natural and semi-natural ecosystems

Water Bodies

- E6 Enhance Putrajaya Lake Awareness Programme
- E7 Monitor Diversity Index and Protect Lake Water Quality



5. COMMUNITY

Community Engagement

- S1 Transform existing Residents' Association, Local Businesses and Industries into Low Carbon communities
- S2 Strengthen Putrajaya Urban Farming Program (*Program Pertanian Bandar 'PUF'*) by increasing participation and involvement of residents

Waste and Lifestyle

- S3 Expand Food Waste Composting Programme for the purpose of Community Farming in every residential precinct
- S4 Further Expand Waste-to-Wealth program (e.g., CAREton@Putrajaya) by collaborating with other private companies
- S4 Enhance community awareness on 3R, Proper Disposal and Illegal Dumping
- S7 Cultivate Recycling Behaviour of the Public through FIKS (Fasiliti Inovasi Kitar Semula)



6. CLIMATE RESILIENCE

Dengue

- D1 Raise community awareness and participation in prevention of dengue through a step-by-step guide such as COMBI
- D2 Improve Enforcement and Inspection of PJC on Potential Mosquito Breeding Sites (Constructions Sites and Residential Neighbourhoods)

Severe Wind

- D3 Identify potential spots and frequency of downed trees at housing and commercial areas
- D4 Improve tree selection and landscape design to reduce the impact of wind

Drought

- D5 Expand and improve monitoring systems through social media or other communication platforms to reduce outdoors activities due to heat wave
- D6 Introduce programs or initiatives to reduce water consumption in commercial and residential areas

Flood

- D7 Improve maintenance of drainage system in Putrajaya
- D8 Improve early warning systems through Multi-Hazard Platforms such as social media, newspaper, public announcement and other applications

Appendix D: Aligning Planned Climate Actions with the Low Carbon Cities Framework + Society (LCCF+S)

Action for Environment Sectors		Page
E1	Promote vertical gardens and green roofs in commercial buildings, schools and government buildings	54
E2	Conduct Tree Planting Campaign in Putrajaya in line with 100 Million Tree-Planting Campaign 2020-2025	54
E3	Conduct Continuous Monitoring and Updating on Existing Tree Inventory	55
E4	Conduct Continuous Enhancement of Urban Biodiversity	56
E5	Promote Nature-Based Solution (NBS) to protect, restore and manage natural and semi-natural ecosystems	58
E6	Enhance Putrajaya Lake Awareness Programme	59
E7	Monitor and Protect Lake Water Quality	60

Action for Transportation Sectors		Page
T1	Promote Pedestrian and Cycling as mode choice in home to work's travel in Putrajaya	48
T2	Maintain Comfortable & Safe Pedestrian Networks	49
T3	Rebrand Existing Car Free Day Event into Monthly Active Mobility Program	50
T4	Promote a shift from private vehicles to public transport	51
T5	Provide more environmentally friendly public bus services by using clean and green fuel	52
T6	Install digital display board for real time information on public transport	52
T7	Promote sharing green economy and the future of personal mobility (e.g partnering with EV Car Sharing Companies)	53

Action for Building Sectors		Page
B1	Collaborate with relevant agencies for promoting solar energy system (PV) and solar thermal system on buildings in Putrajaya	37
B2	Install energy efficiency (EE) equipment and smart meters for PJC assets and commercial buildings	41
B3	Protect cultural identity, precincts character and sense of place through sustainable urban design practices (TOD, compact development)	44
B4	Incorporate the Latest Green Building Designs and Certification in Development Control	45
B5	Promote Adoption of Passive Architecture in New Buildings via Natural Ventilation, Shading and Lighting	46

Action for Society Sectors		Page
S1	Transform existing Residents' Association, Local Businesses and Industries into Low Carbon communities	61
S2	Strengthen Putrajaya Urban Farming Program (Program Pertanian Bandar 'PUF') by increasing participation and involvement of residents	62

S3	Expand Food Waste Composting Programme for the purpose of Community Farming	63
S4	Enhance community awareness on 3R, Proper Disposal and Illegal Dumping	65

