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CYBERJAYA SMART LOW CARBON CITY

ACTION PLAN 2025

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CYBERJAYA SMART & LOW CARBON CITY 2025

This report is prepared for
Majlis Perbandaran Sepang

This report is prepared by
AJM Planning and Urban Design Group

Supported by
Low Carbon Cities & Sustainability Centre

Contents

Executive Summary

The preparation of Cyberjaya Smart & Low Carbon City 2025 (CSLC 2025) has been part of the recommendation being made from the output of the CO2 Baseline Data Report 2011. It has also been part of the response to the Government's initiatives in reducing the level of CO2 emission and achieving sustainable development amid facing modern and dynamic urban development processes.

The preparation of this Report has also been seen as an active participation of MP Sepang in supporting the Selangor State Government's agenda in balancing and improving human and physical progression based on the principle of sustainable development, through the launch of the Selangor Green Technology Action Plan 2016-2018 as well as the launch of Smart Selangor Blueprint 1.0 recently.

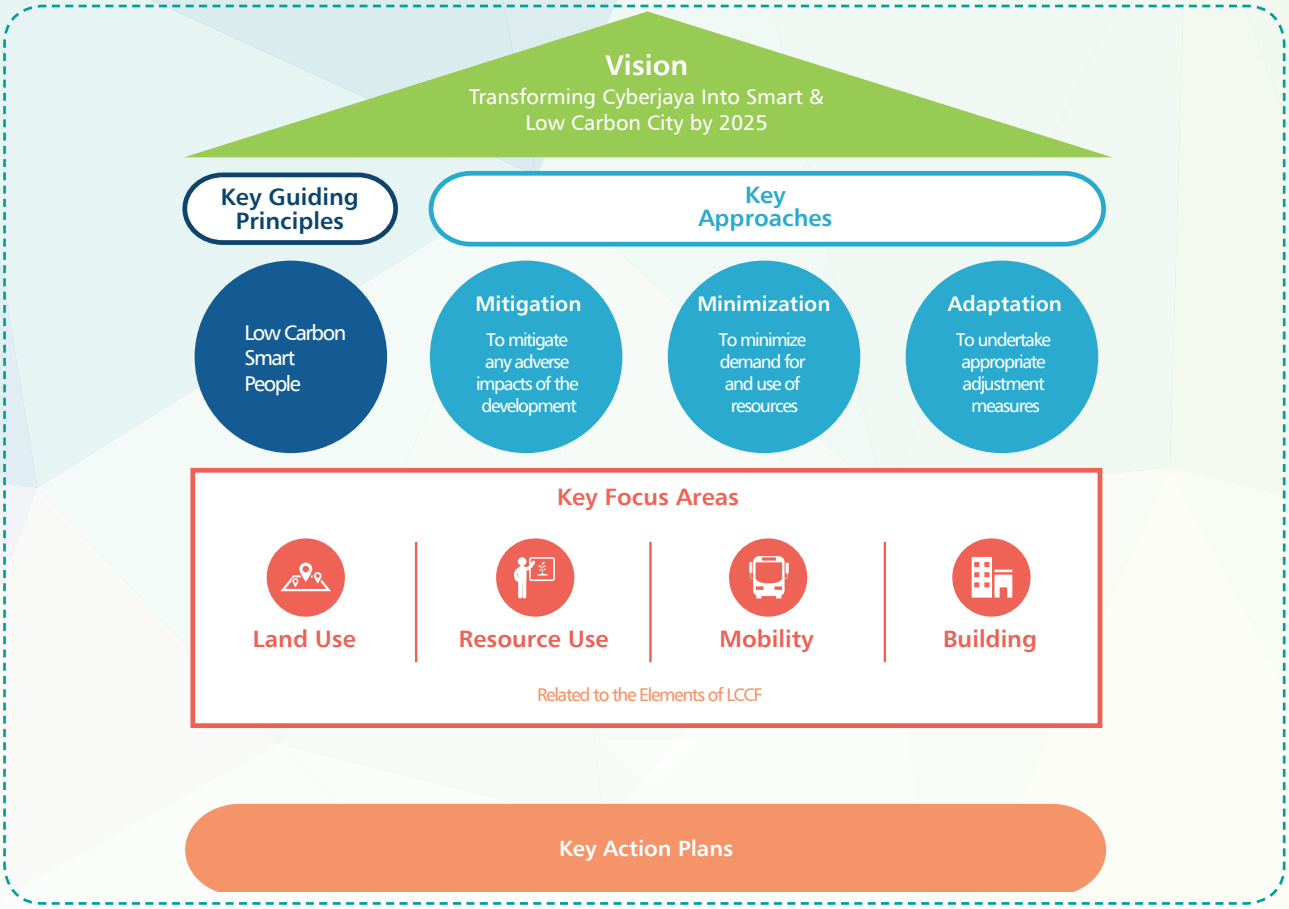
For Cyberjaya, the aspiration or vision is to be a Smart and Low Carbon City by the year 2025, whereby "smart" being defined as leveraging ICT infrastructure to :

- Improve the quality of life of its population
- Improve the well-being of its citizens
- Establish an environmentally responsible and sustainable approach to development

Whilst "low carbon" being referred to lowering the emission of CO2 amid experiencing rapid urbanization process.

As such, the formulation of action plans is seen vital to guide and help MP Sepang and its strategic partners (such as Cyberview Sdn Bhd and Setia Haruman Sdn Bhd) and/or other key stakeholders to implement a correct transformation agenda towards making Cyberjaya as a smart and low carbon city by the year 2025.

CSLC 2025 are being guided by three Guiding Principles which are Low Carbon, Smart and People to determine the key focus area for of accessing current spatial and development conditions of Cyberjaya to draw relevant Key Action Plans needed for the transformation as illustrated in the diagram below :



Overview of Cyberjaya Smart & Low Carbon City Key Strategies & Actions

A. Strategy 1: Establish Smart Mobility

Target : 80% coverage of integrated green mobility network by 2025

DESCRIPTION OF KEY & SUB-ACTIONS		
Key Action 1.1 : Creating A Bike-Friendly Cyberjaya		
1.1a	**Enhance existing bike sharing program with OBike and encourage more users to ride bicycles by improving access to rental bike locations (e.g. integrate bike stations with bus stops/TOD).**	
	To integrate bus stops, LRT/MRT Stations with bike sharing programs and Park & Ride systems. This is to encourage the usage of green transport on the last mile of journey. In order to make it more connected, improvement to the existing buildings' pedestrian paths is also suggested. In addition, a pedestrian friendly city guideline will be established for developers usage to ensure that new development will contribute to the improvement and expansion of pedestrian environment.	
1.1b	**Review, improve and expand the current bike routes and ensure their functionality and connectivity.**	
	To build and expand continuously on-street and off-street cycling infrastructure from existing bike routes. The cycling routes is to integrate with land use activity to ensure more riders. Bike sharing program for Cyberjaya will garner more ridership with multiple bike stations around the city as well as provision of easy access to affordable rental bikes for short trips around the city.	
1.1c	**Construct "Cyberjaya Green Parkway" with quality facilities/amenities (e.g. rental bicycles), improvement on the landscape and creating nodes of activities.**	
	To re-activate/improve one of Cyberjaya's green public spaces – i.e. the Cyberjaya Lake Gardens. This park has great potential to be a good public space due to its infra-ready and amenities such as community halls, sports facilities, boardwalks and matured trees. Constructing an improved bikeway and adding supportive infrastructure would definitely make it more vibrant for public to visit.	
Key Action 1.2 : Defining Bus Priority Systems And Smart Services In Cyberjaya		
1.2a	**Plan for bus stops that are well integrated with land use activities.**	
	To ensure that existing bus stops integrate and compliment the surrounding activities nearby so that it would be more convenience and practical to the bus users – e.g. cafes, restaurants, newspaper stands, grocery stores, kiosks, etc..	
1.2b	**Integrate with future MRT or Regional Transit System.**	
	To ensure seamless connectivity by connecting bus stops with MRT or regional transit system. This way, efficiency and ridership can be increased tremendously.	

Strategy 1: Establish Smart Mobility

Target : 80% coverage of integrated green mobility network by 2025

DESCRIPTION OF KEY & SUB-ACTIONS

Key Action 1.2 : Defining Bus Priority Systems And Smart Services In Cyberjaya

1.2c	**Install smart apps (e.g. GPS, Real Time Info, Real Time Tracking Devise) in all public transports.**	
	To increase ridership in public transportation, improve the bus services and door to door journey, public transport users must be informed with real-time information (such as expected bus arrivals, etc.) via smart apps.	
1.2d	**Invoke aggressive promotion and advertisement on the usage of public transport to increase more ridership.**	
	To increase ridership for public transportation, it is recommended that aggressive advertisement to encourage and support the usage of public transport is vital. Incentives and any in-kind supports should also be advertised. These are meant to develop trust among public transport users.	

Key Action 1.3 : Making Alternative Vehicle Mode Sharing System Works In Cyberjaya

1.3a	**Increase , improve and promote the usage of existing Smart Car Sharing Scheme under GoCar as well as promote the cars run by EV.**	
	To drive Cyberjaya towards innovation, Smart Car Sharing Scheme and system shall be introduced and implemented. An aggressive promotion on electric cars is also in the pipeline. Definitely these will give significant impact in reducing cars and increasing usage of EVs within the city.	 
1.3b	**Introduce EV Scooter Sharing Service/Scheme.**	
	EV Scooter Sharing Service can reduce congestions caused by motorcycles as well as private vehicles. Scooters can cater for short distance rides within Cyberjaya – e.g. from enterprise to retail areas.	 

Key Action 1.4 : Implementing More Efficient Traffic Flow And Environmental Conditions

1.4a	**Install more smart traffic management system to control congestion during peak hours.**	
	To install more smart traffic devices such as Smart Traffic Analytic and Recognition System on the streets of Cyberjaya to control congestions during peak hours caused by incoming vehicles. Currently, there are 8 intersections using this system in Cyberjaya.	

Strategy 1: Establish Smart Mobility

Target : 80% coverage of integrated green mobility network by 2025

DESCRIPTION OF KEY & SUB-ACTIONS		
Key Action 1.5 : Promoting Clean And Energy Efficient Vehicles		
1.5a	**Improve visibility of EV charging stations for private vehicles along prominent roads.**	
	To add more locations especially along the prominent roads and to also improve the visibility of the charging station using signage and directions. This is to support and encourage more usage of electric vehicles in Cyberjaya and at the same time reduce air pollution from traffics.	
1.5b	**Provide EV charging station facilities for buses at terminal hub and Park & Ride.**	
	To install EV charging facilities for public buses to encourage the transition of diesel-run to electric-run public buses. The charging stations should be integrated with the TOD areas to ensure efficiency and convenience.	
1.5c	**Convert conventional public transport vehicles to green vehicles (e.g electric bus, hybrid taxi) by 2025.**	
	To ensure that more public transport vehicles are green vehicles in order to reduce carbon emissions.	 Adelaide creates world's first solar- powered public transport system

B. Strategy 2: Promote Walkability

Target : Walking to account for 60% of total trips by 2025

DESCRIPTION OF KEY & SUB-ACTIONS	
Key Action 2.1 : Making Walk Interesting And Safe	
2.1a	**Create "Cyberjaya Link" to increase pedestrian vibrancy (e.g. covered walkway or shaded trees, parklets and public arts) – to encourage people to walk for leisure as well as business.**
	To make streetscape as the main public spaces. This is actually the visual elements of a street, including the road, adjoining buildings, sidewalks, street furniture, trees and open spaces, etc, that combine to form the street's character. The concept recognizes that a street is a public place where people are able to engage in various activities. Streetscapes and their visual experience largely influences public places where people interact, and it ultimately helps define a community's aesthetic quality, economic activity, health, and sustainability. 
2.1b	**Ensure comfortable and safe walkways by providing 24-7 surveillance and proper lightings as well as creating new nodes as places to rest before people continue walking to their final destination.**
	Cyberjaya pedestrian link is to be design with 24-7 surveillance system (CCTV), good street lighting and other street amenities/facilities/fixtures for people to take a rest before continuing to their final destination. 
2.1c	**Encourage flexible sidewalk cafes (on utilities corridor) that add visual appeal to attract people and to slow down vehicle speed.**
	To allow street sidewalk cafes or small retail kiosks that consist of non-permanent structure at ROW's utilities corridor that will add visual appeal and inject more activities to attract people and slow down vehicles. 
Key Action 2.2 : Making Walk Convenient, Quick And Easy Through Local Connection	
2.2a	**Integrate and connect public and private green open spaces with pedestrian and cycling networks.**
	To connect more private and public open spaces with pedestrian and cycling lanes. 
2.2b	**Impose through block connector in between private and public buildings.**
	To connect buildings in adjacent plots through block connector so that pedestrian permeability can be increased. 

Strategy 2:
Promote Walkability

Target : Walking to account for 60% of total trips by 2025

DESCRIPTION OF KEY & SUB-ACTIONS		
Key Action 2.3 : Making Pedestrian Priority Zone		
2.3a	**Organise a monthly event like Cyberjaya Car Free Festival.**	
	To close certain main roads in Cyberjaya for vehicles to organize celebration events and festivals that give priority to pedestrians.	
2.3b	**Impose guideline for efficient block size as well as guideline to integrate pedestrian and cycling network within the pedestrian priority zone (i.e. area within 250m distance from TOD/ Nodes) to increase permeability.**	
	To make city more walkable by increasing the permeability whereby street must be designed in such a way that it permits movement of people/vehicles in different direction. It should also prioritizes pedestrian and cycling lanes and connect it with block connector so that people can walk/cycle to their destination in a shorter period of time.	 Street pattern with **low permeability**  Street pattern with **high permeability**

C. Strategy 3: Embrace Compact & Mixed Use Development

Target : Reduce door to door journey time within cyberjaya by 20 minutes

DESCRIPTION OF KEY & SUB-ACTIONS

Key Action 3.1 : Promoting Compatible Land Use Mix

3.1a **Create neighbourhood scale commercial activity closer to residential area (i.e. at the edges of Cyberjaya or at least 5 km away from the CBD).**

Most area in the western side of Cyberjaya are residential, lack of commercial or enterprise land use and still have a lot of vacant land. The effort to bring these commercials and enterprises closer to home will allow more flexibility to configure future work-life requirements and will be an important factor in contributing towards improvement in quality of life.

3.1b **Increase mixed use development in enterprise zone with 70% commercial and 30% enterprise as well as add service apartments to increase population/density and ridership of public transport.**

To allow mix activity within the enterprise land use. By making it more compact with mixed use development, this will reduce commuting time, living space per-person and ensure optimum use of infrastructure.

Strategy 3:
Embrace Compact & Mixed Use Development

Target : Reduce door to door journey time within cyberjaya by 20 minutes

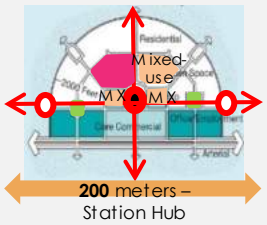
DESCRIPTION OF KEY & SUB-ACTIONS

Key Action 3.2 : Fostering Efficient Use of Urban Spaces

3.2a **Identify TOD Zone for areas around major transit hubs with transit supportive guidelines such as:**

- **increasing intensities and concentration of developments with adequate mix of use;**
- **introducing reduction in parking spaces for TOD Area;**
- **providing clear and comfortable pedestrian access to areas around transit stops.**

One of the most effective ways in improving the accessibility and connectivity of pedestrian network at transit stations is through the implementation of Transit Oriented Developments (TOD). TOD is basically the development that involves compact, walkable neighbourhoods built around or centred by a high quality rapid transit system. It also concentrates higher density development near transit stations making transit as a convenient activity and encourages ridership for public transport.



3.2b **Integrate Community Centre as one-stop amenities hub with new and innovative elements of integrated development such as hawker centre, library, day-care, clinic and other community facilities.**

Promote integration of components within public facility reserves where several facilities are placed within the same reserve. This reduces the need for land and at the same time manages to meet communities demand for public facilities as well as enhance efficiency and resources to manage these facilities. Some facilities that can be placed under one roof include library, day care, clinic, eateries, etc..

D. Strategy 4: Integrate Nature Into Urban

Target : 35% increase in carbon sequestration from baseline and 30% increase in ecological biodiversity (Eco-D) by 2025

DESCRIPTION OF KEY & SUB-ACTIONS

Key Action 4.1 : Enhancing The Environmental Quality

4.1a

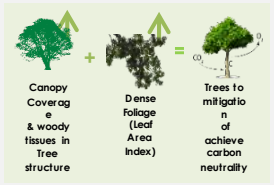
- **Convert conventional drainage to Sustainable Urban Drainage System (such as Bio-ecods, Bioswales) to ensure effective water detention & retention,as well as improve water quality & biodiversity.**
- **Turn it to be used as recreational spaces.**
- **Add smart sensors to detect pollution.**

To convert the concrete drain to Sustainable Urban Drainage System with combination of natural and engineered landscape - such as planting the aquatic or wetland plants and engineering methods that can help to improve the quality of water, increase infiltration by evapotranspiration process and at the same time create recreational spaces for public.

4.1b

- **Plant specific tree types/species that increase urban canopy and urban biodiversity.**
- **Encourage xeriscaping for sustainable landscape maintenance.**

One aspect of trees that has received significant attention related to climate change is that trees are natural carbon sinks. The existing parks and streets will be intensified with aggressive tree planting activities and more dense with large coverage of trees canopy. Xeriscaping is landscaping and gardening that reduces maintenance as well as the need for supplemental water from irrigation.



Key Action 4.2 : Providing Quality And Functional Recreational Facilities

4.2a

Establish and encourage Urban Farming activities in every neighborhoods, schools and city parks.

Urban farming is one of useful activities to utilise vacant or under-utilised land. Simply put, urban farming is growing or producing food in a small scale area that can bring benefits to the community.

Strategy 4:
Integrate Nature Into Urban

Target : 35% increase in carbon sequestration from baseline and 30% increase in ecological biodiversity (Eco-D) by 2025

DESCRIPTION OF KEY & SUB-ACTIONS

Key Action 4.2 : Providing Quality And Functional Recreational Facilities

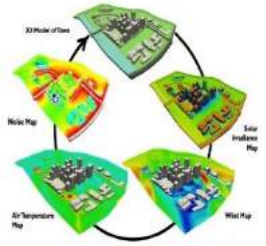
4.2b **Rejuvenate existing parks that cater for all ages and conduct new activities and new amenities/facilities (e.g movie park, music park, etc.).**

The existing park (i.e. the south side of Taman Mini Cyberjaya) is to be upgraded/revived by creating various activities (e.g. movie in the park, eateries, placemaking event, etc..) that can attract people to come and visit.

Key Action 4.3 : Imposing Smart Planning Tools For Low Carbon Planning

4.3a **Develop and enforce Smart Planning Tools Guideline on KM2 Submission with modelling tools to help Local Authority to simulate environmental conditions (such as wind flow, sun and shade) for better city planning.**

This integrated software platform uses a 3D city models to simulate the sole interaction of urban microclimatic conditions such as wind flow, temperature fluctuations and solar irradiance as well as their combined effects on the surrounding urban landscape (such as buildings, water bodies, vegetation, etc.).



4.3b

- **Develop smart apps for Nature Interpretation and Park Activities for recreational and education purposes.**
- **Develop smart apps for tree measurements to estimate ecosystem services (economic and environmental value).**

The app signifies the important of wetland ecosystem In Taman Tasik Cyberjaya and other public parks in Cyberjaya. This virtual device is hoped to engage and excite visitors through a series of interactive interpretation, events information and educational tools.

A similar app is also to be developed specifically for tree monitoring and data measurements that enable users to assess the condition of trees based on parameters such as carbon rate, health status, energy effect, pollution reduction, age and threats impact.

E. Strategy 5: Adopt Efficient and Effective Resource Management Practices

Target : Wide application of smart/green technology in managing resources

DESCRIPTION OF KEY & SUB-ACTIONS

Key Action 5.1 : Improving Solid Waste Collection And Treatment

5.1a

- **Introduce 3 bin system for separating organic waste, recycle and non recycle materials at residential, public buildings (e.g. schools, bus stops, etc.) and main roads.**
- **Enforce separation at source.**
- **Introduce e-waste program to dispose electronics waste (like mobile phones).**

This initiative is about improving recycling activities among the community of Cyberjaya to ease the management of waste and streamline the stage of recycle waste. Looking at the current recycling rate of Cyberjaya, efforts need to be intensified to promote waste reduction and recycling at the early stage of the process i.e. at source.

5.1b

Introduce pre-treatment system such as MRF for waste minimization and segregation.

Materials Recovery Facilities (MRF) are housed facilities which combine a number of screening / sorting techniques to divide residual municipal waste into a recyclable material stream and a non-recyclable residual waste stream disposed to landfill. More advanced plant may be used to produce a third stream either a primarily biodegradable waste stream which can be sent for Anaerobic Digestion or In-vessel composting or a relatively high calorific value stream for conversion to Refuse Derived Fuel.

Key Action 5.2 : Greening The Waste Water System

5.2a

Adopt to Sustainable Sewerage Treatment Plant (STP) by :

- **Converting existing STP to sustainable STP systems;**
- **Constructing future new STP with sustainable STPs;**
- **De-centralizing future STPs to encourage the utilization of recycle water to local area neighborhood.**

This initiative is about moving away from the conventional centralized approaches to wastewater management. Traditional sewer typically collect and convey wastewater collected from relatively long distances to large centralized treatment plants. By contrast, decentralized systems are smaller wastewater and storm water systems located in close proximity to the source of water being managed. Treating water near its source reduces the energy demand associated with conveyance and promotes localized reclamation, reuse of treated water and resource recovery in terms of energy.

Key Action 5.3 : Implementing Integrated Waste to Energy/Wealth Project

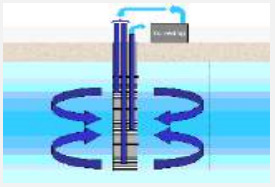
5.3a

- **Conduct Feasibility Study on waste to energy (WTE) project leveraging on the GTALCC Fund & Assistance.**
- **Set up WTE project that potentially generates biogas, synthetic fuel (diesel) and engineered soil.**

A robust thermal waste-to-energy facility is a cornerstone of most modern waste management systems. A waste-to-energy facility may generate a range of energy outputs : electricity, district heating, steam for industrial processes, desalinated seawater or district cooling. In this way, residual waste – i.e. waste that cannot be recycled in an economic or environmentally beneficial way – can become a resource by turning it into energy for the benefit of people, businesses, countries and the environment.

Strategy 5: Adopt Efficient and Effective Resource Management Practices

Target : Wide application of smart/green technology in managing resources

DESCRIPTION OF KEY & SUB-ACTIONS		
Key Action 5.4 : Improving Telecommunication Services		
5.4a	**Make Cyberjaya a city-wide high speed wireless connection leveraging on existing and new platform like LORA.**	
	Everything from consumers, cities, supply chains, homes, commerce and enterprises will be connected through high speed internet, fundamentally changing how we conduct our daily lives.	
Key Action 5.5 : Improving Water Management System		
5.5a	▪ **Introduce advanced water like underground water extraction.** ▪ **Encourage the utilization of recycle water from STPs to local area neighbourhood.**	
	One of the efforts to improve the existing potable water supply. Of course, further studies on the feasibility and approach are needed before embarking into this project.	
Key Action 5.6 : Reducing Energy Consumption		
5.6a	**Convert existing conventional District Cooling System (DCS) to green DCS by using recycle water and running on Renewable Energy.**	
	To look into the optimization of DCS integrated with sustainable energy technologies including systems integrated with RE, combined cooling, heating and power systems, and thermal storage systems.	
5.6b	**Increase more innovative use of solar panel in Cyberjaya for common area consumption :** ▪ **Floating solar panel on retained water bodies;** ▪ **Façade and roofs of public buildings;** ▪ **Car park areas; and** ▪ **Utility buildings.**	
	This initiative is about promoting and implementing innovative solar panel systems that are more effective and able to perform better (e.g. one square acre of floating solar panels is capable of generating 500,000 kWh of energy).	

F. Strategy 6: Implement Smart & Low Carbon Buildings

Target : 40% energy reduction from buildings by 2025

DESCRIPTION OF KEY & SUB-ACTIONS		
Key Action 6.1 : Implementing Energy Reduction Practices In All Buildings		
6.1a	**Conduct energy audit as the first step in identifying opportunities to reduce energy consumption and carbon footprints.**	
	Energy audit is an exercise to gauge on the energy performance of existing buildings and at the completion of the exercise, it recommends energy saving measures (ESMs) that can be undertaken to reduce energy consumption.	
6.1b	**Impose installation of water and energy efficient fixtures/appliances/apparatus to all buildings.**	
	This initiative is to encourage water saving and energy efficiency methods in buildings through the installation of water and energy efficient fixtures/appliances/apparatus. Reducing water use and energy consumption from fixtures and equipment is perhaps the easiest method to reduce total potable water and energy use. It does not require extensive design solutions, just specifying certain products.	 LED light fixtures  Tap water with aeration
6.1c	**Promote the usage of solar energy in residential areas of Cyberjaya using the NEM scheme.**	
	Net metering scheme allows residential and commercial customers who generate their own electricity from solar power to feed electricity they do not use back into the grid.	
6.1d	**Provide Passive Design Toolkits and Low Carbon Home Renovation Guidebook to educate and update homeowners with information on sustainable material providers.**	
	A collaborative effort between local authority and the community to establish toolkits or guideline for homeowners of Cyberjaya to live more sustainably. Passive design is design that takes advantage of the climate to maintain a comfortable temperature range in the home. Passive design is able to reduce the need for auxiliary heating or cooling, which accounts for high percentage of energy use in the average home.	
6.1e	**Replace existing conventional electricity consumption measurement systems with respective smart meters.**	
	Deployment of smart meters in Cyberjaya would enable remote recording of meter readings using wireless and communication technologies for monitoring and billing.	

Strategy 6:
Implement Smart & Low Carbon Buildings

Target : 40% energy reduction from buildings by 2025

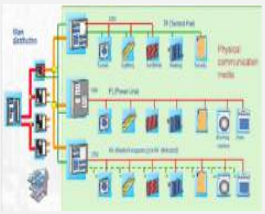
DESCRIPTION OF KEY & SUB-ACTIONS		
Key Action 6.1 : Implementing Energy Reduction Practices In All Buildings		
6.1f	**Implement energy management system (EMS) on public buildings and eventually expand to commercial buildings.**	
	This intelligent energy management software control system is designed to reduce energy consumption, improve the utilization of the system, increase reliability, predict electrical system performance, and optimize energy usage to reduce cost.	 Indoor Lighting
6.1g	**Encourage buildings to produce on-site carbon free Renewable Energy in the amount to offset the annual CO2 emission associated with the buildings' operations.**	
	Buildings with extra spaces and areas are encouraged to implement and harvest certain renewable energy to reduce conventional energy consumption as well as to save money on electricity in the long run.	
6.1h	**Develop/install/use more smart apps on real-time information through intelligent and wireless connection especially at public buildings (e.g. parking sensors at mall and hospital, LED advertisements on buildings, etc.).**	
	This initiative is to develop, install and use more smart apps that are able to provide real-time information through intelligent and wireless connection. More commercial and mixed use buildings in Cyberjaya shall install this apps for the convenient of the public (e.g. installation of display of real-time parking availability through transferring data from sensors in the parking bays).	
Key Action 6.2 : Imposing Compulsory Low Carbon Building Regulations At City Council Level		
6.2a	**Impose rule of "passive design first then active".**	
	For new upcoming developments, a guideline will be established to consider the rule of 'passive design first and then active'. As mentioned before, passive design is design that takes advantage of the climate to maintain a comfortable temperature range in the home. Passive design is able to reduce the need for auxiliary heating or cooling, which accounts for high percentage of energy use in the average home.	

Strategy 6:
Implement Smart & Low Carbon Buildings

Target : 40% energy reduction from buildings by 2025

DESCRIPTION OF KEY & SUB-ACTIONS

Key Action 6.2 : Imposing Compulsory Low Carbon Building Regulations At City Council Level

6.2b	**Enforce the adoption of MS1525 (Energy Efficiency And Use Of Renewable Energy For Non-Residential Buildings) to all public buildings and eventually expand to commercial buildings.**	
	MS:1525 is the Malaysian code of practice for energy efficiency and use of renewable energy for non-residential buildings. It provides guidelines for the design and construction of buildings in the Malaysian context, keeping climate factors and comfort conditions in mind.	 Energy Management System
6.2c	**Impose additional 5% vertical greenery to the existing 10% of green on ground level within building plot.**	
	This is an initiative to improve the greenery area at plot level by encouraging the plot developer to provide Landscape Replacement Area, whereby sky-rise buildings are to provide a landscaped area equivalent in size to its development site area. The replacement strategy includes greenery on buildings such as rooftop gardens, vertical wall, green roof and green balconies.	
6.2d	**Impose low carbon certification requirement for public buildings and on developers for commercial buildings.**	
	This initiative is to increase the number of green certified building in Cyberjaya. It is recommended to have more green certified buildings as they are usually sustainable in design and manage to increase the efficiency of the buildings in terms of their use of energy, water, and materials. In addition, green buildings reduce negative impacts on human health and the environment throughout their entire building lifecycle.	

G. Strategy 7: Intensify Community Participation

Target : Increase awareness and develop low carbon community

DESCRIPTION OF KEY & SUB-ACTIONS

Key Action 7.1 : Organizing Various Community Projects

7.1a

Introduce community empowerment and ownership projects :

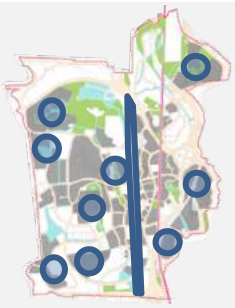
- **"Cyberjaya : Tree for Life" Program - a fun tree planting program to increase green spaces;**
- **"Adopt -A -Park" Program – whereby volunteers from schools, community and individuals participate/contribute to make adopted parks more vibrant and attractive.**

Cyberjaya targets to plant 10,000 trees per year. In order to do so, engaging with the community is vital to increase participation and create a sense of ownership among residents of Cyberjaya. The tree planting program and the "adopt-a park" program will help to add more trees and manage more green open spaces in a mission to cool Cyberjaya down by 2 degrees in the long run.

7.1b

Initiate Urban Community Gardens Program or Rooftop Gardens Program.

A community garden/rooftop garden is where members can grow produce and ornamental plants for personal use. Gardens range in size from a few hundred square feet to thousands of square feet, some offer individual plots while others have shared plots. Each garden is operated by a group of committed volunteers, and membership fees are often self-imposed to cover common expenses. Community gardens benefit everyone by creating safe and healthy recreational activity within own neighbourhood.



7.1c

Organize "Recycling Competition" event between Enterprises and residential neighbourhoods in Cyberjaya.

This initiative is to encourage existing Enterprises in Cyberjaya such as Shell, Dell, IBM and many others to participate in a recycling competition. The whole objective is to increase awareness on recycling activity and to encourage more people to recycle.

7.1d

Develop an Award Program to reward good environmental behaviour and to recognize substantial contribution/initiatives towards the environment and low carbon development :

- **Low Carbon Office Building Award**
- **Low Carbon Neighbourhood Award**
- **Low Carbon School/University Award**

Awareness on environment and public participation can be further strengthen by acknowledging good behaviour and recognizing substantial contributions by good doers.

Strategy 7: Intensify Community Participation

Target : Increase awareness and develop low carbon community

DESCRIPTION OF KEY & SUB-ACTIONS

Key Action 7.2 : Establishing Community Sustainability Centre

7.2a	**Diversify function and waste collection at the Recycling Centre – e.g. point of collection of cooking oil, e-waste products, furniture, etc..**
7.2b	**Provide anaerobic digester facility for composting.**
7.2c	**Enhance and implement green features in the existing center to promote/demonstrate green building.**
7.2d	**Place WSUD (Water Sensitive Urban Design) at the site to demonstrate and educate people on water efficiency.**
7.2e	**Exhibit smart features at the center to demonstrate and educate people on the integration between smart and green initiatives.**
7.2f	**Integrate urban farming area with composting activities at the center.**
7.2g	**Built a library section and put old recycled books to good use at the center.**

Cyberjaya Community Sustainability Centre is a focal point whereby a lot of activities related to sustainable living are organized and initiated from there. This is also the place where community can volunteer to participate in the various programs run by the centre. This is also the place where people can get information or education related to protecting and conserving the environment.

Strategy 7:
Intensify Community Participation

Target : Increase awareness and develop low carbon community

DESCRIPTION OF KEY & SUB-ACTIONS		
Key Action 7.3 : Developing Smart & Low Carbon Education Program For Youngsters		
7.3a	**Nurture young generations on smart and green living :** ▪ **Work with schools/colleges to deliver education packs and to involve them in environmental related activities.**	
	Environmental education raises awareness of issues impacting the environment upon which we all depend, as well as actions we can take to improve and sustain it. Environmental education provides important opportunities for students to become engaged in real world issues that transcend classroom walls. They can see the relevance of their classroom studies to the complex environmental issues confronting our planet and they can acquire the skills they will need to be creative problem solvers and powerful advocates.	

Conclusion

There are considerable opportunities of lowering carbon emissions in Cyberjaya. Of the many sources, buildings (from embodied to operational carbon) present the biggest share contributing to the overall emissions, therefore mitigating through building-related GHG is the most effective measure to bring down emissions (UNEP 2007).

Reductions in building-related GHG emissions can be achieved in many different ways : by increasing the amount of electricity generated from low- and zero-carbon technologies, by retrofitting existing buildings to reduce energy consumption and improve energy efficiency, and by constructing new buildings to be low- or zero-energy buildings. Many factors influence the level of emission reductions achieved. Significant improvements in energy efficiency are attainable and can reduce building-related emissions to very low levels or, when coupled with renewable energy sources, to zero. Pairing these measures with greeneries to provide sinks is the most economical and effective way to slash emission. Planting trees with high sequestration properties will elevate sequestration to a higher level beneficial for a safe environment.

The second major contributor to CO2 emission is the transport sector as a result of high dependency on private vehicles. Recommended mitigation measures include encouraging people to use public transport and other means of green mobility (including walking and cycling). As such, public transport services (buses and upcoming rails) need to be efficient and convenient to draw ridership. Facilities and amenities for people to walk and cycle need also be convenient, safe and vibrant to encourage more people to walk and cycle.

This study undertaken by MP Sepang provides a thorough understanding of greenhouse gas (GHG) emissions as well as an understanding on the impact of CO2 reduction contribute by various and different activities within the city. This would allow the authority to determine where to best direct mitigation efforts, set emission reduction targets, create strategies to address climate change and monitor progress. The maxim “if you can’t measure it, you can’t manage it” applies here, and so the idea that urban fabric and activity can be ‘instrumented’ and measured in detail, and acted upon instantly, enables a new form of management, operation and engagement.

Cyberjaya
& Smart Low Carbon City
2025

40%
Carbon emission reduction by 2030

Chapter 1.0 About the Report

1.1 Background

The preparation of Cyberjaya Smart & Low Carbon City 2025 (CSLC 2025) has been part of the recommendation being made from the output of the CO2 Baseline Data Report 2011. It has also been part of the response to the Government's initiatives in reducing the level of CO2 emission and achieving sustainable development amid facing modern and dynamic urban development processes.

The goals of the 2011 Report were :

- to obtain baseline data for 2011;
- to identify low-carbon projects that can be implemented until the year 2020 using the Low Carbon Cities Framework & Assessment System (LCCF).

The 2011 Report had provided an early understanding of CO2 emission levels in Cyberjaya and had been part of pioneering initiatives by the government to showcase Malaysia's efforts towards developing low-carbon cities. It had also been part of the 10th Malaysia Plan to mobilize Cyberjaya, together with Putrajaya as the pioneer of green cities in the country.

The preparation of this Report has also been in line with the Selangor State Government's effort in balancing human and physical progression based on the principle of sustainable development, through the launch of the Selangor Green Technology Action Plan 2016-2018. The Selangor Green Technology Action Plan focuses on 5 main sectors namely :

And it contains eight (8) main actions as per diagram below :

Figure 1.1: Main Actions of the Selangor Green Technology Action Plan 2016-2018

- Low Carbon Township;
- Government Green Procurement;
- Installation Of Electric Vehicle Charging Stations;
- Electric Vehicle as Official Vehicle for Selangor State Government;
- Electric-Powered Buses Under the Free-Bus Program At Local Councils;
- Installation of Solar PV on the Roof for Selangorku Housing Project;
- Energy Efficient Buildings for State Government Buildings; and
- Green Industrial Park Program.

The Selangor State Government targets 12 local councils to adopt the Low Carbon Township Framework by 2020 and 4 local councils will to be awarded with the status of Green City by 2030.

Hence, Majlis Perbandaran Sepang's initiative to prepare this CSLC 2025 Report is timely and appropriate. CSLC 2025 shall determine the vital steps needed towards achieving the reduction of CO2 emissions over a period of short, medium and long term, as well as transforming the city into "city of the future" by 2025. This initiative subsequently supports the country's commitment to reduce CO2 emissions by 45% per GDP per capita by 2030.

1.2 Objectives

The preparation of this **CSLC 2025** for Majlis Perbandaran Sepang aims to provide a comprehensive document that shall be used to guide the implementation of formulated strategies / action plans and their respective interventions, projects and programs in a consensus effort involving various key stakeholders towards transforming Cyberjaya into Smart & Low Carbon City by year 2025.

Objectives of the study include the followings :

I. To provide a Blueprint / Framework / Action Plan for Cyberjaya Smart & Low Carbon City 2025 that is in line with Majlis Perbandaran Sepang's Local Plan 2025;

II. To provide recommendations / guidelines related to solving issues / challenges for long, medium and short term duration based on the 2011 Report and feedback from key stakeholders during engagement sessions;

III. To identify implementable actions for Cyberjaya and Sepang in general towards cost savings and reduction of CO2 emission based on the current operating costs of Majlis Perbandaran Sepang in areas such as solid waste management, landscape maintenance and building management (energy savings / renewable energy);

IV. To identify among the twelve (12) domains of Smart Selangor that are feasible to be implemented either in the pre or post development as well as to promote the use of IT / ICT / IOT through the development of Smart City Apps and Smart City Infrastructure with the emphasis on 'Cyberjaya Towards Global Technology Hub'; and

V. To identify suitable programs towards creating Cyberjaya Low Carbon Community (i.e. promoting low carbon lifestyle).

1.3 Highlights of the Report

This report has been prepared in such a way that the intricate processes of deriving the final action plans are covered throughout to ensure that the proposed action plans are relevance, feasible, practical and implementable at the same time.

Key highlights of each chapter are described below :

Chapter 1
About the Report

The preparation of Cyberjaya Smart & Low Carbon City 2025 is mainly a response towards the recommendation made in the CO2 Baseline Data Report 2011, as well as towards a few green agenda initiated by the state and the federal government.

Chapter 2
Cyberjaya Today

Through a well-planned development in terms of its land use, transportation and infrastructure network, Cyberjaya has established itself as the premier ICT hub in Malaysia.

Chapter 3
Concept of Smart & Low Carbon City

The concept of smart and low carbon city can be broadly defined by 9 key features : land use efficiency, non-motorized transport mode, efficient public transportation, quality public spaces, process management and technology upgrading, building efficiency, waste as a resource, water efficiency and urban governance.

Chapter 4
Two Decades of Development

Achievement garnered throughout two decades of development as well as various plans and policies emphasizing on sustainability form good pillars for transformation towards “city of the future”.

Chapter 5
Towards a Smart & Low Carbon City

The assessment of the spatial planning are keys towards the formulation of Action Plans for Cyberjaya Smart & Low Carbon City 2025, whilst the three (3) Guiding Principles serve as support and boundaries in defining relevant measures to achieve the vision of Cyberjaya to be Smart & Low Carbon City by 2025.

Chapter 6
Smart & Green Key Action Plans

Seven (7) Key Actions under four types of action have been identified for Cyberjaya towards becoming a Smart & Low Carbon City.

Chapter 7
Implementation Timeline

The planning of time and resources is important to ensure actions are carried out within a given timescale.

Chapter 8
Carbon Assessment

An estimation of current CO2 emission and projection of reduction by 2025.

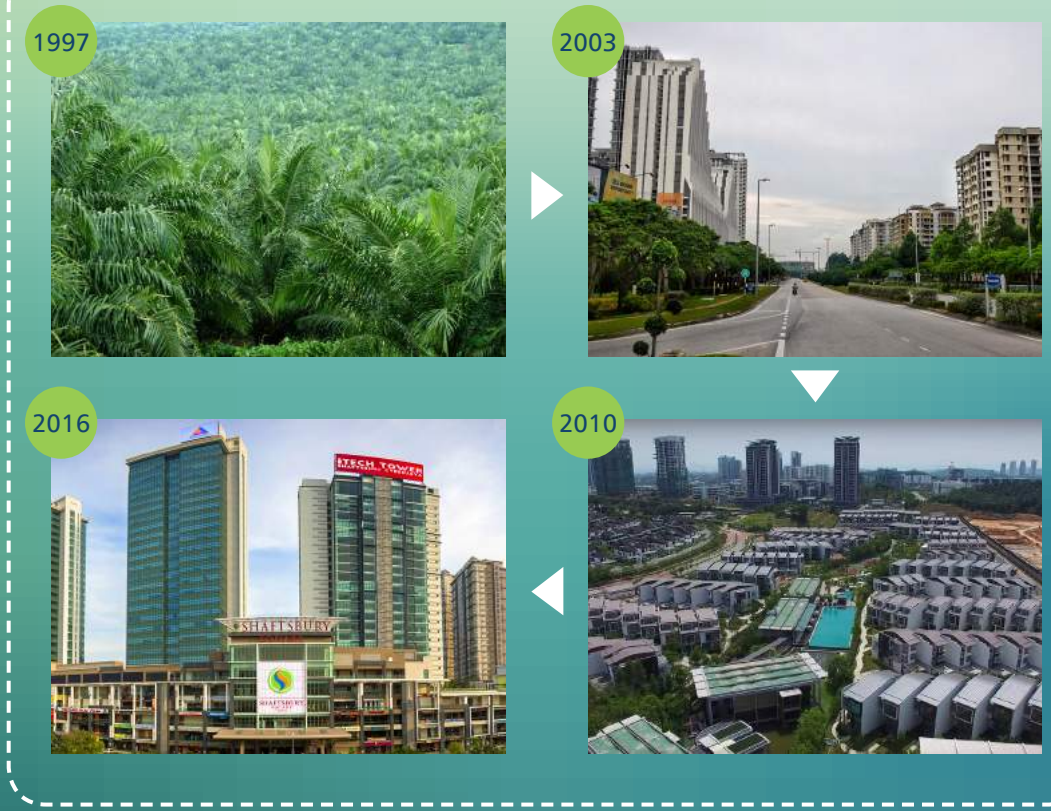
Chapter 2.0 Cyberjaya Today

2.1 Introduction

Cyberjaya was established as the catalyst to leapfrog Malaysia into a technologically advanced nation, by serving as the nucleus of MSC Malaysia. Sprouting from a modest plantation 16 years ago, Cyberjaya now houses over 700 companies and has attracted many prominent technology firms; creating tens of thousands of high value jobs in the process. Most of these jobs are technology services, technology based services or high-value business process outsourcing. Consequently, Cyberjaya is also home to notable higher learning institutions in Malaysia such as Lim Kok Wing University, Multimedia University and several other colleges.