Action for Infrastructure Sectors		Page
11	More and more renewable energy	38
12	Implement an online energy monitoring system	40
13	Adopt Energy Efficiency Infrastructures and Facilities (Energy Saving Street Light, Sensor on Site Facilities, Centralised Electronic Bulletin Board)	40
14	Adopt and implement Safe City practices to promote active mobility and use of public transport	43
15	Expand the Adoption of Rainwater Harvesting System and Promote Periodical Maintenance of It	47
16	Further Expand Waste-to-Wealth program(e.g., CAREton@Putrajaya) by collaborating with other private companies	64
17	Cultivate Recycling Behaviour of the Public through FKS (Fasiliti Inovasi Kitar Semula)	66

Appendix E: Aligning Planned Climate Actions with Existing Seven Focus Areas (Putrajaya Green City 2025)

7 FOCUS AREAS (PGC 2025)

Focus Areas	Actions
FA1 City Planning & Building	<ul style="list-style-type: none"> Integrated City Planning and Management Cutting-Edge Sustainable Buildings Cooler Urban Structure and Buildings
FA2 Integrating Nature into the Urban Fabric	<ul style="list-style-type: none"> The Green Lung of Putrajaya In Harmony with Nature
FA3 Transportation & Mobility	<ul style="list-style-type: none"> Low-carbon Transportation
FA4 Energy Usage	<ul style="list-style-type: none"> More & More Renewable Energy Improve Energy Efficiency
FA5 Water Usage	<ul style="list-style-type: none"> Keeping the Water Clean Alternative of Water Resources
FA6 Solid Waste Management	<ul style="list-style-type: none"> Use Less Consume Less Think Before You Throw Integrated Waste Treatment
FA7 City Administration & Management	<ul style="list-style-type: none"> Low-carbon Lifestyle Community and Individual Action to Reduce Urban Temperature Green Incentives and Capacity Building

PLANNED ACTIONS (CAP 2030)

Focus Areas	Actions
Theme 1 Energy	<ul style="list-style-type: none"> Renewable Energy Energy Efficiency
Theme 2 Urban Planning and Buildings	<ul style="list-style-type: none"> Urban Design Building
Theme 3 Mobility	<ul style="list-style-type: none"> Active Mobility Public Transport Mobility Technology
Theme 4 Blue and Green	<ul style="list-style-type: none"> Planting And Green Spaces Water Bodies
Theme 5 Community	<ul style="list-style-type: none"> Community Engagement Waste And Lifestyle
Theme 6 Climate Resilience	<ul style="list-style-type: none"> Severe wind Drought Flash flood Dengue



Appendix F: Mission Report for Focus Group Discussion (FGD)



MISSION REPORT FOR FOCUS GROUP DISCUSSION (FGD)

PUTRAJAYA CLIMATE ACTION PLAN 2030

PREPARED BY:
LOW CARBON ASIA RESEARCH CENTRE

JULY 2022



FOCUS GROUP DISCUSSION FOR PUTRAJAYA CLIMATE ACTION PLAN 2030 SPONSORED BY THE GLOBAL COVENANT OF MAYORS FOR CLIMATE AND ENERGY (GCoM)

Date : 19th July 2022 (Tuesday)
Time : 8.30 a.m. (UTC+8)
Venue : Pulse Grande Hotel, Putrajaya, Malaysia

Aims :

Following the successful organisation of three FGDs for the pilot cities of Segamat, Iskandar Puteri and Petaling Jaya, UTM-Low Carbon Asia Research Centre (UTM-LCARC) conducted the fourth and final focus group discussion (FGD) in collaboration with the Putrajaya Corporation in the preparation of the GCoM Common Reporting Framework (CRF) compliant climate action plan (CAP) for Putrajaya. As with the previous FGDs, a key purpose of the workshop was to collect and verify data provided by relevant departments and agencies for the Putrajaya's GHG emission inventory using CIRIS (City Inventory Reporting Information System) as well as the city's climate risk and vulnerability analysis (CRVA).

Another key aim of the FGD was to obtain constructive comments and feedback from stakeholders concerning existing and potential mitigation actions and adaptation options that are suited to Putrajaya's specific contexts and needs. As with the previous FGDs, this FGD would improve the reliability and accuracy of data collected as well as the results from CIRIS and CRVA. This would provide a concrete basis for Putrajaya to set ambitious yet pragmatic mitigation target and adaptation goals, and formulate effective and implementable climate actions to significantly cut the city's GHG emissions and enhance the city's climate resilience by 2030.