As the nucleus of MSC Malaysia, Cyberjaya has established itself as the premier ICT hub. Moving forward, the new mandate is to elevate Cyberjaya into a global technology hub (not limited to ICT), whilst accelerating its global leadership in ICT. The new mandate shall not only spur the creation of high technology jobs in Cyberjaya, but also an opportunity for Cyberjaya to position itself as the preferred investment hub for technology companies, while at the same time reaffirm its existing position as the premier location for ICT-related companies in the region.

Transformation of Cyberjaya in 2 Decades



Cyberjaya's rapid growth is spurred by Cyberview's efforts in creating a thriving Cybercity with dedicated infrastructure, cutting edge technology, 'green initiatives and the townships own global platform.

After two (2) decades since its inception, the southbound wave of development has reached this cornerstone of the Multimedia Super Corridor (MSC).

Total Land Area
6,960.7 acres (2,816.6 hectares)

Total Built Up Area
4,294.4 acres (1,737.9 hectares)

Total Green Area
2,666.3 acres (1,070.0 hectares)

Total Number of MSC Status Companies 2015
3,881

Total Malaysian Owned Companies 2015
2,820

Live-in Population 2016
42,253

Population Density
6 persons per acre or
24 persons per hectare

Total Students Population
25,626 (including school children)

Total Number of Students at Institution of Higher Learning 2016
21,839

Total Number of Universities/Colleges
7 nos

Total Workforce 2016
54,492

MSC Status Workforce
37,615

Non MSC Workforce
2,045

Government Workforce
6,992

Commercial Workforce
7,840

2.2 Site Profile

2.2.1 Location & Area Wide

Cyberjaya, which is known as the Silicon Valley of Malaysia concerning its association with the MSC Malaysia, is located in the district of Sepang. Sepang is one of the nine (9) districts that make up the state of Selangor. Sepang district shares its border with Kuala Langat to the west, Petaling to the north, Hulu Langat to the northeast and the state of Negeri Sembilan to the east and completely surrounds Putrajaya, which is a Federal Territory.

The Sepang district is situated in the southern part of Selangor with the acreage of 152,958 acres or 61,900 hectares and had a population of 212,050 at the 2010 Population Census.

Sepang district is divided into three (3) Mukims which are Dengkil, Labu and Sepang. The capital of Sepang district is Bandar Salak Tinggi. Cyberjaya is located in Mukim Dengkil and covers an area of 6,960.0 acres or 2,816.6 hectares.

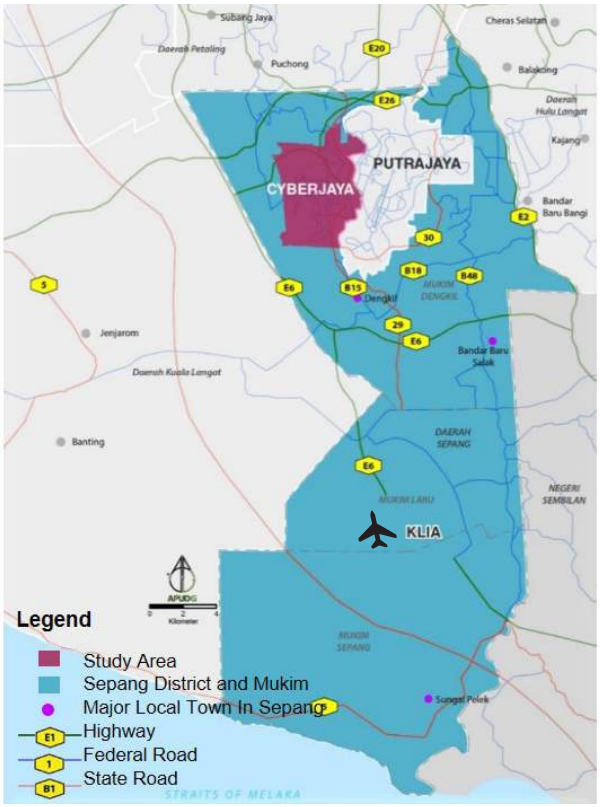
The Cyberjaya city lies at the heart of Malaysia's Multimedia Super-Corridor (MSC). The corridor covers 750 square kilometers (300 square miles) and is equipped with world-class physical infrastructure as well as next–generation 2.5 - 10 Gb multimedia network.

Figure 2.1: Cyberjaya and Its Surrounding Area

Source: Sepang Local Plan 2025

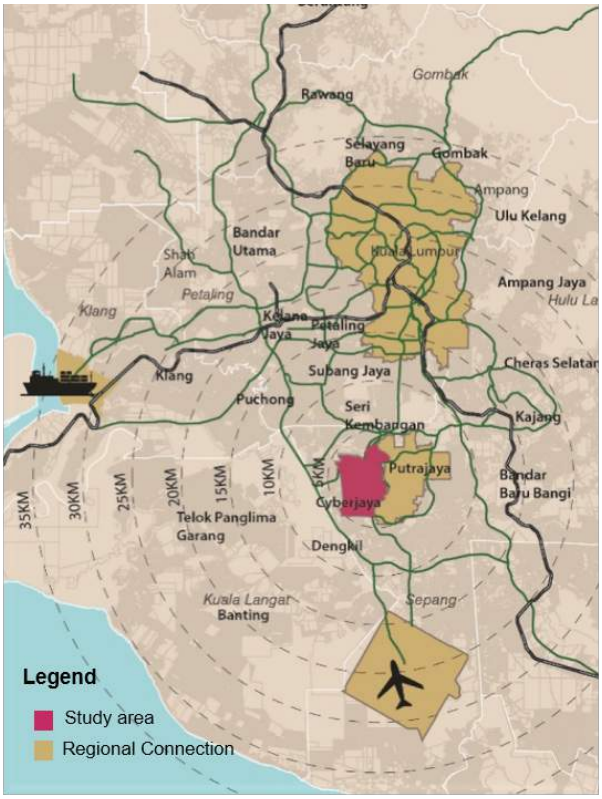
Cyberjaya is located about 20 minutes away from the city centre of Kuala Lumpur, 30 minutes from Petaling Jaya and Shah Alam (Selangor state capital), 15 minutes from Putrajaya (federal administrative centre of Malaysia) and 20 minutes from Kuala Lumpur International Airport (KLIA), the major air hub and gateway of Malaysia.

Figure 2.2: Cyberjaya In Regional Context



Source: Sepang Local Plan 2025

Figure 2.3: Location of Cyberjaya within the Major Transportation Hub



Source: APUDG

2.2.2 Planning Block of Cyberjaya

District of Sepang has a sheer size of 152,958 acres or about 61,900 hectares. This area is further sub-divided into eight (8) smaller area known as planning blocks (BP). The sub-division is basically to ensure that MPS prepares a comprehensive development planning or development control over its jurisdiction area. The eight (8) BP and their boundaries are shown in Table 2.1 and Figure 2.4 respectively.

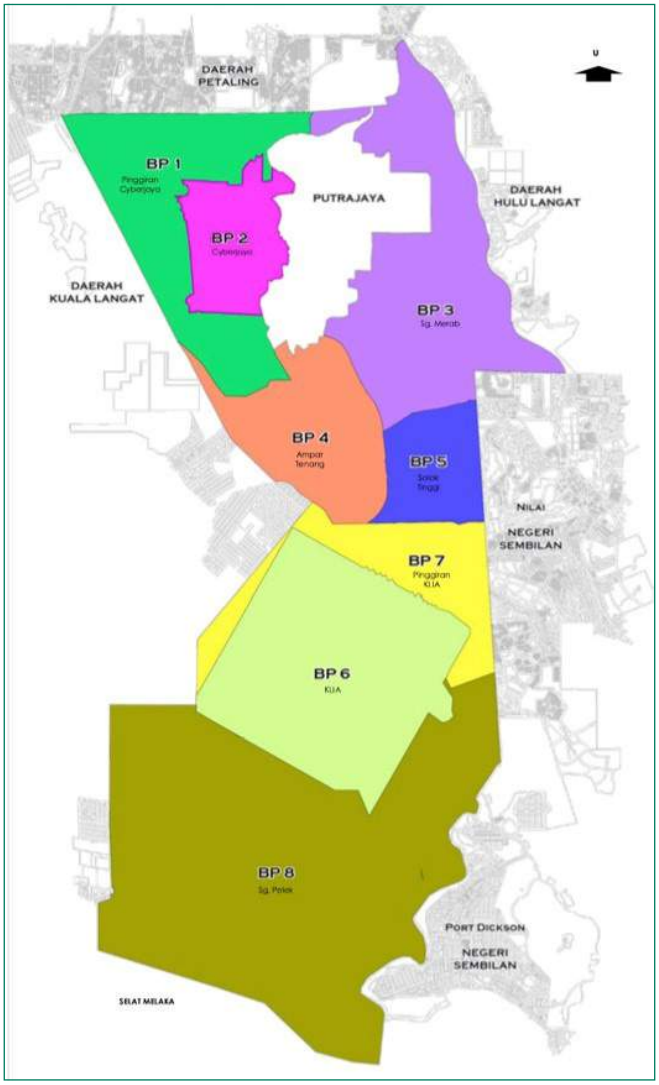
Cyberjaya comes under BP 2 and according to Sepang Local Plan 2025, BP 2 is designated for residential and commercial development. Overall, Cyberjaya makes up about 4.6% of total size area of Sepang district. Cyberjaya or BP 2 is further sub-divided into twelve (12) small planning blocks (BPK) namely Cyber 1 until Cyber 12 (Table 2.2 and Figure 2.4). These BPK signify the more details development planning of an area.

Table 2.1: Breakdown of 8 Planning Blocks In Sepang District According To Size

Planning Block (BP)		Size (Acres)	Size (Hectares)	% of Total Area
BP 1	Pinggiran Cyberjaya	15,320.00	6,199.80	10
BP 2	Cyberjaya	6,960.00	2,816.60	4.6
BP 3	Sungai Merab	21,330.10	8,632.00	13.9
BP 4	Ampar Tenang	11,170.10	4,520.40	7.3
BP 5	Salak Tinggi	5,938.10	2,403.10	3.9
BP 6	KLIA	24,325.80	9,844.30	15.9
BP 7	Pinggiran KLIA	9,037.00	3,657.20	5.9
BP 8	Sungai Pelek	58,877.00	23,826.70	38.5
Total Area		152,958.00	61,900.00	100

Source: Sepang Local Plan 2025

Figure 2.4: The Boundary of 8 Planning Blocks in Sepang District



Source: Sepang Local Plan 2025

Cyberjaya city centre is situated at Cyber 3 and the centre for business district (CBD) is located at Cyber 12. Major universities such as University Islam Malaysia, University Lim Kok Wing and Multimedia University are located at Cyber 1, 3 and 11 respectively. Meanwhile, commercial area are focussed at Cyber 4, 5, 6, 8 and 12. Most residential area are located at Cyber 1, 2, 3, 7, 9 and 10.

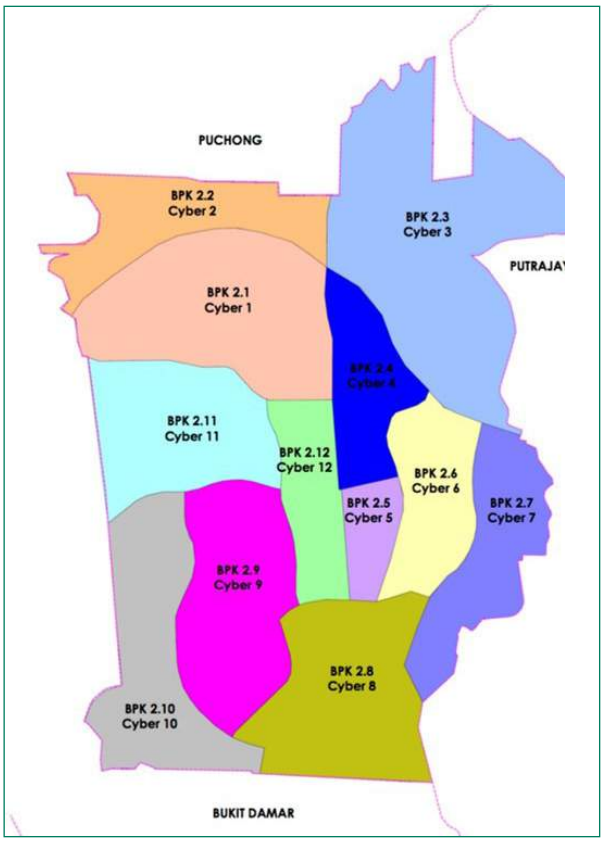
Key stakeholders such as Majlis Perbandaran Sepang, Setia Haruman Sdn Bhd and Cyberview Sdn Bhd and are located at Cyber 1, 9, 7 and 6 respectively.

Table 2.2: Breakdown of 12 Small Planning Blocks According to Size

Small Planning Block (BPK)		Size (Acres)	Size (Hectares)	% of Total Area
BPK 2.1	Cyber 1	993.1	401.9	14.3
BPK 2.2	Cyber 2	421.8	170.7	6.1
BPK 2.3	Cyber 3	1,277.70	517.1	18.4
BPK 2.4	Cyber 4	288.3	116.7	4.1
BPK 2.5	Cyber 5	166.4	67.3	2.4
BPK 2.6	Cyber 6	342.3	138.5	4.9
BPK 2.7	Cyber 7	576.3	233.2	8.3
BPK 2.8	Cyber 8	599.2	242.5	8.6
BPK 2.9	Cyber 9	674.1	272.8	9.7
BPK 2.10	Cyber 10	675.2	273.2	9.7
BPK 2.11	Cyber 11	616.4	249.4	8.9
BPK 2.12	Cyber 12	329.1	133.2	4.7
Total Area		**6,960.00**	**2,816.60**	**100**

Source: Sepang Local Plan 2025

Figure 2.5: The Boundary Of 12 Small Planning Blocks Within Cyberjaya



Source: Sepang Local Plan 2025

2.2.3 Land Use

The land use type of Cyberjaya as at 2016 can be categorised as per Table 2.3 below.

Table 2.3: Breakdown of Existing Land Use In Cyberjaya as at 2016

Land Use Type	Size (Acres)	Size (Hectares)	% of Total Area
Housing	436.5	176.6	6.3
Commercial	848.3	343.3	12.2
Light Industry	10	4	0.1
Institution & Public Amenities	286.3	115.9	4.1
Mixed Development	224.6	90.9	3.2
Infrastructure & Utilities	634.2	256.7	9.1
Transportation	1,234.60	499.6	17.7
Open Spaces & Recreational Area	624.6	252.8	9
Water Bodies	453.3	183.4	6.5
Vacant Land (Vacant & Committed)	2,207.50	893.3	31.7
Total Area	**6,960.00**	**2,816.60**	**100**

Source: Sepang Local Plan 2025

There are 10,362 unit of houses identified in Cyberjaya with two (2) different types or category – high rise and landed housing. The same type of housing units can also be found in the mixed development areas.

12 percent of Cyberjaya are currently occupied by commercial land use with an equivalent floor space of 10,228,834 square meters. The commercial activities are classified into three (3) categories namely Business & Services, Enterprise and Private Institutions.

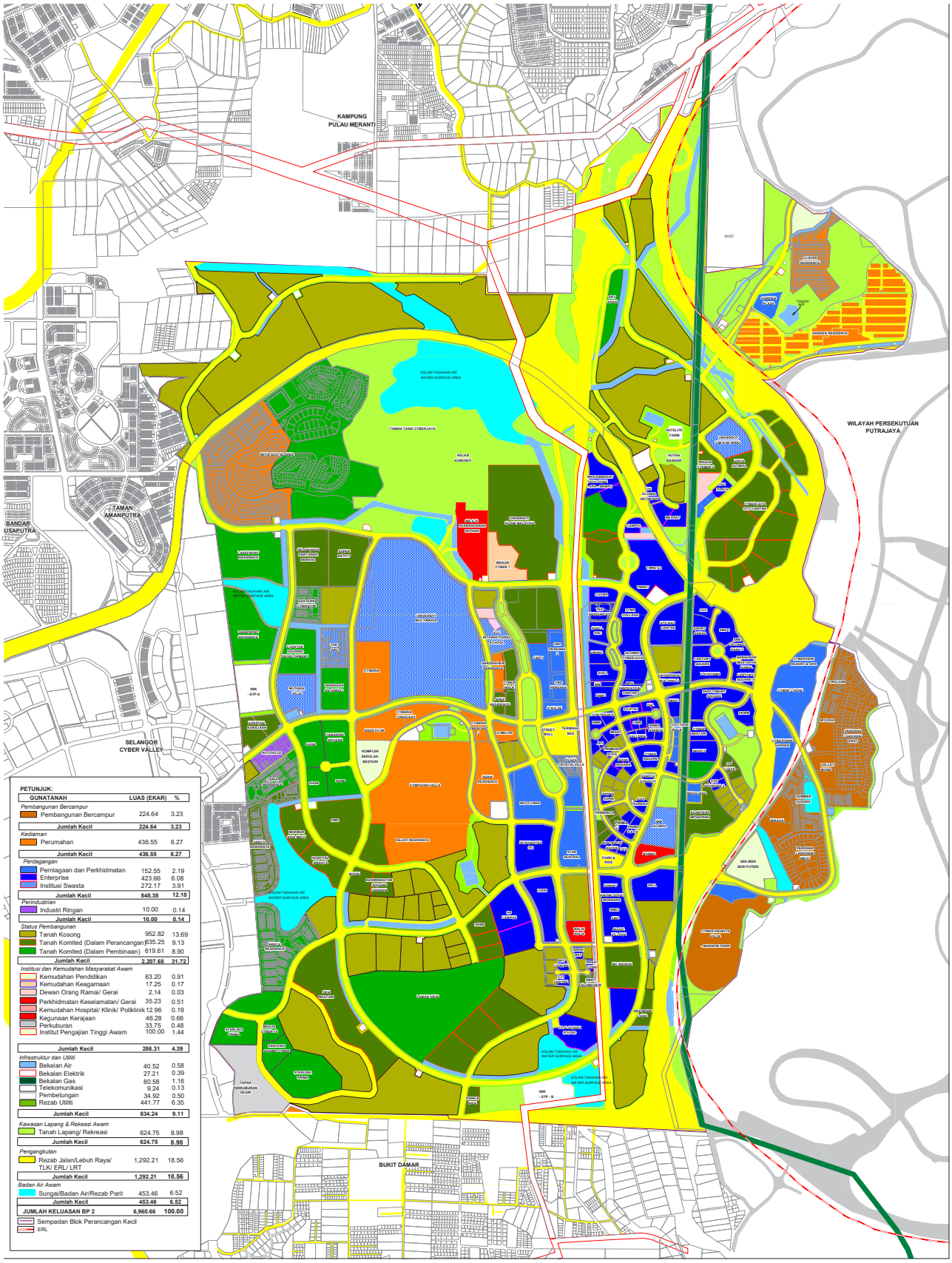
The land use pattern of Cyberjaya as at 2016 can be further broken down into categories/activities as per illustrated in Table 2.4.

Table 2.4: Breakdown of Land Use According to Categories/Activities

Type	Categories/Activities
Housing	• Non Strata • Strata
Commercial	• Business & Services • Enterprise • Private Institutions
Light Industry	• Enterprises
Institution & Public Amenities	• Education Facilities • Religious Facilities • Community Hall/Stalls • Safety Services/Stalls • Hospital/Clinic/Polyclinic • Government • Graveyard • Public Higher Learning Institution
Mixed Development	• Commercial & Housing
Infrastructure & Utilities	• Water Supply • Electrical Supply • Gas Supply • Telecommunication • Sewerage System • Utilities Reserve
Transportation	• Reserve Road/Highways/TLK/ERL/LRT
Open Spaces & Recreational Area	• Open Spaces/Recreational Area
Water Bodies	• River/Water Bodies/Drainage Reserve
Vacant Land	• Vacant Land • Committed Development (Planning) • Committed Development (In Contsruction)

Source: Sepang Local Plan 2025

Figure 2.6: Land Use In Cyberjaya as at 2016

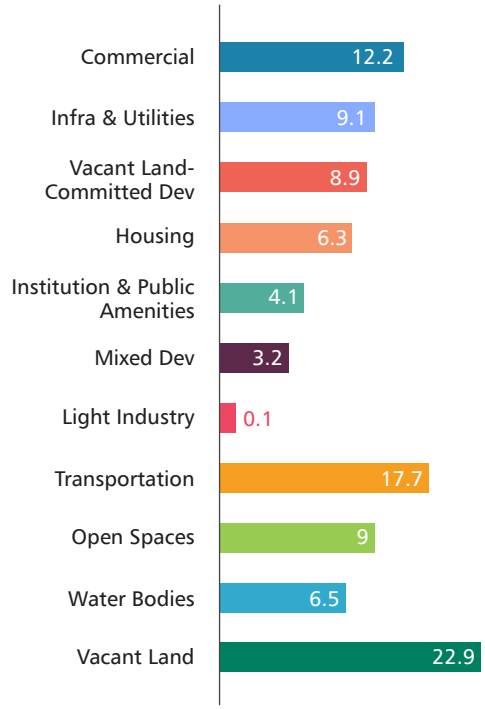


Source: Sepang Local Plan 2025

As illustrated in Figure 2.7 below, Commercial land use has been the active activity, accounted for 12.2% from total area. The lowest land use activity is Light Industry which accounted for only 0.1% of total area.

Vacant Land in Cyberjaya is divided into three (3) different categorisation - Vacant Land, Committed Development (Planning) and Committed Development (under construction).

Figure 2.7: Breakdown of Existing Land Use Activities According to Percentage



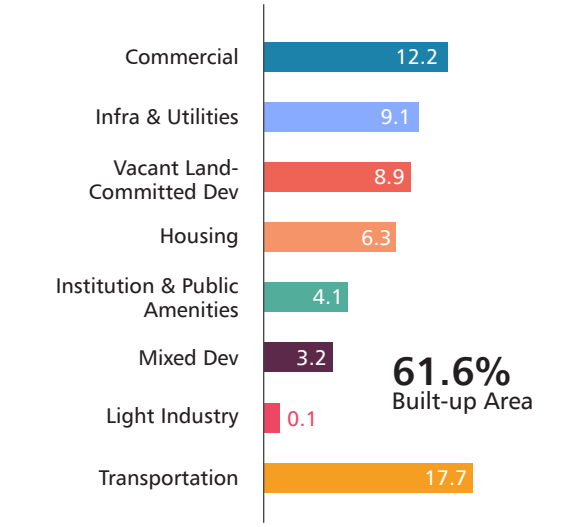
Source: Sepang Local Plan 2025

A. Built Up Area

The existing land use that makes up the built up area for Cyberjaya comprise of Housing, Commercial, Industry, Institution & Public Amenities, Mixed Development, Infrastructure & Utilities, Transportation as well as Committed Development (under Construction).

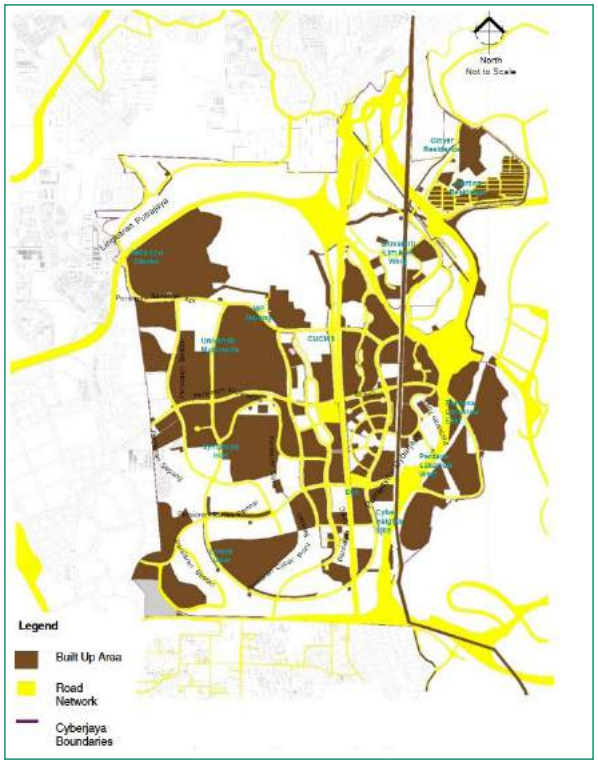
Built-up area made up a total of 61.6% of Cyberjaya, covering an area of 4,294 acres (1,737 hectares).

Figure 2.8: Percentage of Built Up Area



Source: Sepang Local Plan 2025

Figure 2.9: Built Up Area in Cyberjaya As At 2016



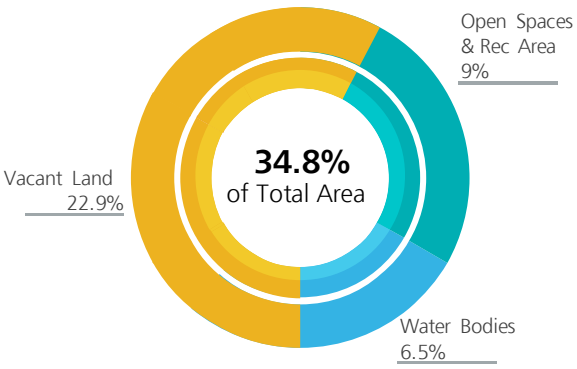
Source: Sepang Local Plan 2025

B. Non Built Up Area

The existing land use that makes up the non-built up area for Cyberjaya comprise of Open Spaces & Recreational Area, Water Bodies and Vacant Land (excluding Committed Development). Water Bodies represent all the rivers, drainage reserve and other water bodies that are available at the site.

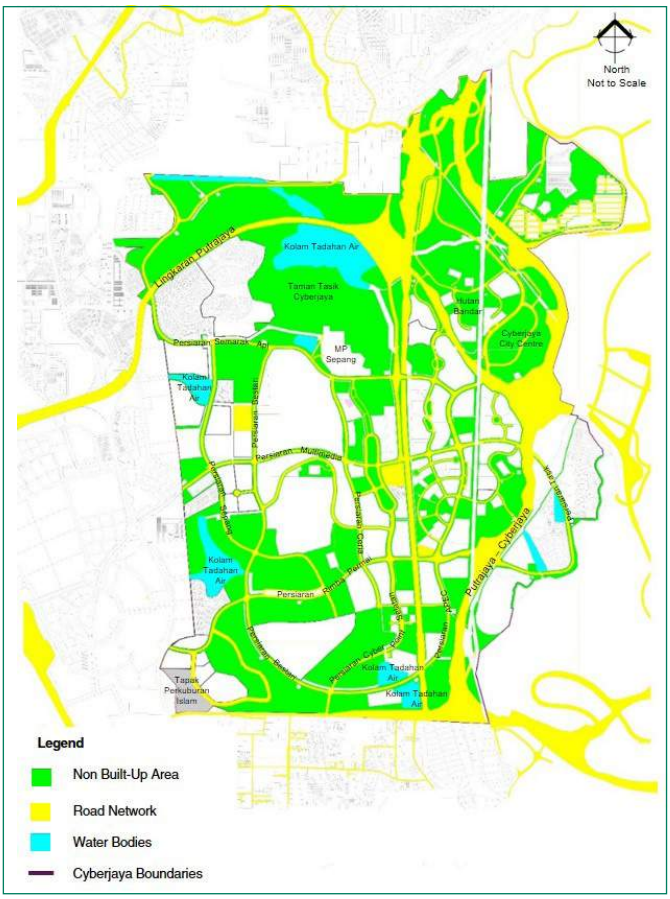
The total size for non-built up area in Cyberjaya accounted for about 2,665.9 acres (1,078.8 hectares) or 38.4% of the whole area.

Figure 2.10: Breakdown of Existing Land Use Activities According to Percentage



Source: Sepang Local Plan 2025

Figure 2.11: Non Built Up Area In Cyberjaya As At 2016



Source: Sepang Local Plan 2025

2.2.4 Population

Based on the population census in 2010, the Department of Statistics (DOS) estimated that Sepang district had a total population of 272,400 people as at 2016. Out of this, 232,300 people are staying in Mukim Dengkil whereas the remaining 40,100 people are residing in Mukim Labu and Mukim Sepang.

Apart from DOS, the following population related figures were amassed from secondary data provided by Setia Haruman Sdn Bhd, Cyberview Sdn Bhd and some analysed data gathered from Sepang Local Plan 2025.

A. Live-in Population

The total population of Cyberjaya (which is in Mukim Dengkil) as at 2016 is estimated to be at 42,253 people. This number is accounted for about 15.5% and 18.2% of total population of Sepang district and of Mukim Dengkil respectively.

With the upcoming construction of MRT2 line and two (2) stations, as well as some budget allocation for new development in the next 5 years (including the development of Cyberjaya City Centre), Cyberjaya's population is expected to increase to 210,000 by 2020. The current population constitutes only 20.1% of Cyberjaya's total planned population.

The population of Cyberjaya is being derived from a multiplication of 'occupied units' and 'number of household' as illustrated in Table 2.5.

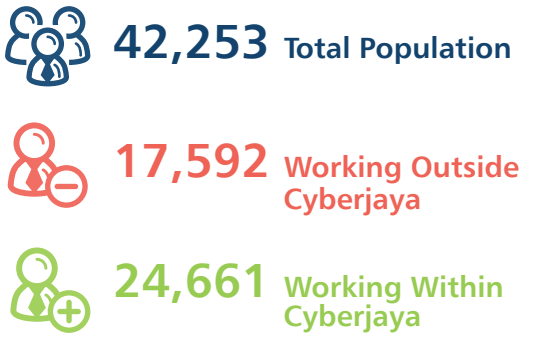
Table 2.5: Population of Cyberjaya

			Occupied Units	Appx Res Per Unit	Total Res
BPK 2.1	Cyber 1	Setia Eco Glades	144.5	5	722.5
BPK 2.2	Cyber 2	None	-	-	-
BPK 2.3	Cyber 3	Garden Residence/ Plaza	1,700	5	8,500
		Seri Mutiara	310	5	1,550
BPK 2.4	Cyber 4	None	-	-	-
BPK 2.5	Cyber 5	Cybersquare	712	3	2,136
BPK 2.6	Cyber 6	Hyve	402	3	1.206
		Shaftsbury Residences	548	3	1,644
BPK 2.7	Cyber 7	Cyber Heights	740	5	3.700
		D'Pulze Condo	455	3	1,365
		Gardenview Residence	167	5	835
		Lakeview Residency	70	3	210
		Mirage	96	3	288
		Perdana Lakeview East & West	51	5	255
		The Masions, PLE	8	5	40
		MyDiva & Trillium	33	5	165
		Summer Glades	110	5	550
BPK 2.8	Cyber 8	None	-	-	-
BPK 2.9	Cyber 9	Cyberia Cresent 1 & 2	280	5	1,400
		Serin Residency	480	3	1,400
		Symphony Hills	125	5	625
BPK 2.10	Cyber 10	None	-	-	-
BPK 2.11	Cyber 11	Cyberia	1,404	5	7,020
		Mutiara Ville	194	3	582
		Pangea	571	3	1,713
		The Arc	600	5	3,000
BPK 2.12	Cyber 12	Cristal Residence	200	3	600
		D'Melor	108	3	324
		Domain 1-5	794	3	2,382
Subtotal Occupied Units			**10,303**	**-**	**-**
Total Population		**42,253 people**			

Source: Setia Haruman Sdn Bhd

From the total population of 42,253 people, around 24,661 people work in Cyberjaya while the remaining balance of 17,592 people work outside of Cyberjaya.

Figure 2.12: Breakdown of Night Population



Source: Setia Haruman Sdn Bhd

B. Housing

As illustrated in Table 2.6, total number of existing unit of housing in Cyberjaya is 15,278 whilst another 15,160 units are still under construction.

Housing in Cyberjaya is broken down into two (2) types of housing – 'high rise' and 'landed'. Table 2.6 further shown that 'high rise unit' dominated the type of houses in Cyberjaya, contributing to 82.9% from total completed units.

Table 2.6: Housing Breakdown

			Sum of High Rise Units	Sum of Landed	Sum of Under Construction	Sub Total
BPK 2.1	Cyber 1	Setia Eco Glades	-	289	521	810
BPK 2.2	Cyber 2	None	-	-		
BPK 2.3	Cyber 3	Garden Residence/ Plaza	1,149	965	-	2,114
		Seri Mutiara	388	-	-	388
BPK 2.4	Cyber 4	None	-	-	-	-
BPK 2.5	Cyber 5	Cybersquare	1,424	-	-	1,424
BPK 2.6	Cyber 6	Hyve	804	-	-	804
BPK 2.7	Cyber 7	Cyber Heights	699	-	124	823
		D'Pulze Condo	505	-	-	505
		Gardenview Residence	210	-	-	210
		Lakeview Residency	117	-	-	117
		Mirage	413	68	-	481
		Perdana Lakeview East & West	-	44	7	51
		The Masions, PLE	-	16	-	16
		MyDiva & Trillium	-	109	-	109
BPK 2.8	Cyber 8	None	-	-	-	-
BPK 2.9	Cyber 9	Cyberia Cresent 1 & 2	211	100	-	311
		Sejati Residence	-	78	38	116
		Serin Residency	600	-	-	600
		Symphony Hills	-	335	881	1,216
BPK 2.10	Cyber 10	None	-	-	-	-
BPK 2.11	Cyber 11	Cyberia	1,188	372		1,560
		Mutiara Ville	388	-	1,990	2,378
		Pangea	1,142	-	666	1,808
		The Arc	1,000	-	-	1,000
BPK 2.12	Cyber 12	Cristal Residence	350	50	-	400
		D'Melor	120	-	-	120
		Domain 1-5	992	-	-	992
Total Housing			**12,673**	**2,605**	**15,160**	
Total Overall			**30,438 units**			

Source: Setia Haruman Sdn Bhd

C. Population Distribution

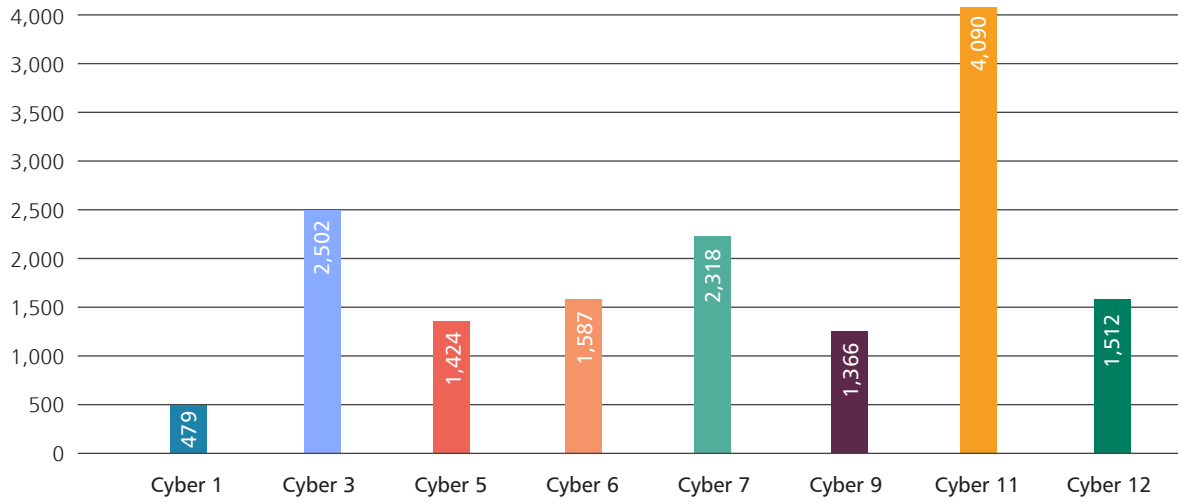
Figure 2.12 shows distribution of population within Cyberjaya area.

As illustrated, Cyber 11 has the most dense population. This is because there are many existing high rise units in the area (such as Cyberia, Pangea, The Arc, etc.) as compared to other places which have more landed properties. Cyber 3 and 12 are also a dense area due to the fact that Cyber 12 is central business district area, whereas Cyber 3 is being populated by a big residential area i.e. Garden Resident which has 2,114 housing units.

The demand and provision of high rise housing type in Cyberjaya are mostly to support existing college and university students and housing development especially high rise were clustered around these university areas.

Cyber 2, 4, 8 and 10 are yet to be developed.

Figure 2.13: Population Density In Cyberjaya According to Planning Blocks



Source: Setia Haruman Sdn Bhd

D. Student Population

The total number of students in Cyberjaya is estimated at 25,626 at which 21,839 or 85.2% are students studying at seven (7) institution of higher learning in Cyberjaya. The seven (7) institutions are Cyberjaya University College of Medical Sciences, FTMS College, Kirkby International College, Lim Kok Wing, Malaysia Automotive Institute, Malaysia Multimedia University and Universiti Islam Malaysia.

The remaining balance of 3,787 or 14.8% are students studying at various schools and kindergarten in Cyberjaya. The schools are Sekolah Kebangsaan Cyberjaya, Sekolah Menengah Cyberjaya, Sekolah Seri Puteri and ELC International School.

2.2.5 Establishment

As the nucleus of MSC Malaysia, Cyberjaya has established itself as the premier ICT hub and a gateway to the ICT industry in Malaysia and the region.

MSC Malaysia is Malaysia's national ICT initiative designed to attract world-class technology companies while grooming the local ICT industry. Fully supported by the Malaysian Government, MSC Malaysia has led the nation's transformation towards a K-Economy over the past decade and a half.

MSC Malaysia status is a recognition by the Malaysia Government through the Malaysia Digital Economy Corporation (MDEC) for ICT and ICT-facilitated businesses that develop or use multimedia technologies to produce and enhance their products and services.

There are four (4) technology clusters under the MSC Malaysia Status companies :

- Information Technology (InfoTech)
- Creative Content & Technologies (CCT)
- Global Business Services (GBS)
- Institution of Higher Learning (IHLs) and Incubators

As at end of 2015, there are more than 2,800 active MSC status companies in Cyberjaya.

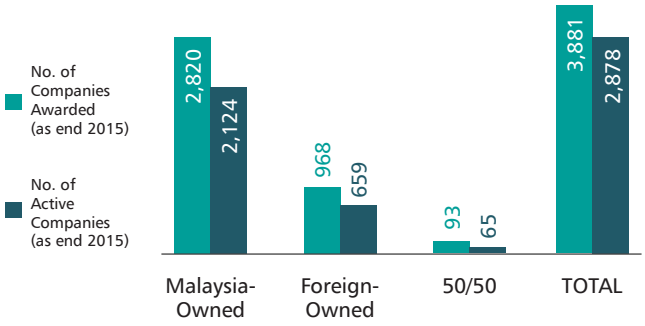
Table 2.7 and Figure 2.14 highlighted the breakdown of these active companies according to the four (4) clusters mentioned above as well as the breakdown according to type of ownership respectively.

Table 2.7: Breakdown of MSC Companies According to Cluster

Cluster	No. of Companies Awarded	No. of Active Companies (as @ end 2015)
InfoTech	2,796	1,998
Creative Content & Technologies	473	358
Global Business Services	480	405
IHLs & Incubators	132	117
TOTAL	**3,881**	**2,878**

Source: MSC Malaysia Annual Industry Report 2015

Figure 2.14: : Breakdown of Companies According To Type of Ownership



Source: MSC Malaysia Annual Industry Report 2015

Some of the big and well known MSC status companies that are residing in Cyberjaya are listed in Figure 2.15.

Figure 2.15: MSC Status Companies According to Cluster Type

INFOTECH
- Ondelet Technology (MSC) Sdn Bhd
- Fujitsu Telecommunication Asia Sdn Bhd
- Techpeople Infotech Sdn Bhd
- AJV Multimedia Development Sdn Bhd

GBS
- IBM Global Delivery Centre (Malaysia) Sdn Bhd
- Fujitsu (Malaysia) Sdn Bhd
- Hewlett-Packard Multimedia Sdn Bhd
- AIG Technologies (Malaysia) Sdn Bhd

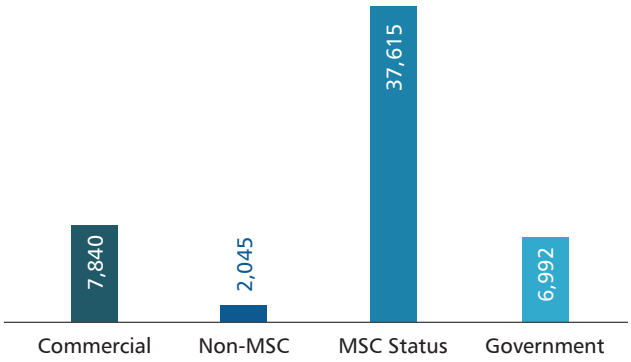
CCT
- MEASAT Satelite Systems Sdn Bhd
- MIG Pictures Sdn Bhd
- Animonsta Studios Sdn Bhd
- Addeen Multimedia Sdn Bhd

IHLS
- FTMS College
- MAD Incubator Sdn Bhd
- Limkokwing University College of Creative Technology (LUCT)
- Multimedia University (Cyberjaya Campus)

2.2.6 Employment

The estimated total number of employment in Cyberjaya is 54,492. Figure 2.16 below shows the breakdown of number of employment according to type of entities. Statistics shows that about 69% of total employment in Cyberjaya comes from MSC Status companies.