Agenda :

Time	Agenda
8.30 AM	Participants' registration and breakfast
9.00 AM	<i>Doa</i> Recital
9.05 AM	Officiation speech from the Putrajaya Corporation (PJC) YBhg. Dato' TPr. Fadlun Bin Mak Ujud – PJC President
9.15 AM	Group Photo Session
9.20 AM	Project Introduction on GCoM CRF Climate Action Plan for Malaysia Pilot Cities- Putrajaya Prof. TPr. Dr. Ho Chin Siong – Project Leader
10.00 AM	Morning Break
10.30 AM	Focus Group Discussion
	Group 1: City Inventory Reporting and Information System (CIRIS)
	TPr. Chau Loon Wai
	Prof. TPr. Dr. Ho Chin Siong
	TPr. Dr. Siti Hajar Misnan
	Miss Rohayu Abdullah
	Representative from TNB, ST, SEDA, etc.
	Group 2: Climate-Risk Vulnerability Assessment (CRVA)
	Dr. Teh Bor Tsong
	Dr. Gabriel Ling Hoh Teck
Miss Nur Syahidah Sulaiman	
Representative from MET, NAHRIM, JPS, JAS, etc.	
12.30 PM	Wrap up speech by Prof. TPr. Dr. Ho Chin Siong
12.50 PM	Closing speech by TPr. Noor Sita Abbas, Director (Sustainable Development and Housing)
1.00 PM	Lunch

Attendance:

Agencies	Name/ Position	Email
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Agencies	Name/ Position	Email
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Bhg Pembangunan Mampan & Perumahan PPj	En. Norazle Bin Ab Malik	norazle@ppj.gov.my

Feedback:

Sectors	Agencies Comment
CIRIS	
Stationary Energy	<p>Mr. Azhar Othman (<i>Bhg. Kawalan Perancangan dan Pembangunan</i>) informed that apart of natural gas, the data of LPG for commercial building in Putrajaya is also available. The consultant will check on the matter.</p> <p>Meanwhile, Mr. Azharuddin Ismail (<i>Suruhanjaya Tenaga</i>) suggested to include the data of natural gas for Malaysia 2018</p>
Transportation	Mr. Azharuddin Ismail (<i>Suruhanjaya Tenaga</i>) enquired the electricity data for transportation. According to him, the value (0.2 ktoe) of energy demand for electricity in Putrajaya is quite big. Mr. Mohd Sazilan Sahak (<i>Bhg. Trafik and Pengangkutan Awam PPj</i>) replied to him that energy demand is included the train (ERL) and electric bus in Putrajaya.
Waste	<p>Ms. Ainol Mardhiah Mohd Khalid (<i>Bhg. Kesihatan Persekitaran PPj</i>) enquired if the data for total solid waste to landfills is included both bulky waste and domestic waste. Then, the consultant confirmed that total solid waste to landfills is included both types of waste in this study.</p> <p>Ms. Nurul Jannah Ab Samad (<i>Indah Water Konsortium HQ</i>) informed that she has shared the data of total wastewater produced per year in Putrajaya with PPj. The consultant will check on the matter.</p>
Planned Actions (Energy)	Mohd Fadzril Bin Mohd Aris (<i>TNB Cawangan Putrajaya & Cyberjaya</i>) informed the smart meters have been installed in residential in Putrajaya. The smart meters are able to show residence daily and monthly home electricity usage, through the myTNB app.
Planned Actions (Transport)	Ms. Noor Sita Abbas (<i>Pembangunan Mampan dan Perumahan, PPj</i>) suggested consultant to check with the Road Safety Inspection (RSI) Report by MIROS (Malaysia Institute of Road Safety and Research)
Planned Actions (Blue and Green)	Ms. Noor Sita Abbas (<i>Pembangunan Mampan dan Perumahan, PPj</i>) voiced her concerns over the selection of tree species for vertical gardens and green roofs. Trees which are unhealthy or not well maintained planted at roadsides increase the risk of falling trees which are hazardous to motorists and pedestrians and may cause damage to properties.
CRVA	
Flooding & Thunderstorm	<p>Ts. Muhammad Zulhusni (JPS Officer) informed that flooding hazard in Putrajaya are not serious compare to storm. The factors of flooding at Precinct 19 in Putrajaya because of the water overflow from Langat River but no people living there. Other than that, Precinct 19 are identified as flood prone area in Putrajaya by JPS and in progress to prepare telemetry station in Precinct 19. JPS also introduce <i>Program Ramalan dan Amaran Banjir Negara</i> to develop a system that is able to predict monsoon flooding events 7 days in advance based on weather forecast data from the Malaysian Meteorological Department.</p> <p>Mr. Mohd Afizi (<i>Bomba</i>) added that flash flood in Putrajaya occurred due to clogging and topography. The maintenances of drainage system should be improve to avoid flooding in Putrajaya. He also informed that there are three weather station in Putrajaya. The probability and consequences of flooding consider have low level.</p>