Figure 2.16: Breakdown of Number of Employment in Cyberjaya



Source: Setia Haruman Sdn Bhd

2.3 Accessibility & Connectivity

Cyberjaya is internationally and domestically well connected. Located adjacent to Kuala Lumpur International Airport (KLIA) and approximately 40km from Kuala Lumpur City Center, Cyberjaya is an easy hub for local and international commuters.

While buses and cabs remain the only form of public transportation here at the moment, the recently announced MRT2 (or the Sungai Buloh-Serdang-Putrajaya Line) will soon connect Cyberjaya to existing and future rail and bus lines in and around KL. The proposed alignment will span 52.2km with an expected end-to-end travel time of 84 minutes.

2.3.1 Road Networks & Connection

Cyberjaya is accessible via several highways and major roads which are North South Highway (PLUS) - E1, North-South Expressway Central Link (ELITE) - E6, Maju Expressway (MEX) - E20 and South Klang Valley Expressway (SKVE) - E26.

Table 2.8: Highways and Road Connections

Road Hierarchy	Road
Highways / Expressway	▪ North South Highway (PLUS) - E1 ▪ North-South Expressway Central Link (ELITE) - E6 ▪ Maju Expressway (MEX) - E20 ▪ South Klang Valley Expressway (SKVE) - E26
Federal Road	▪ Federal Road FT29 (Lebuh Raya Damansara Puchong – Putrajaya dan Cyberjaya) ▪ Federal Road FT30 (Persiaran Timur/ Lingkaran Bandar)
State Road	▪ State Road B15 (Jalan Baru) ▪ State Road B18

Source: Sepang Local Plan 2025

The main roads that connected Cyberjaya with another districts and areas are Federal Road FT29 and Federal Road FT30. Whilst the state roads connecting Cyberjaya are State Road B15 and State Road B18.

A. Accessibility Within Cyberjaya

For the accessibility within Cyberjaya area, there are at least nine (9) main roads connecting it which are as follows :

- Persiaran Semarak Api
- Persiaran Sepang
- Persiaran Bestari
- Persiaran Multimedia
- Persiaran Ceria
- Persiaran Rimba Permai
- Persiaran Cyberpoint Selatan
- Persiaran APEC
- Persiaran Tasik

The highway/expressway that linked within Cyberjaya area are :

- Lingkaran Putrajaya
- Lebuh raya Kuala Lumpur Putrajaya
- Putrajaya-Cyberjaya Expressway

Figure 2.17: Regional Connectivity

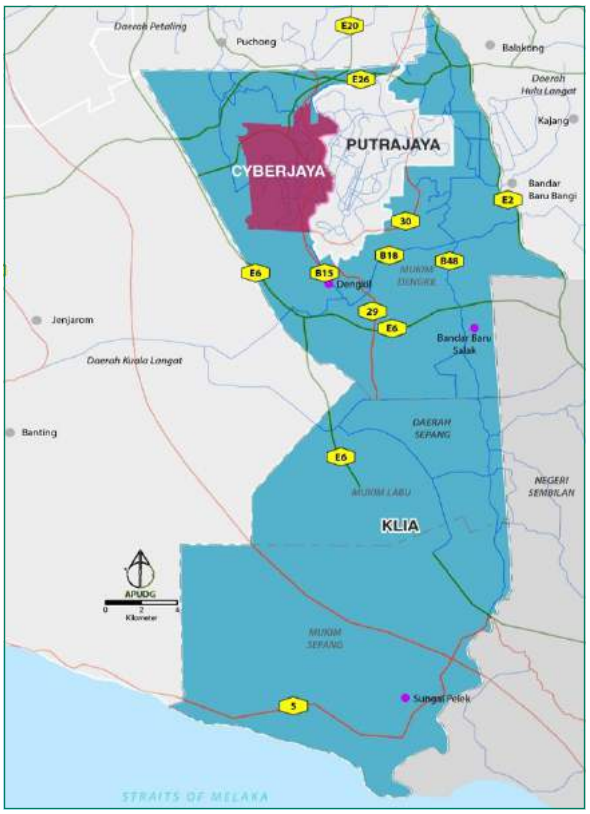
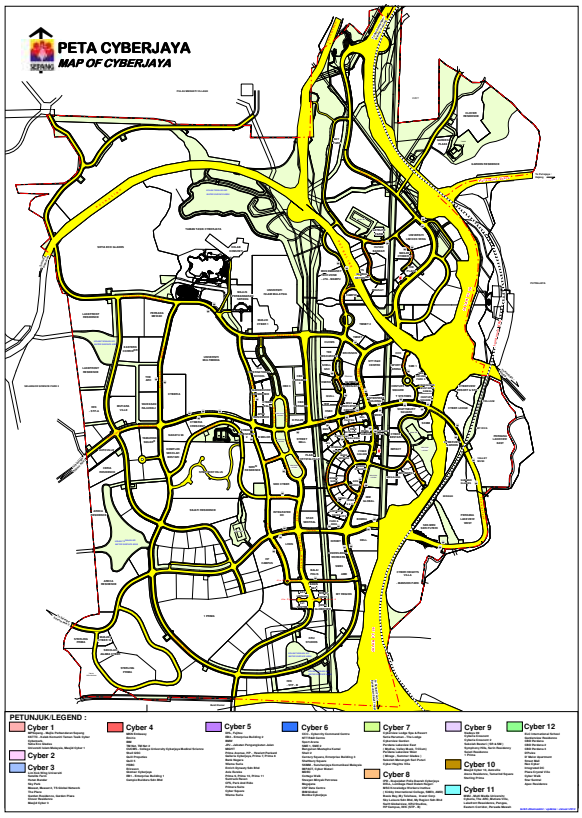


Figure 2.18: Accessibility and Connectivity Within Cyberjaya



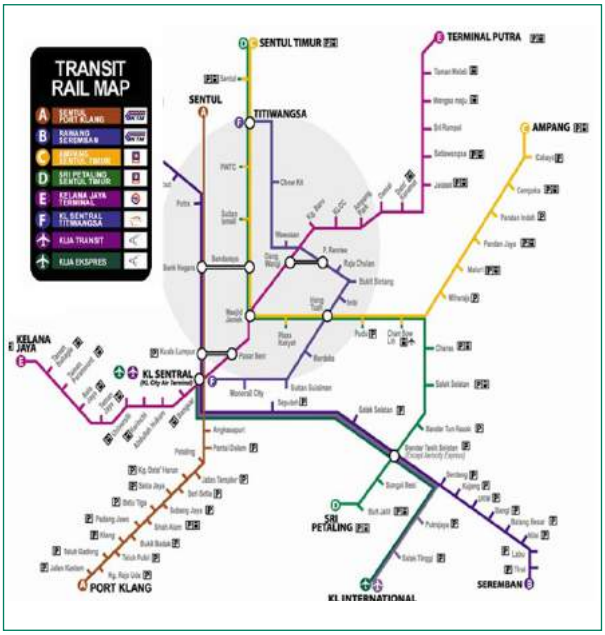
Source: Sepang Local Plan 2025

B. Accessibility – Rail

Cyberjaya is also reachable by the rail transport system known as Express Rail Link (ERL). The train services covered 57 kilometer route that offer two types of services namely KLIA Express and KLIA Transit. It is a rail linked from Kuala Lumpur Sentral to Kuala Lumpur International Airport (KLIA & KLIA 2).

KLIA Transit offered 4 transit station between KL Sentral and KLIA 2 station which are Bandar Tasik Selatan station, Putrajaya & Cyberjaya station, Salak Tinggi station and KLIA station. The Putrajaya & Cyberjaya station is the station that connecting Cyberjaya via train services.

Figure 2.19: Rail Connection in Cyberjaya



Source: www.kliaekspress.com

ERL Transit


Putrajaya / Cyberjaya KLIA Transit Terminal

2.3.2 Road Networks & Connection

In terms of the public transport network, Cyberjaya is linked by three (3) main transportation system which are bus services, Dedicated Transportation System (DTS) and taxis/cabs .

A. Bus Services

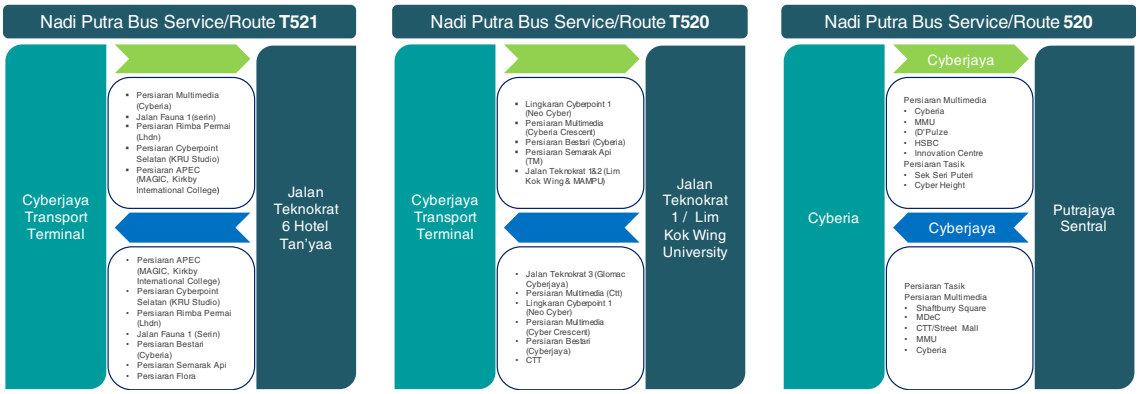
For the bus services, Cyberjaya is reachable by two domain bus provider known as Nadi Putra and MyRapid. Nadi Putra provides bus services through Cyberjaya with 2 routes which are :

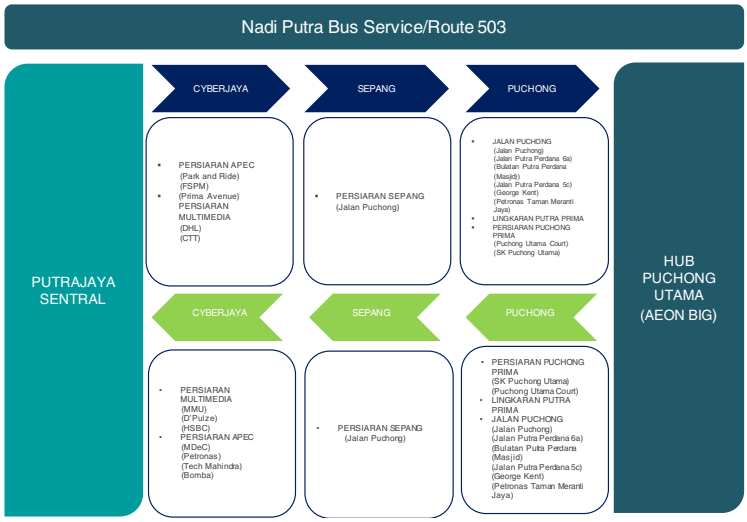
- The routes from Cyberjaya Transport Terminal (CTT) – T520 & T521
- The routes from Putrajaya Sentral - 520, 503 and BET15

According to Nadi Putra, bus route 503 and BET15 covered the linkages outside the boundaries of Cyberjaya. They were stationed at the Putrajaya Sentral and ended the routes at Puchong Utama and Bandar Saujana Putra.

Another bus provider is MyRapid that connects through the transportation hub of Putrajaya Sentral. The Rapid bus that provides services is U429. Apart from that, myRapid also provides conventional bus routes as follows :

- Bandar Utama (U43) and Serdang KTM Komuter (U42) to Putrajaya Sentral
- Express Bus Route from Terminal Jalan Sultan Mohamad, Kuala Lumpur (E1) to Putrajaya Sentral.





Source: www.papsb.com.my

B. Taxis

Cyberjaya is also reachable by taxis or cabs. According to Sepang Local Plan 2025, the taxis and cab services available are being operated by Persatuan Kebajikan Pemandu Tuan Punya Teksi / Kereta Sewa Pekan Dengkil and Cyberjaya.

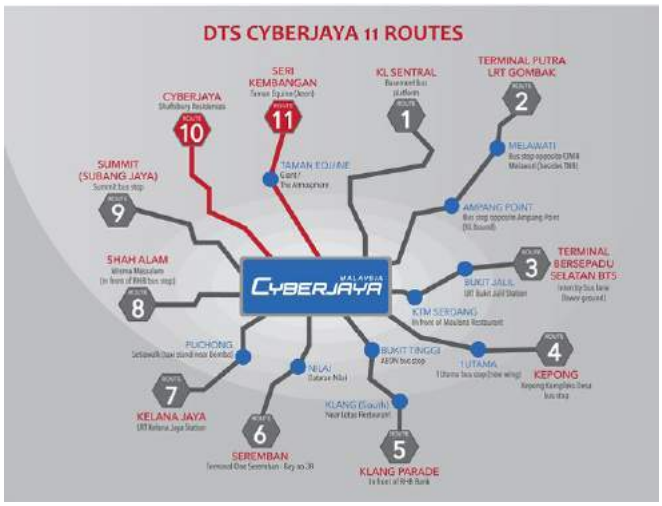
C. Dedicated Transportation System

Cyberjaya Dedicated Transportation System (DTS) was initiated by Cyberview Sdn. Bhd, one of the Cyberjaya main stakeholders. Cyberjaya DTS is being operated by a private company known as Disitu Holdings Sdn Bhd and the bus operation system is controlled by BSMart Solutions (M) Sdn Bhd.

Cyberjaya DTS provides dedicated transportation system that help ferry knowledge workers from the Klang Valley area and Seremban to Cyberjaya. The significant of DTS is that it provides routes from important transportation hubs within Klang Valley, Banting, Klang and Seremban. The services run 24 hours and 7 days a week and use the Global Positioning System (GPS) and General Packet Radio Service (GPRS) to monitor the passengers and movement of buses in near real time.

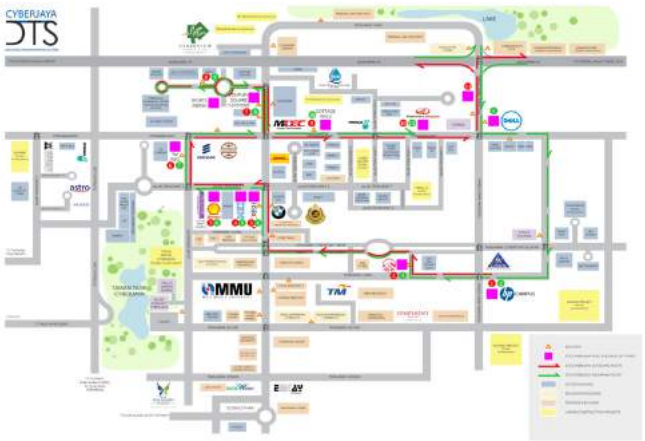
DTS is also known as one of the public transportation system providers available in Cyberjaya based on the bus and van mode of transportation it provided. To date, DTS arranges for nine (9) routes connecting Cyberjaya with another districts and places. Another two (2) upcoming routes are underway to serve the community that stays outside Cyberjaya but working there.

Figure 2.20: Accessibility and Connectivity Within Cyberjaya



Source: www.cyberjayadts.com.my

Figure 2.21: Available Routes by DTS Within Cyberjaya



2.4 Infrastructure

2.4.1 Solid Waste Management

Since 2011, MP Sepang has taken over the management of solid waste from Alam Flora Sdn Bhd. From January until June 2016, there were three (3) contractors appointed by MP Sepang which were Syarikat SDA Niaga, Syarikat WL Jaya Enterprise and Syarikat Layang Maju Jaya Enterprise. Starting from July 2016 till present, MP Sepang appointed only one contractor i.e. Syarikat Mainiza Mantap to manage solid waste in Cyberjaya. The scope of services include the removal and disposal of solid waste to the landfill nearby.

The operating area of solid waste management in Sepang has been divided into three (3) zones, namely the operation of the North Zone, Central Zone and Southern Zone which cover residential areas, town, village, night market, main street and area of community facilities. Cyberjaya falls under the operating area of Central Zone along with Kota Warisan, Dengkil and Sungai Merab.

There are two disposal areas for Sepang district which are Tanjung 12 sanitary landfill and Dengkil Inert Waste Landfill. For Cyberjaya, all waste is disposed at Tanjung 12 sanitary landfill in Kuala Langat, which is about 32km from Cyberjaya.

It is recorded that in 2016, about 4,445.05 MT of waste were sent to Tanjung 12 landfill (Source : Unit Perkhidmatan Bandar, MP Sepang) and the amount of waste collected was between 600 MT and 700 MT per month.

Table 2.9: Details On Tanjung 12 Landfill

Landfill Information – Tanjung 12 Sanitary Landfill	
Location	Lot 12194 and 12196, Mukim Tanjung Dua Belas, Kuala Langat
Operator	Worldwide Holdings Berhad
Acreage	160 acre
Capacity	1000 tonne/day
Life Span	20 years (will be operated until 2030
Date Operated	11th January 2010

Source: Majlis Perbandaran Sepang

Nonetheless, information on the previous year as well as the type of waste collected were unobtainable.

2.4.2 Recycling Center

There is one recycling centre in Cyberjaya – Cyberjaya Community Recycling Centre (CCRCC). This center is under the supervision of Cyberview Sdn Bhd and is located at Park and Ride Cyberjaya, Persiaran Rimba Permai. It is being operated on Monday, Wednesday and Friday from 9.30 am to 4.30 pm.

Cyberview Sdn Bhd and Alam Flora had initiated a few programs/ initiatives to nurture and encourage recycling habits amongst Cyberjaya community. One of the initiatives to encourage the public to recycle is the cash conversion program whereby community is given a platform to convert their recycling materials into cash.

Table 2.9 below listed the cash conversion equivalent for types of waste to be recycled.

CCRCC in Cyberjaya

Table 2.10: Waste to Cash

Items	Price	Items	Price
Old newspaper	RM0.20/kg	CPU	RM5.50/unit
Black & White Paper	RM0.30/kg	Monitor	RM4.50/unit
Old corrugated carton/boxes	RM0.18/kg	Notebook	RM3.50/unit
Old magazine	RM0.20/kg	Server	RM15.00/unit
Mixed papers	RM0.15/kg	Printer	RM3.00/unit
Beverage carton/tetrapak	RM0.50/kg	TV	RM4.00/unit
Tin/metal	RM0.30/kg	Refrigerator	RM5.00/unit
Aluminium	RM2.50/kg	Microwave	RM3.00/unit
Used cooking oil	RM0.20/kg	Vacuum	RM1.50/unit

Source: Cyberview Sdn Bhd

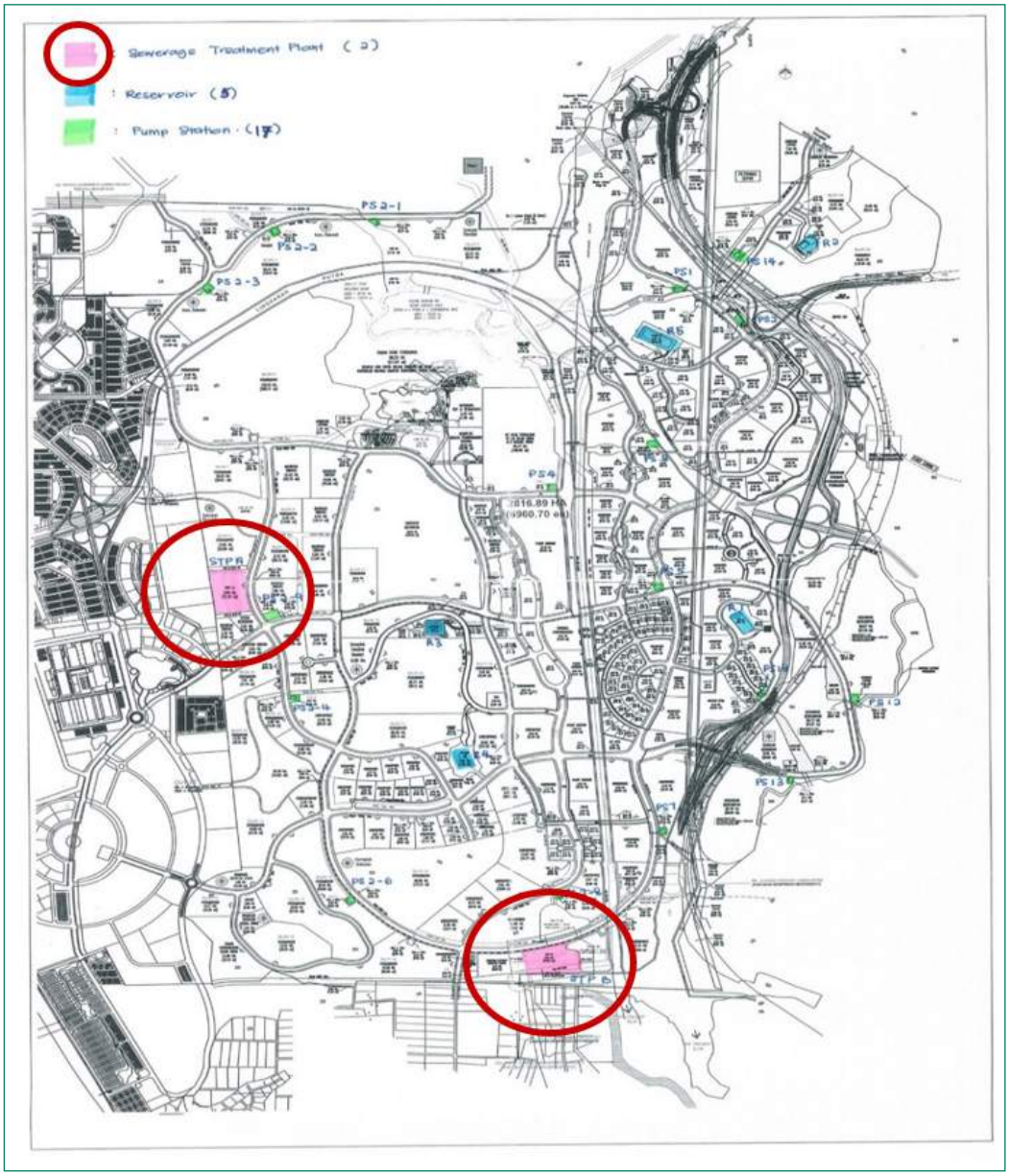
2.4.3 Sewerage System

Cyberjaya owns two (2) main sewerage treatment plants (STP), which is STP A and STP B. These main STPs are supported by seventeen (17) pump stations that use gravity flow method to transfer the sewerage to either STP A or B for processing.

STP A is located at Persiaran Sepang, Off Persiaran Multimedia whilst STP B is stationed at Persiaran APEC, Cyber 8 which is situated at the south of Cyberjaya.

By using the gravity flow method, the usage of energy needed to haul sewerage to the main STP A or B will be reduced considerably.

Figure 2.22: Location of STPs in Cyberjaya



Source: Setia Haruman Sdn Bhd

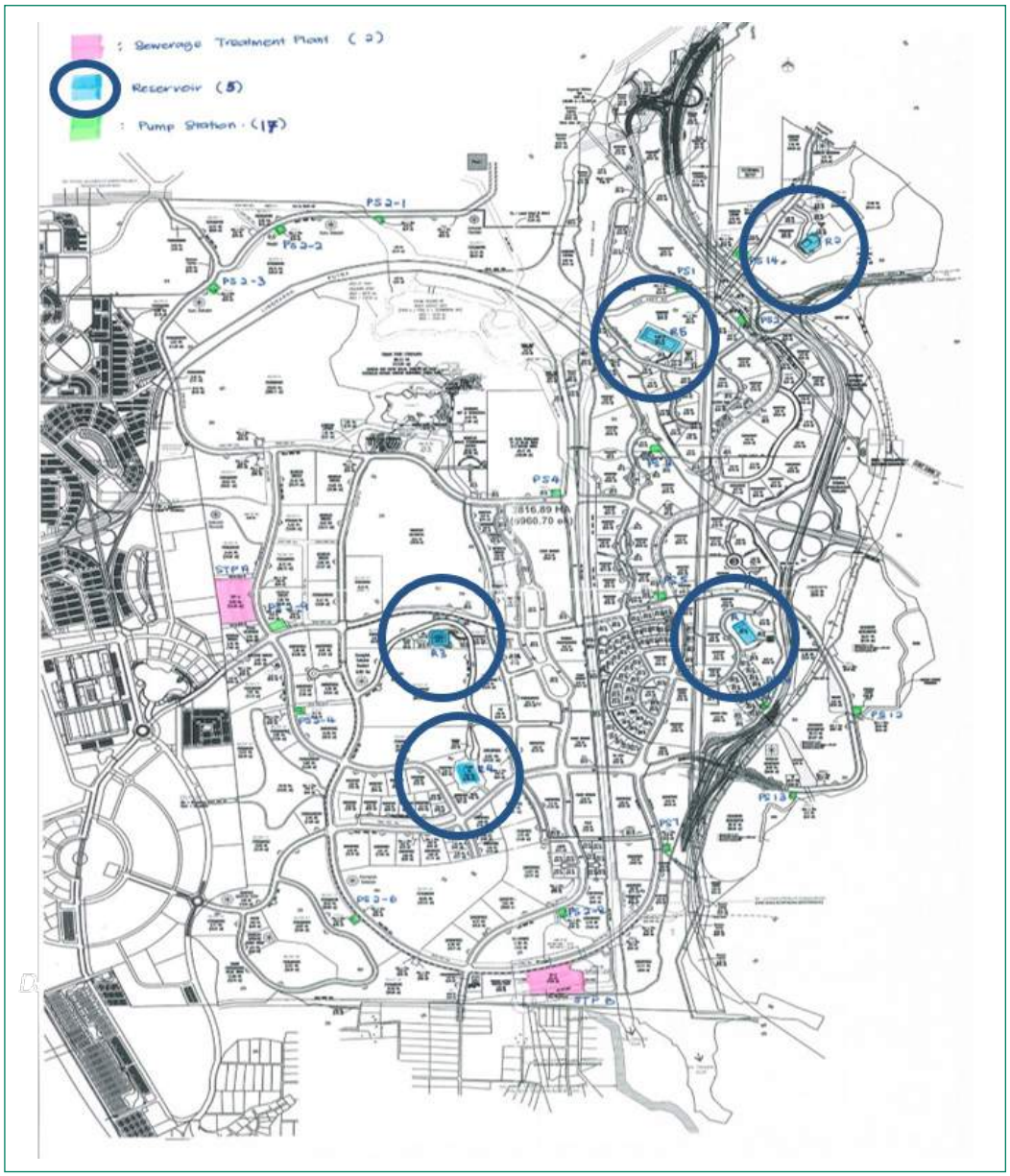
2.4.4 Water

The main source of water supply in Cyberjaya came from the water treatment plant in Sungai Semenyih area. This water treatment plant gets its supply of water from five (5) identified reservoirs within Cyberjaya. The location of the reservoirs are as follows :

- Reservoir 1 – Cyber 6
- Reservoir 2 – Cyber 3
- Reservoir 3 - Cyber 9
- Reservoir 4 – Cyber 9
- Reservoir 5 – Cyber 3

The water distributor body in Cyberjaya is Syarikat Bekalan Air Selangor Sdn Bhd (SYABAS).

Figure 2.23: Location of Water Reservoir in Cyberjaya



Source: Sepang Local Plan 2025

2.4.5 Energy

The main intake substation or PMU is located at Kota Warisan area and the main distribution substation or PPU is situated at Salak Tinggi area. This substation is the main energy supply for the Mukim Dengkil and Sepang district including Cyberjaya area.

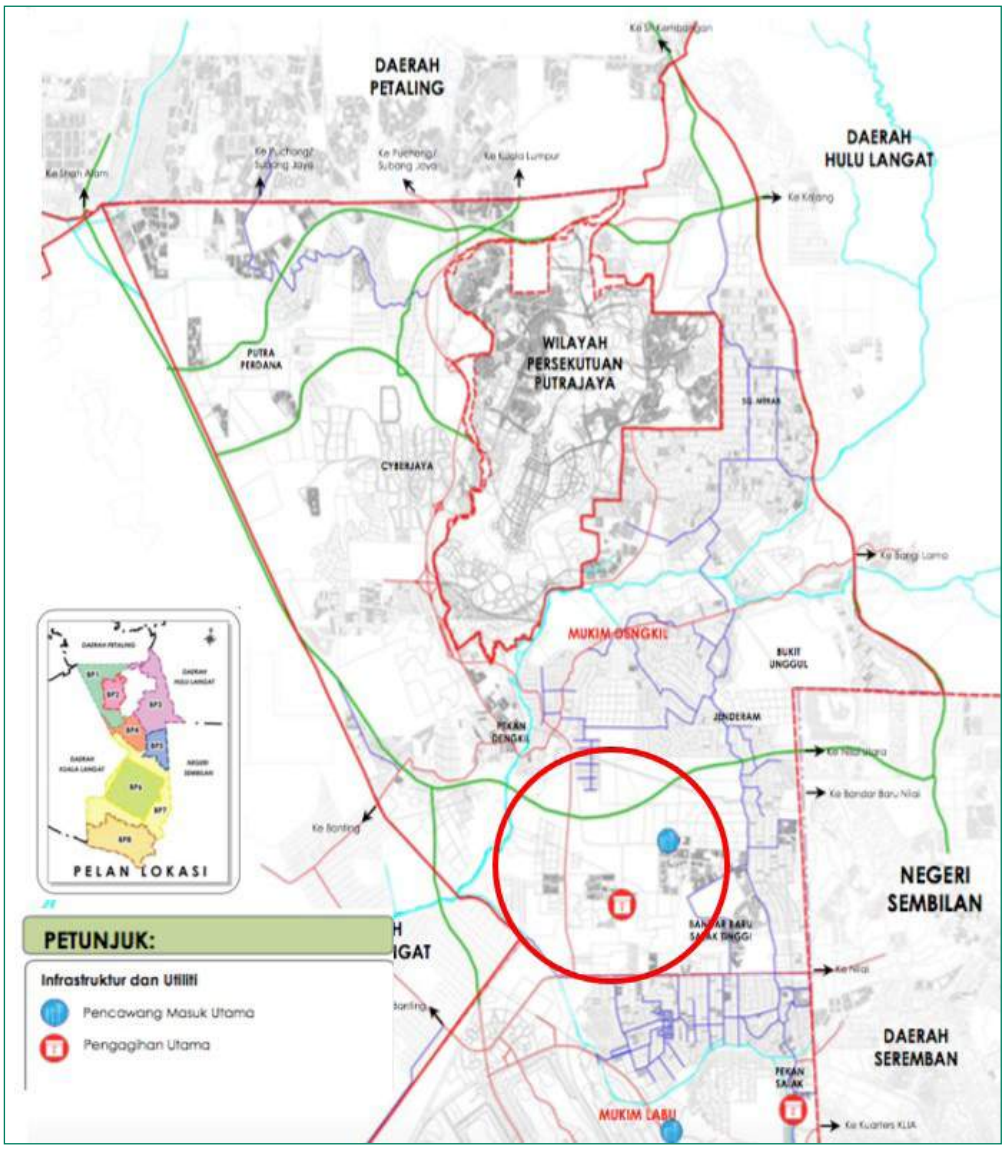
The PMU at Kota Warisan supplies electricity to both Cyberjaya and Putrajaya area. As such, detail information related to energy demand for Cyberjaya is unobtainable.

Table 2.11: Energy Distribution in Cyberjaya

Energy Distribution		
Substation	PMU BBST	PPU Salak Tinggi
Carrying Capacity Available (MVA)	2x30 MVA	2x30 MVA
Carrying Capacity Used (MVA)	10	10
Supply Area	Kota Warisan and surrounding area	Salak Tinggi and surrounding area

Source: Tenaga Nasional Berhad

Figure 2.24: Location of PMU and PPU in Cyberjaya



Source: Sepang Local Plan 2025

2.4.6 District Cooling System

There are two (2) plants of District Cooling System (DCS) in Cyberjaya. These DCSs are located in Cyber 6 (DCP 1) and Cyber 8 (DCP 2).

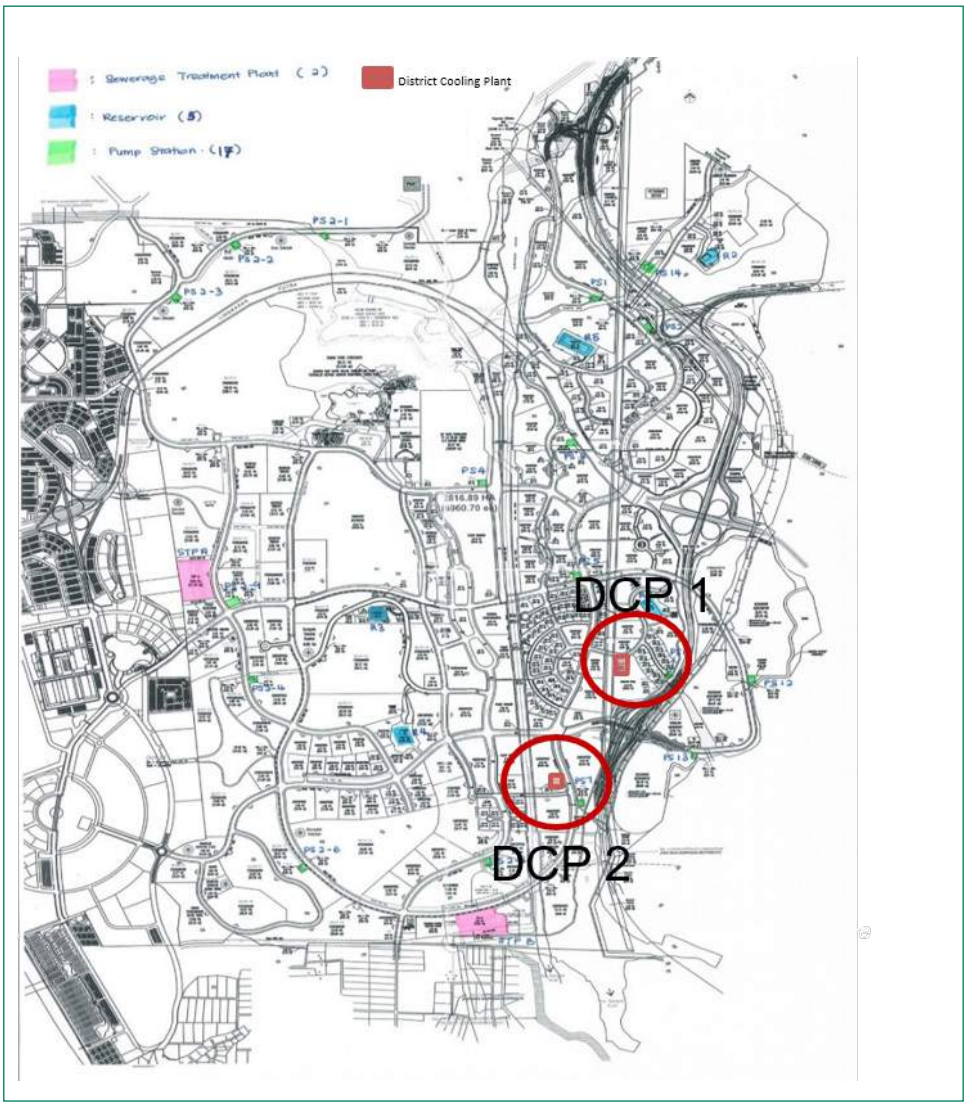
The DCSs provide chilled water for the air-conditioning requirement of 40 multi-storey buildings which include the following :

- Wisma Shell
- Malaysia Digital Economy Corporation (MDEC)
- Various government agencies

The system basically utilises off-peak electricity at night to chill water for the buildings' air-conditioning usage during the day, thus reducing electricity consumption by more than 65% as compared to traditional air-conditioning systems.

The DCSs in Cyberjaya are being managed by Pendinginan Megajana Sdn Bhd, which is a wholly owned subsidiary of Cyberview Sdn Bhd.

Figure 2.25: Location of DCS in Cyberjaya



Source: Setia Haruman Sdn Bhd

2.4.7 Telecommunacations

According to the interview with Setia Haruman, in Cyberjaya, they are two provider of the telecommunication which are Telekom Malaysia Berhad and Setia Haruman Technology.

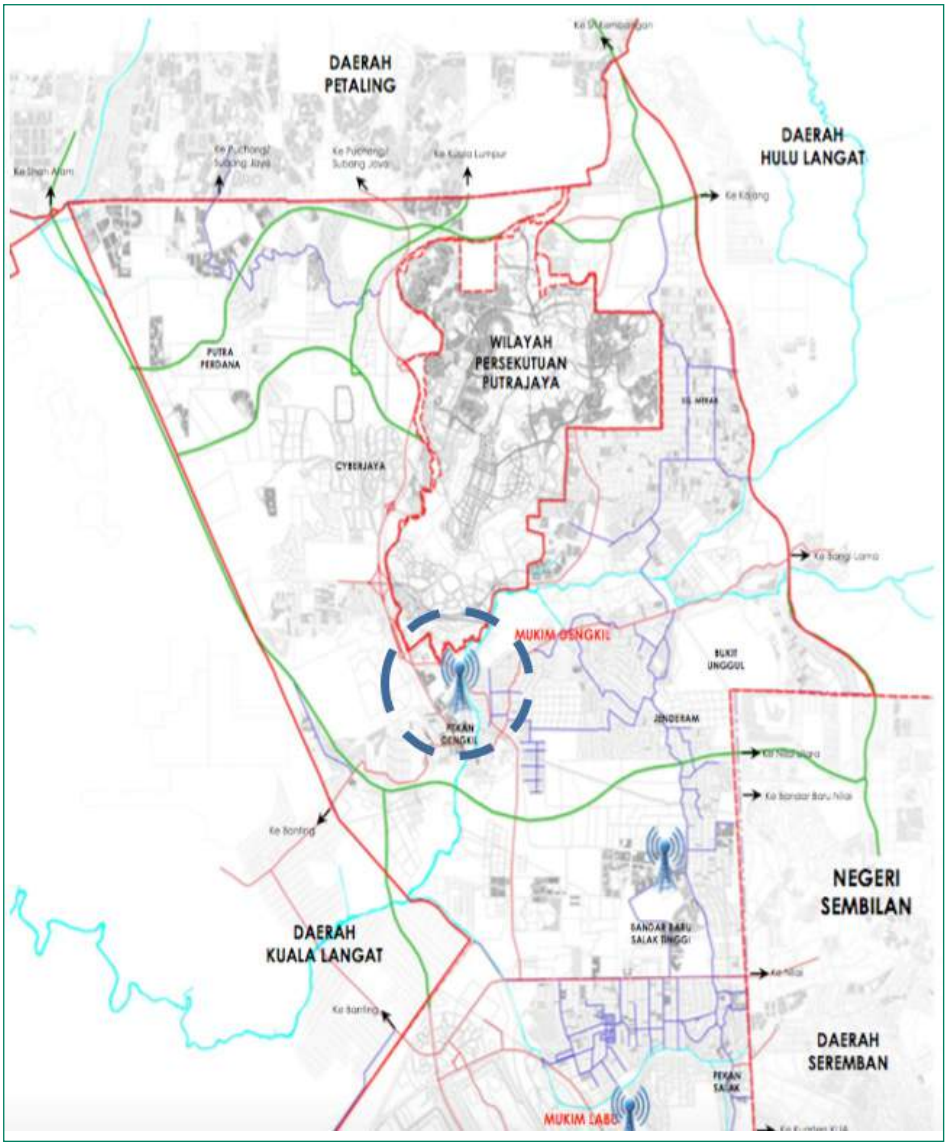
Setia Haruman Technology also providing the infra but data was unavailable at this moment.

Table 2.12: Information of Telecommunication in Cyberjaya

Type of Exchange	Coverage Area	Existing Line Capacity	Line Used	Surplus Line
Telecom Exchange	Overall Cyberjaya	16,824	7,409	9,415
Setia Haruman Technology	-	-	-	-

Source: Sepang Local Plan 2025

Figure 2.26: Location of Telecommunication Tower in Cyberjaya



Source: Sepang Local Plan 2025

Chapter

3.0

Concept of Smart & Low Carbon City

3.1 Introduction

It is noted that rapid urbanization over the past twenty five years after the introduction of Wawasan 2020 by then Prime Minister, has boosted economic development, brought about fundamental social change, and helped to raise the living standards of both urban and rural populations in Malaysia. These achievements have been recognized and acknowledged globally.

However, this process has also been characterized by intensive resource consumption and an emphasis on speed rather than quality of urbanization, which have directly affected the natural environment. Not only Malaysia, but many other countries too are facing with these same challenges – i.e. issues concerning urban resilience and adaptation as a result of rapid urbanization.

Going forward, Malaysia's urban development must adopt a greener and low-carbon approach that is focused on efficient uses of land, energy, and other resources. The Malaysia's government has recognized the need to ensure the quality of urbanization. On 08 June 2017, it released an important document, entitled National Physical Plan 3 (NPP3), putting forward several strategies as well as measures required to shape the direction and pattern of land use, biodiversity conservation and development in Malaysia.

NPP3 provides three (3) major thrusts in formulating the country's sustainable development for 20 years into the future. Thrust 2 - Spatial Sustainability and Resilience To Climate Change – focuses on development strategies for building a country that is resilient to climate change through sustainable spatial management.