Sectors	Agencies Comment
	<p>Ms. Noraliza Noordin (<i>Bhg. Alam Sekitar</i>) suggest that to include thunderstorm as one of the climate hazard in Putrajaya. Thunderstorms can cause downed trees and damage public property. This hazard has affect to facilities, landscaping and public property (car). She mentioned that the factors of downed trees are the type of trees are not suitable. She also suggest the inventory for local species and tree before use as landscaping.</p> <p>Suggestion from Ms Wang (PPj) for flooding and thunderstorm are:</p> <ul style="list-style-type: none"> • Implement awareness program • Locate more buffer areas to absorb water like Sponge city • Identify spot of downed trees frequency • Improve maintainance of drainage system in Putrajaya
Heat wave & Haze	<p>Mr. Mohan Kumar (MET Officer) suggest that to consider heat wave rather than drought hazard. Based on heat wave monitoring by MET, heat wave refer to 37 Celsius of maximum temperature in 3 days. He will share the data of number of day without rains and maximum temperature in Putrajaya.</p> <p>Suggestion program from En Mohan (MET Officer) for heat wave are:</p> <ul style="list-style-type: none"> • Implement awareness program • Water mist installation at pedestrian walkway • Continues monitoring by relevant agencies by media social or other platforms • Reduce outdoor activities <p>Mr. Mohan suggest that to include haze as one of the potential climate hazard in Putrajaya but the hazard is more to trans boundary. To more confirmation, he suggest to looks index air quality data from JAS.</p>
Dengue	<p>Mr Azman Ahmad (<i>Bhg Kesihatan Persekitaran</i>) mentioned that dengue cases in Putrajaya are serious. He concluded that the trend number of cases are increasing on 2021 until 2022 because of endemic.</p> <p>The hotspot location in Putrajaya are Precinct 8, 9, 15 and 18 with number of cases more than 100. He also identified that the factors of breeding of aedes mosquitoes are lack of awareness, temperature, landscape and cross border.</p> <p>Suggestion program from Mr. Azman for Dengue are:</p> <ul style="list-style-type: none"> • Implement awareness program- COMBI • Introduce biotention technique (using wolbachia mosquitoes) • Monitor tree selection and design landscaping to prevent of dengue
Landslide	<p>Ms. Marina Omar (<i>Bhg Jalan – Unit Cerun & Jalan PPj</i>) informed that the landslide hazard in Putrajaya are not serious. Based on discussion and photo provided by Ms. Marina, we decided that the hazard is more to erosion. The erosion occurred at Precinct 10 and suggest that to determine the landslide hazard as potential hazard in Putrajaya.</p>

Appendix:



TPr. Chau Loon Wai was emceeing the Putrajaya FGD



Putrajaya Presiden, YBhg. Dato' TPr. Fadlun Bin Mak Ujud delivering a Welcoming Speech



Project Leader Prof. Ho Chin Siong providing a briefing on the introduction of the GCoM CRF CAP project to the VIPs and participants.



TPr. Chau Loon Wai facilitating the group discussion focusing on climate mitigation data for CIRIS and the preliminary climate change mitigation planned actions



Dr. Gabriel Ling and Dr. Teh Bor Tsong facilitating the group discussion focusing on climate adaptation data for CRVA and the preliminary climate change adaptation planned actions



Prof. Ho Chin Siong delivering the FGD wrap-up speech



Putrajaya CAP 2030 Focus Group Discussion group photo

Research Project Team Member

Putrajaya Corporation

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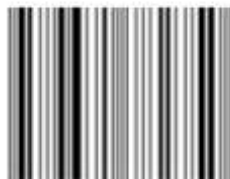
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