> ***"It is estimated that by 2050 more than two thirds of the world's population will live in cities, up from about 54 percent today."***

> ***"Deputy Prime Minister Datuk Seri Dr Ahmad Zahid Hamidi said Malaysia is ranked among East Asia's more urbanised countries and its urban population has continued to increase rapidly from 27 per cent in 1970 to 74 per cent in 2014."***

Figure 3.1 : Three Strategic Directions Under Thrust 2 of NPP3

Source: National Physical Plan 3

Figure 3.2 : Low Carbon Cities and Sustainable Infrastructure Strategies under NPP3

Strategy 1: Creating a Low Carbon City Development

- Provides a Low Carbon Cities Action Plan
- Promote sustainable building practices
- Applying the principle of carbon sequestration through landscape

Strategy 2: Realization of the Sustainable Use of Energy Sources

- Promote biogas and biomass energy development in farming areas
- Promote environmental friendly solar energy development
- Promote the use of micro-hydropower for rural areas

Strategy 3: Realization of the Sustainable Use of Energy Sources

- Provide sustainable water supply
- Implement water reuse
- Reduce water demand

Strategy 4: Developing Low Carbon Mobility

- Providing Urban Public Transport Master Plan
- Stimulate the use of low-carbon private vehicles in urban area
- Complete accessibility and facilities for pedestrian and cyclist

Strategy 5: Strengthening the Integrated and Sustainable Solid Waste Management

- Provide solid waste management facilities in line with social needs and low carbon in urban areas
- Recovery of urban area solid waste
- Enforcing laws related to solid waste management

Source: National Physical Plan 3

It is exciting and encouraging to note that currently many parties (including the State Government) have responded to the federal government's call by announcing their green development visions and goals, and by carrying out pilot projects on new concepts, such as Eco-City, Low-Carbon City, Livable City and least but not least Smart City.

However, common understanding on the above concepts are still lacking due to inadequate understanding of the core content of the concept itself. Nonetheless, they are all leading towards a goal of sustainability or sustainable development.

Recognizing this gap, an identification of basic key features that encompassing both the smart and low carbon elements is inevitable to best reflect identities of smart and low carbon city in their own rights.

But prior to laying out the nine (9) key features of smart and low carbon city, the following section discusses the individual definition of Smart City and Low Carbon City respectively.

3.2 Smart City

Below is an excerpt of the definition of Smart City according to Wikipedia – which nicely sums up what Smart City is all about :

A **smart city** is an urban development vision to integrate information and communication technology (ICT) and Internet of things (IoT) technology in a secure fashion to manage a city's assets. These assets include local departments' information systems, schools, libraries, transportation systems, hospitals, power plants, water supply networks, waste management, law enforcement, and other community services. A smart city is promoted to use urban informatics and technology to improve the efficiency of services. ICT allows city officials to interact directly with the community and the city infrastructure and to monitor what is happening in the city, how the city is evolving, and how to enable a better quality of life. Through the use of sensors integrated with real-time monitoring systems, data are collected from citizens and devices – then processed and analyzed. The information and knowledge gathered are keys to tackling inefficiency.

Information and communication technology (ICT) is used to enhance quality, performance and interactivity of urban services, to reduce costs and resource consumption and to improve contact between citizens and government. Smart city applications are developed to manage urban flows and allow for real-time responses.

Other terms that have been used for similar concepts include Cyberville, Digital City, Electronic Communities, Flexicity, Information City, Intelligent City, Knowledge-Based City, MESH City, Telecity, Teletopia, Ubiquitous City and Wired City.

Examples of Smart City technologies and programs have been implemented in city of Southampton, Amsterdam, Barcelona, Madrid, Stockholm and in China.

In local context, Smart Selangor Blueprint 1.0 (SSB 1.0) was launched by the State of Selangor in December 2016. As the blueprint is still labelled as 1.0, it is implied that there will be more concrete plans added to the domains as it goes along. In a nutshell, SSB 1.0 tries to achieve SUSTAINABILITY, EFFICIENCY and LIVABILITY using a combination of innovative technology and sound urban design to cope with the issues of modern cities. Ultimately, the Selangor Government aspires to become a 'Smart State' by 2025. To achieve this aspiration, twelve (12) key dimensions have been identified as priority in order to turn itself into a smart state with the key aim of improving citizen's quality of life. The key dimensions are visualized in diagram below :

Figure 3.3 : Focus Area of Selangor Smart City Blueprint

Source: Selangor Smart City 2016

Figure 3.4 : Key Outcome of Selangor Smart City Blueprint

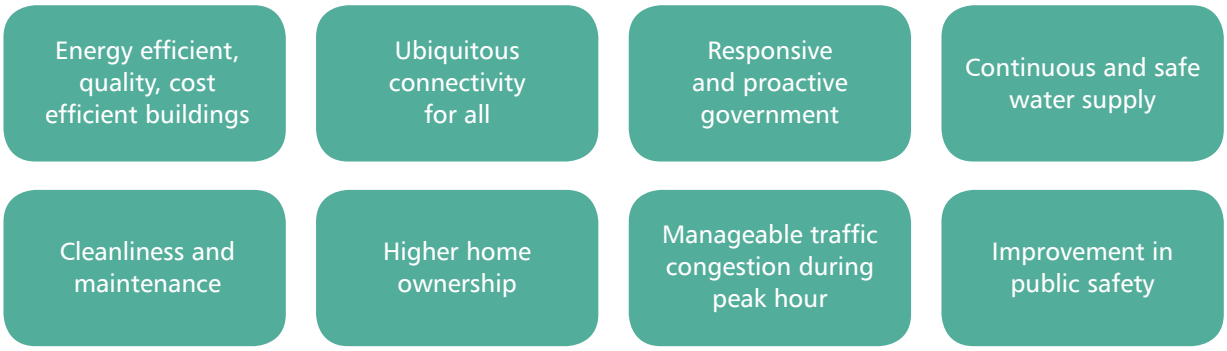


Table below summarizes what the Key Dimensions are all about :

Table 3.1 : Focus Area of Selangor Smart City Blueprint

Key Dimensions	What It Is About
Smart Governance	The Smart Selangor initiative will be executed by the 4 governing bodies : • Smart Selangor Steering Committee – will focus on strategic governance, will set and determine directions • Project Execution Committee – will look at methods and controls adopted by implementation team • Project Management Committee – will concentrate on working methods and best practices to implement project • Project Team Committee – will concentrate on working methods and best practices to implement project
Smart Digital Infrastructure	Looking into Next Generation Networks, IoT Platforms, mobile & wireless access, data centres and disaster recovery centres, ubiquitous connectivity for citizens, government and citizens.
Smart Disaster Management	Integrated crisis management system and early warning system to enable better inter-agency coordination and prepare citizens for calamities.
Smart Development	Looking into the full cycle of buildings, from the construction methods to the operations of the building. Using a combination of building sciences and technology, the intention is to optimise energy efficiency and improve building quality.
Smart Safety & Security	Looking into implementing a range of integrated safety and security system through collaboration with public in areas related to accidents, crimes, terror incidents, etc..
Smart Agriculture	Looking into using technological solutions to maximize yield and minimizing agricultural input in order to boost efficiency and enhance food & agricultural ecosystem to meet growing food consumption in Malaysia.
Smart Energy	Looking at a suite of systems that enable Sustainable Energy infrastructure to reduce cost and reinforce energy networks, which also includes solutions for Demand Side Response, smart transmissions, and distribution networks.
Smart Water Management	Looking into minimising NRW, ensuring safe and clean water supply and river cleaning as its core focus.
Smart Mobility & Transportation	Looking into fostering seamless multi modal transportation access and efficient connectivity by interacting smart infrastructure, integrating big data and providing smart services that improve user experience.
Smart Waste Management System	Looking into minimizing waste by engaging the community. The end goal is to achieve a zero waste society.
Smart Healthcare	The Selangor government intends to invest 6%-8% of its GDP for healthcare digital transformation, which includes investments into Population Health Management, integrating case/disease management, care co-ordination and advanced tools to perform the tasks.
Smart Education	Looking into preparing human capital to capture new economy opportunities, which includes initiatives to set-up a coding academy to equip citizens with the skill to code and develop apps, coupled with the initiatives to create Smart App Development platform with Open API.

3.3 Low Carbon City

Low carbon city is one of potential ways that has recently appeared as a way to fight climate change. The low carbon city intends to systematically incorporate mitigation, minimization and adaptation measures to enable the city to respond to climate change through a well planned and designed urban environment.

Although many countries and regions are already taking action to address the carbon issue, the term "low-carbon city" is quite new that a consensus has not yet been reached on how to define it. And as being discussed earlier, it leads towards a common goal of sustainability.

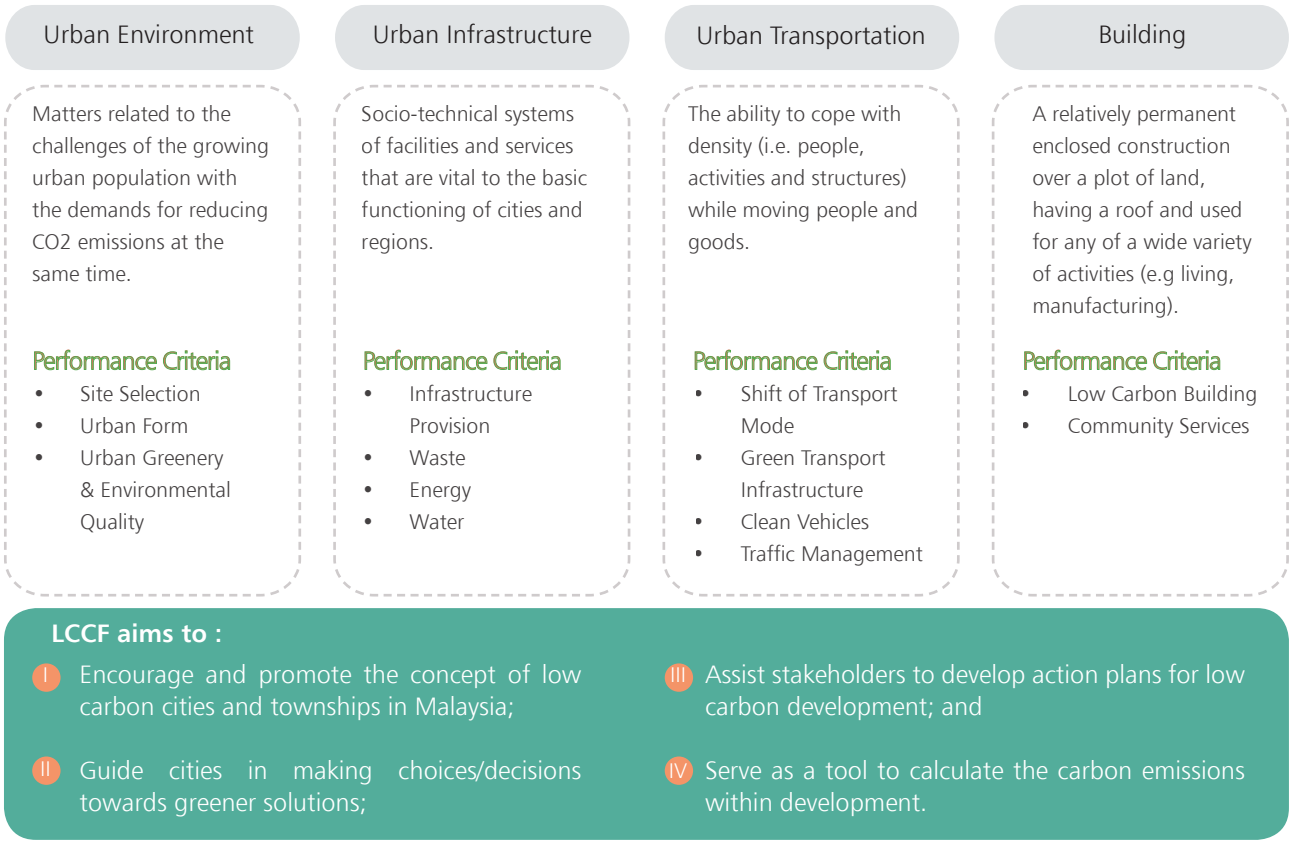
The concept of "sustainable development" was defined as "development that meets the needs of the present without jeopardizing the ability of future generations to meet their own needs", and as such, a sustainable development project should balance between ecological protection, social equity and continued economic growth.

One of the many goals of sustainable development has been focussed on climate control and the reduction of carbon dioxide emissions, especially the greenhouse gas emissions. Hence, the dominant direction of sustainable development practice has moved to carbon control, which has profound implications for the practice of community and regional planning (While et al., 2009). Therefore, it is safe to say that one of the fundamental principles of a low-carbon city is defined as "a comprehensive local land use planning approach to reduce the amount of carbon emissions through mitigating climate change and preparing communities for adaptation".

In local context, the government through Ministry of Energy, Green Technology and Water (KeTTHA) has developed a documented system known as Low Carbon City Framework & Assessment System (LCCF) to guide the implementation of CO2 reduction measures in cities and townships. This document was launched by the Prime Minister in 2011.

LCCF highlighted four (4) main elements which are shown and briefly explained in the diagram below :

Figure 3.5 : Key Elements of LCCF



3.4 Key Features Of Smart And Low Carbon City

Briefly, the following nine (9) features broadly define what smart and low carbon city would be :

Low Carbon Urban Form	Efficiency	Inclusive Urban Governance
FEATURE 1: Prioritize land use efficiency in both new town development and urban renewal through compact, efficient, mixed use and functionally balanced urban design.	**FEATURE 5:** Pay equal attention to process management and technology upgrading, when striving for energy and resource efficiency in the industrial and commercial sectors; pursue industrial symbiosis and the "circular economy."	**FEATURE 9:** Transition from "city management" to "city governance" with emphasis on fostering low-carbon communities through information transparency, public participation, and multistakeholder governance.
FEATURE 2: Develop non-motorized transport as a major component of public transportation, integrating walking, biking and public transit into one transport system.	**FEATURE 6:** Keep in mind the energy and environmental performance of building operations when promoting building energy efficiency and green buildings.	
FEATURE 3: Reduce private vehicle use through improved urban layout, efficient public transport networks, and transport demand management.	**FEATURE 7:** View municipal waste as a resource by improving waste recycling and implementing waste minimization mechanisms.	
FEATURE 4: Create and maintain more quality public spaces for the general public that are easily accessible, functional, and environmentally friendly.	**FEATURE 8:** Expand the scope of reclaimed water use and select lowimpact nature-based methods to restore and improve urban ecological water cycles.	

Chapter 4.0

Two Decades of Development

4.1 The Olden Days

4.1.1 Background

Before 1995, there was no name for the 28.94 square kilometres (7,000 acres) of undeveloped land comprising former oil palm plantations, in the district of Sepang, south of the Malaysian State of Selangor. It was not until 1995 that McKinsey & Company, the Management Consultancy Company commissioned to do a study on the setting up of Malaysia's Multimedia Super Corridor (MSC Malaysia), came out with the idea of a 'high-tech city' based on the framework of Silicon Valley in the United States. After its formation, it was given the name Cyberjaya.

4.1.2 Vision

Cyberjaya would be the core of MSC Malaysia, a designated zone where technology entrepreneurs and global multinationals enjoy attractive tax breaks, access to world-class human capital and infrastructure, at developing nation costs. The ambitious project would spearhead Malaysia's transformation into a new knowledge economy, one that would make the country a better competitor on the world stage.

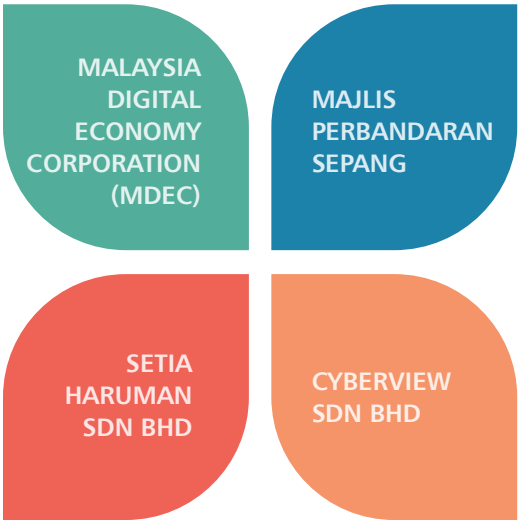
> *The establishment of the Multimedia Super Corridor (MSC Malaysia) and Cyberjaya in particular, will enable Malaysians to leapfrog into the Information Age. We hope to create the ideal environment that will attract world-class companies to use it as a regional multi-cultural information age hub,*

Tun Dr Mahathir Mohamad, former Prime Minister of Malaysia, during Cyberjaya's groundbreaking ceremony on 17 May 1997

4.1.3 The Stakeholders

To ensure the project's success, four key stakeholders were appointed to oversee distinct responsibilities :

Government Agency responsible in advising the government related to legislation and policies and developing / promoting MSC status. Now focusing on spearheading digital transformation. Focus area includes Internet of Things, eCommerce, Cloud & Data Centre, Games, Security, Big Data & Analytics.



Local Authority responsible in providing municipal services, basic amenities, planning function, development control function as well as enforcement on municipal regulations within the Sepang District.

Master Developer responsible in the planning, designing and developing Cyberjaya.

Government-owned Company responsible in providing infrastructure in Cyberjaya – landowner of Cyberjaya & Cybercity Manager.

Under the lead of Cyberview Sdn Bhd as the Cybercity Manager, a supportive and supple ecosystem was developed to attract investors. This included providing a collaborative environment and incentives such as competitive rental rates, flexible repayment schemes, building allowances and customized solutions for investors based on their business requirements, budget and growth plans. With all systems in place, the next step of the strategy was to woo the big tech players to settle in.

4.1.4 The Big Tech Players

In 1996, Nippon Telephone and Telegraph (NTT) agreed to develop a research and development (R&D) facility in Cyberjaya, which proved to be the project's catalyst. Soon, other giants like Dell, HP, DHL and Shell began to follow suit. With the global icons establishing their presence in Cyberjaya, the entire ecosystem began to form naturally.

Almost two decades after its inception, Cyberjaya has reached the tipping point where it has the right scale and mass and most importantly, the proven track record in helping companies to grow and prosper.
In 1996, Nippon Telephone and Telegraph (NTT) agreed to develop a research and development (R&D) facility in Cyberjaya, which proved to be the project's catalyst. Soon, other giants like Dell, HP, DHL and Shell began to follow suit. With the global icons establishing their presence in Cyberjaya, the entire ecosystem began to form naturally.

Almost two decades after its inception, Cyberjaya has reached the tipping point where it has the right scale and mass and most importantly, the proven track record in helping companies to grow and prosper.

4.1.5 The Early Days

In those early years, Cyberjaya became the headquarters of the local council of Sepang and the location of two (2) top Universities – Multimedia University (MMU) and the Limkokwing University of Creative Technology. For general knowledge, MMU was conceptualized to follow the Stanford-Silicon Valley model i.e. to evolve into a centre of teaching and research that would act as a catalyst for the development of high tech industry in the surrounding area.

Cyberjaya also became the venue for MSC Status companies, a boutique hotel, numerous commercial buildings and a community club. The population then was mainly students, with a larger day time population of commuter workers.

4.1.6 From 1997 to 2010

These began as years of development and expansion as more big names in business and technology joined the MSC. While the city boomed during the global recession then, it ironically went into a lull thereafter. Progress was slow and the socio-economic outcomes were not on target. It was however, beginning to develop a Cyber Hub identity quite distinct from any other Malaysian cities.

4.1.7 The National Agenda on Carbon Reduction

In order to achieve a 40% reduction of carbon intensity by the year 2020 (compared to 2005 levels per GDP, as the Prime Minister pledged in Copenhagen in 2009), the Government selected Putrajaya and Cyberjaya as the pilot projects to showcase low carbon initiatives.

In 2011, the Malaysian government through the Ministry of Energy, Green Technology and Water (KeTTHA), unveiled a framework guide and assessment system for Low Carbon Cities. Known as the Low Carbon Cities Framework and Assessment System (LCCF), this was an initiative led by the government that served as a guide for the local authorities, township developers, designers and individuals on how to plan and develop a low carbon city, township or project. LCCF is aimed to reduce carbon emissions in cities, townships and projects.

It was in line with the National Green Technology Policy (NGTP) under KeTTHA in moving towards lowering carbon emissions and simultaneously attaining a sustainable development.

4.2 Present Days

4.2.1 2017

For Cyberjaya today, the stage is set for the development of a Smart City and Low Carbon 2025 Action Plan based on the following urban transport/infrastructure/environment/buildings reaching completion, if not completed already. There is one consideration: it may be necessary to reappraise the structures, networks, infrastructure and technologies that support the community there to build Cyberjaya's low carbon future.

4.2.2 Working Towards A Green Transport System

Cyberjaya's transport system is almost completely in place.

The Klang Valley Mass Rapid Transit (KVMRT) project involves the construction of a rail-based public transport network which - together with the existing light rail transit (LRT), monorail, KTM Komuter, KLIA Ekspres and KLIA Transit systems - forms the backbone of the Greater Kuala Lumpur/ Klang Valley region. MRT2 (or the Sungai Buloh-Serdang-Putrajaya Line) will soon connect Cyberjaya to existing and future rail and bus lines in and around KL. The proposed alignment will span 52.2km with an expected end-to-end travel time of 84 minutes. The upcoming Bus Rail Transit (BRT) system will also see greater accessibility for Cyberjaya, with one of its terminals adjacent to Tamarind Square. The new BRT corridor encircles major cities within the Klang Valley, including Cyberjaya.

Cyberjaya is currently linked to major road networks such as the PLUS, SKVE, ELITE, LDP and most recently the MEX which brings Cyberjaya only 20 minutes away from Kuala Lumpur city centre as well as KLIA and KLIA 2.

While the road networks are excellent, Cyberjaya is emphasizing public mobility. Towards this end, steps such as bus mass transit, smart ticketing, hybrid electric vehicles, specific bicycle lanes can all be taken for carbon reduction.

4.2.3 Global ICT Hub

Its competitiveness as a global ICT hub has made Cyberjaya as one of the top destinations for business support services and outsourcing in the world. It is home to more than 38 multinational corporations (MNCs) including HSBC, DHL, Shell, Motorola, OCBC, IBM, Ericsson, BMW and Fujitsu, as well as another 800 technology-oriented companies.

Cyberjaya, has an excellent fibre optic network infrastructure, to be fully wired with high-speed broadband at 100mb per second. This is in line with Malaysia's aspiration to become a hub for data services and this sector is expected to contribute RM2.4 billion to the country's revenue by 2020. Cyberjaya's unique and independent high-speed carrier network has incentivized many prominent ICT industry players to base their operations in the cyber city.

4.2.4 Established Education Hub

Besides the Multimedia University (MMU), Cyberjaya is also home to two (2) other international standard universities – i.e. Limkokwing University of Creative Technology and Cyberjaya University College of Medical Sciences (CUCMS). Segi University is set to join other local universities like the Islamic University of Malaysia, Open University Malaysia and the University of Computer Science & Engineering to make presence in Cyberjaya.

Cyberjaya is also home to established colleges, international and local schools. This bodes well for the rental market as well as convenience for the next generation of residents seeking world-class educational services.

The youth population from the student market is a bonus for a city with a foundation in ICT, providing ample opportunities for young and eager minds.

4.2.5 Public Facilities & Amenities

The Street Mall has long since been Cyberjaya's hub for convenience, food&beverage and public transportation. In 2007, the Cyberjaya Community Club with indoor and outdoor recreational facilities was launched, adjacent to the 400-acre Cyberjaya Lake Garden. As a prototype city of the future, Cyberjaya also houses state-of-the-art police station, CCTV surveillance, Cyberjaya's state-of-the-art City Command Centre (CCC) and fire station. For the moment, the nearest malls are located in Seri Kembangan, Putrajaya and Puchong.

Cyberjaya is surrounded by highly populated areas such as Putrajaya (Federal Administrative Centre of Malaysia), Puchong, Kajang, Bangi and the whole southern corridor of Klang Valley. The increased offerings of activities, amenities and accessibility are expected to attract crowds from most of the neighbouring areas.

Projects such as OSK's Pangaea are located in the heart of Cyberjaya (Show Village in Cyber 11, across from MMU). It is geared to become one of the biggest mixed development projects offering suites and boutique retail, a shopping mall, a street mall, a boutique hotel and serviced apartments, complete with a 2-hectare central park.

4.2.6 State-of-the-Art Security

The development and architecture in the city follows a Western living-style orientation. Many locals and foreign professionals have affirmed this as their preference. These residences have strict security enforcement to ensure a safe and guarded community under the watchful eyes of the security team. In addition, Cyberjaya has a natural secure surrounding due to its peaceful environment.

Compared to the crime rates in Klang Valley, Cyberjaya is enjoying increasing security, and the township is more than halfway towards achieving its target of being a safe city with a crime rate of zero.

This is largely due to the fully integrated Malaysian Emergency Response System (MERS) 999 CCTV system. Launched in 2009, Cyberjaya's CCTV system is the only system in the country that has been linked to the RM10.0 million MERS 999. The system is designed to be able to operate round the clock, in all types of weather conditions and capture quality daytime and night-time images by utilising Cyberjaya's fibre optic backbone system. The CCTV operation - part of the Cyberjaya Citywide Surveillance System - boasts thirty (30) cameras across the city with a high traffic volume and large population.

According to Cyberview Sdn Bhd, six (6) parties were involved in the planning and design of the MERS 999 CCTV system in Cyberjaya – i.e. Cyberview Sdn Bhd itself, Telekom Malaysia, the Royal Malaysian Police, MP Sepang, Tenaga Nasional Berhad and MDeC.

The objectives of the installation of the system continue to be (1) to ensure the safety of the community at large, which consists of locals and many foreigners, as well as (2) to enhance the township management services of the Cyberjaya Flagship Zone.

4.3 GEARING TOWARDS 2025

4.3.1 Where To Begin

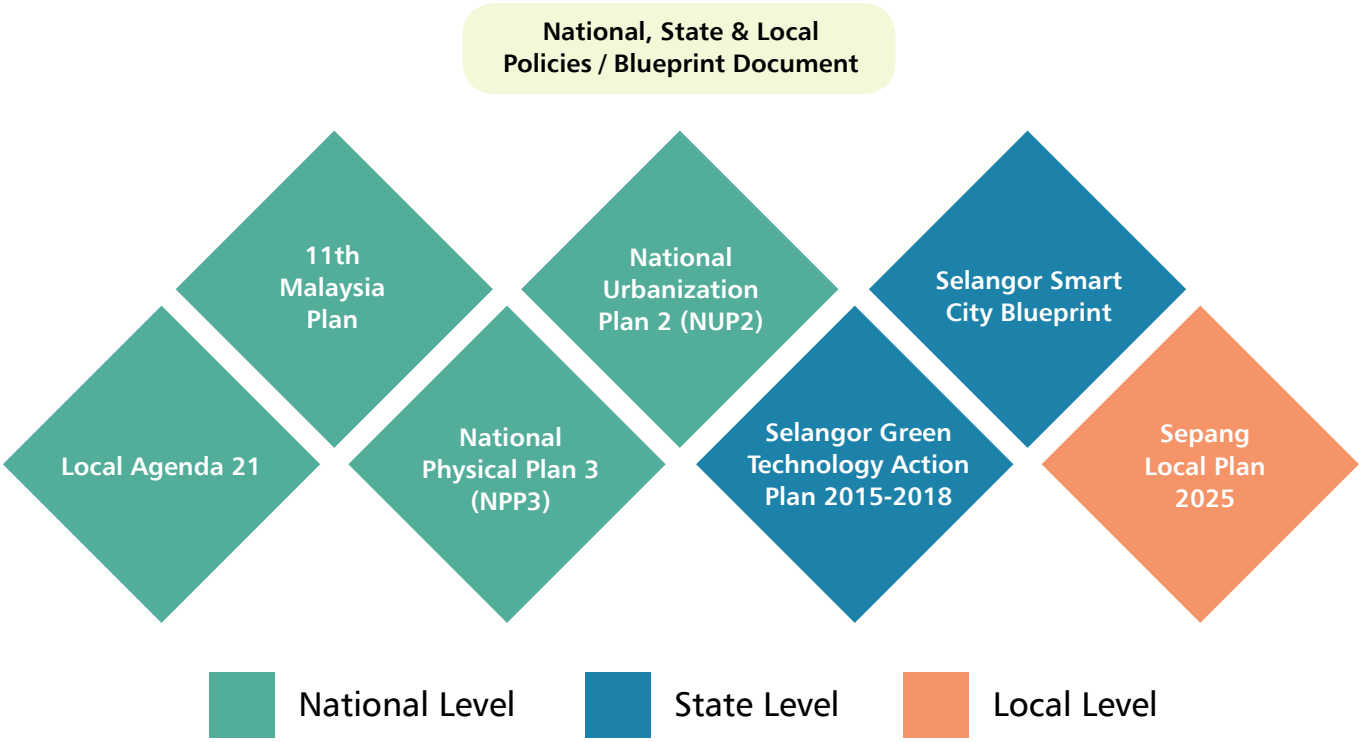
To tap the potential of green growth, it is necessary to exploit the synergies between local and central levels of government. Lessons learnt at local level can be used to modify and fine tune national frameworks to better implement green economy strategies. Likewise, national policy frameworks can empower local governments and accelerate their policy responses on trending policies such as renewable energy, green-tech R&D and greening public services.

Cities are the new engines of green growth, And a truly strong economy is built on environmental and social well-being. Toronto, for instance uses energy efficiency retrofits in over 1000 high rise residential buildings to create jobs and drive community revitalisation.

Rapid urbanization has created challenges between economic growth and conservation of the environment. However, Malaysia's recognition of the concept and necessity of sustainable development and embedding this concept in its policies and development plans both at the national and state level, is a value-added advantage and in fact, the best way to start.

The followings explore some of the policies and plans from the National, State and Local level addressing sustainability and the relevance related to Cyberjaya. Consideration of the various policies and plans discussed in this section is necessary so that holistic, inclusive, integrated and relevant initiatives can be achieved with measurable impact.

Figure 4.1: Development Plan & Policy Documents Related to Cyberjaya



A. Local Agenda 21 (LA 21)

For Cyberjaya Smart & Low Carbon City 2025, incorporating Local Agenda 21 (LA 21) into one of its sustainable development programs in the planning process is one way to start.

LA 21 is a global action plan or blueprint for sustainable development at local level, which was adopted at the Earth Summit in Rio de Janeiro in 1992. It is a document which consists of a list of actions agreed by all stakeholders to undertake for the achievement of sustainable development. It serves as an instrument to achieve the community vision as well as to meet the objectives of integrated issues namely social, economic and environmental.

B. 11th Malaysia Plan

Green growth will be the fundamental shift in how Malaysia sees the role of natural resources and the environment in its socio-economic development, protecting both development gains and biodiversity at the same time.

To pursue green growth, the enabling environment will be strengthened, particularly in terms of policy and regulatory framework, human capital, green technology investment and financial instruments.

Green growth will be the game changer in bringing Malaysia towards a sustainable socio-economic development path, whereby improvements in quality of life are in harmony with the sustainability of the environment and natural resources.

Figure 4.2: Focus Areas of 11th Malaysia Plan

1 Strengthening the enabling environment for green growth

- Strengthening governance to drive transformation
- Enhancing awareness to create shared responsibility
- Establishing sustainable financing mechanism

2 Conserving natural resources for present and future generations

- Creating green markets Increasing share of renewables in energy mix
- Enhancing demand side management (DSM)
- Encouraging low carbon mobility
- Managing waste holistically

3 Adopting the sustainable consumption and production concept

- Ensuring natural resources security
- Enhancing alternative livelihood for indigenous and local communities

4 Strengthening resilience against climate change and natural disasters

- Strengthening disaster risk management (DRM)
- Improving flood mitigation
- Enhancing climate change adaptation

C. National Physical Plan 3 (NPP3)

Malaysia's Third National Physical Plan 3 (NPP3) provides a long-term strategic framework for national spatial planning and includes strategies as well as measures required to shape the direction and pattern of land use, biodiversity conservation and development in Malaysia.

Figure 4.3: Three Strategic Directions Under Thrust 2 of NPP3

Source: National Physical Plan 3

Figure 4.4: Low Carbon Cities and Sustainable Infrastructure Strategies

Strategy 1: Creating a Low Carbon City Development

- Provides a Low Carbon Cities Action Plan
- Promote sustainable building practices
- Applying the principle of carbon sequestration through landscape

Strategy 2: Realization of the Sustainable Use of Energy Sources

- Promote biogas and biomass energy development in farming areas
- Promote environmental friendly solar energy development
- Promote the use of micro-hydropower for rural areas

Strategy 3: Realization of the Sustainable Use of Energy Sources

- Provide sustainable water supply
- Implement water reuse
- Reduce water demand

Strategy 4: Developing Low Carbon Mobility

- Providing Urban Public Transport Master Plan
- Stimulate the use of low-carbon private vehicles in urban area
- Complete accessibility and facilities for pedestrian and cyclist

Strategy 5: Strengthening the Integrated and Sustainable Solid Waste Management

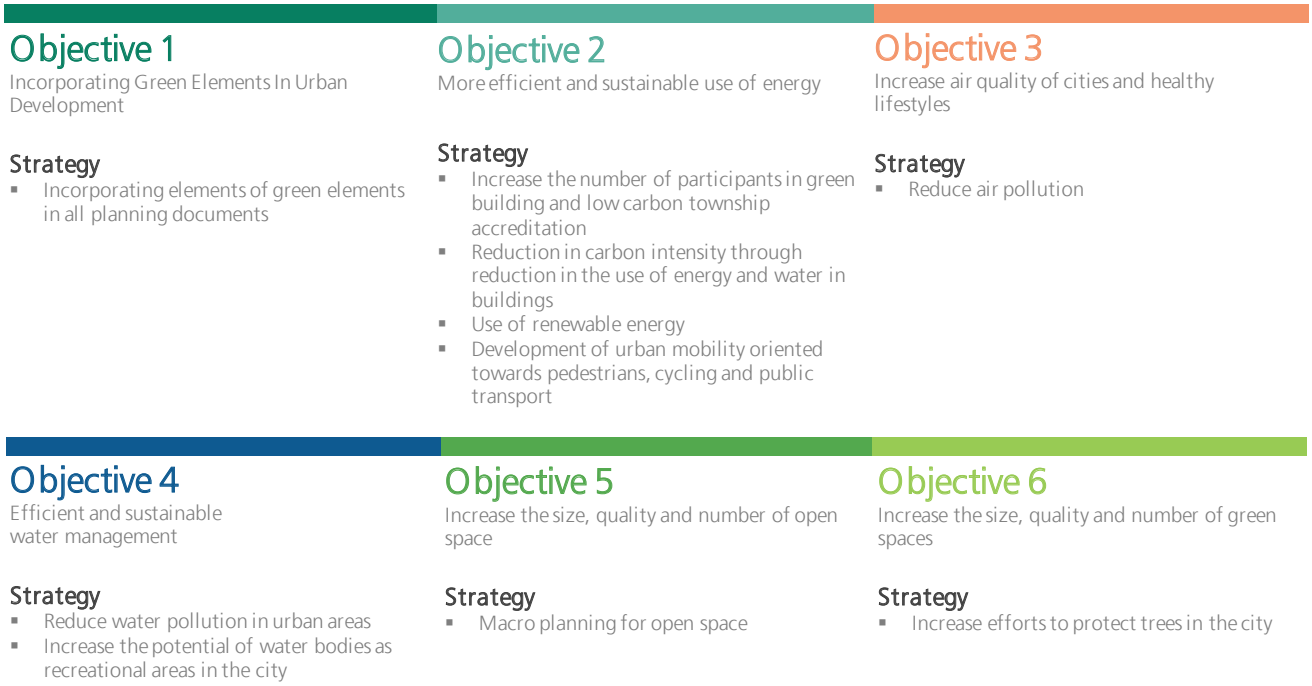
- Provide solid waste management facilities in line with social needs and low carbon in urban areas
- Recovery of urban area solid waste
- Enforcing laws related to solid waste management

Source: National Physical Plan 3

D. National Urbanization Policy 2 (NUP2)

The National Urbanization Policy 2 (NUP2) is a comprehensive plan that will guide and coordinate the planning and urban development of the country to be more efficient and systematic, particularly to handle the increase in the urban population. NUP2 emphasis on balancing the social, economic and physical development within urban areas.

Figure 4.5: Key Objectives of Principle 5



Source: National Urbanization Policy 2

It will also serve as the foundation to encourage racial integration and solidarity for those who will reside in the urban areas. NUP 2 will be the main thrust for all urban planning and development activities in Peninsular Malaysia including development plans at the state and local level.

In NUP2, under Principle 5, it is noted that the objectives are emphasizing on sustainable and low carbon development as illustrated in the diagram above.

E. Selangor Green Technology Action Plan 2015-2018

The Selangor Green Technology Action Plan 2015-2018 is aimed at transforming Selangor into a green technology state.

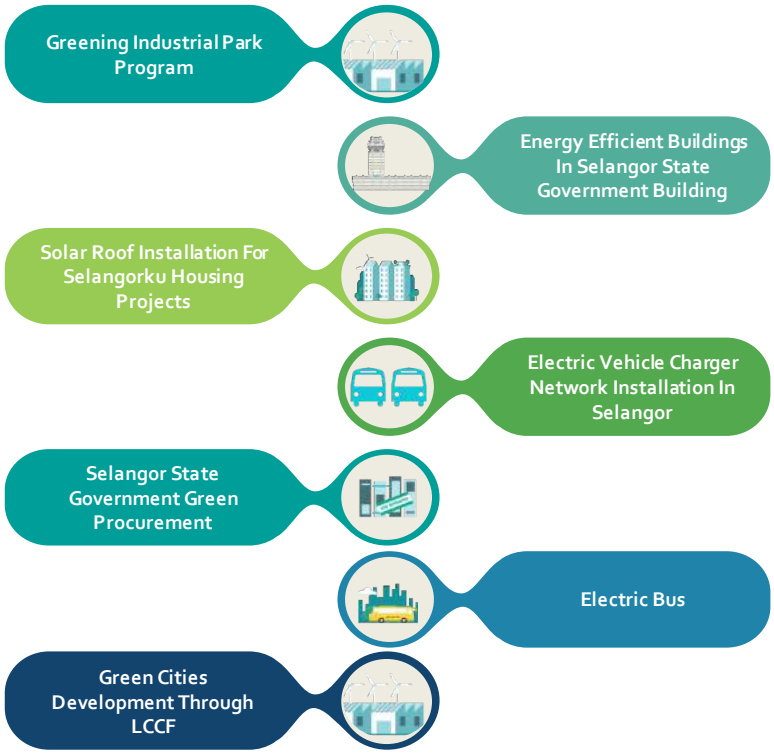
The main focus in the action plan includes having green cities, using electric cars as official state vehicles, building electric vehicle charging stations, using electric buses for the local authorities' free bus programs, installing solar roofing systems for the SelangorKu housing project, energy-efficient State Government buildings and making Industrial Parks more green.

The state government is in the midst of incorporating some elements of Low Carbon Cities Framework & Assessment System (LCCF) and Selangor Smart City into the planning and decision-making policies to be used at the municipality level.

Figure 4.6: KPIs Related to Green Cities Development

Source: Selangor Green Technology Action Plan

Figure 4.7: Focus Area of Selangor Green Technology Action Plan



Source: Unit Perancang Ekonomi Negeri Selangor

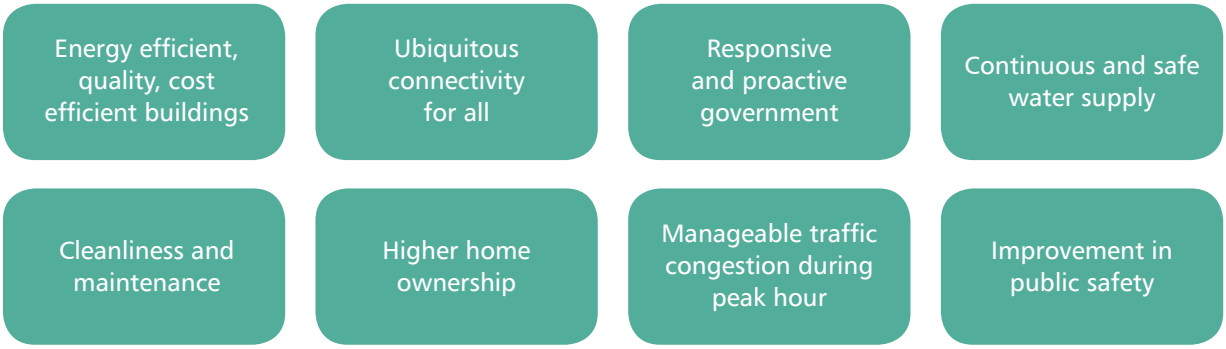
F. Selangor Smart City Blueprint

Selangor is set to become a smart state by 2025 with the state government giving priority to developing effective technology infrastructure to improve the quality of life of Selangor folks. The Blueprint focuses on twelve (12) core areas as per Figure below.

Figure 4.8: Focus Area of Selangor Smart City Blueprint

Source: Selangor Smart City 2016

Figure 4.9: Focus Area of Selangor Smart City Blueprint



Source: Selangor Smart City 2016

G. Sepang Local Plan 2025

This document is actually a replacement and not an amendment for the MP Sepang Local Plan 2020. The Sepang Local Plan 2025 outlines six key strategies which are World-class Planning, Efficient Land Use, Integrated Public Transport System, World Class Tourism, Competitive Industry and Preservation/Conservation of Environment.

Under the Efficient Land Use strategy, there are fourteen (14) development proposals to support this move which include transforming Cyberjaya into green, smart and vibrant city (Strategy S2-4).

This move is also in line with the Selangor state government's initiatives under the Selangor Smart City Blueprint and Selangor Green Technology Action Plan 2015-2018.

Provision of Sepang Local Plan 2025 is to meet the current and future needs / requirements towards dynamic and vibrant development of Sepang.

Figure 4.10: Key Recommendations to Support S2-4

Source: Sepang Local Plan 2025

4.3.2 Community Support

Sustainable urban planning, eco-developments, smart cities, zero carbon cities – all of these represent an aspiration for a better way of life. The technology needed to build a smart and low carbon future for Cyberjaya has to be viable both functionally and financially.

In addition, the community – the people themselves - must truly and honestly believe in a smart and low carbon future, to have any real success. Without commitment and participation from the people themselves, any "token" action with, for instance, the latest green engineering trend from a superficial standpoint is both futile and a waste of precious investment costs and resources.

Chapter 5.0

Towards A Smart and Low Carbon Cyberjaya

5.1 Introduction

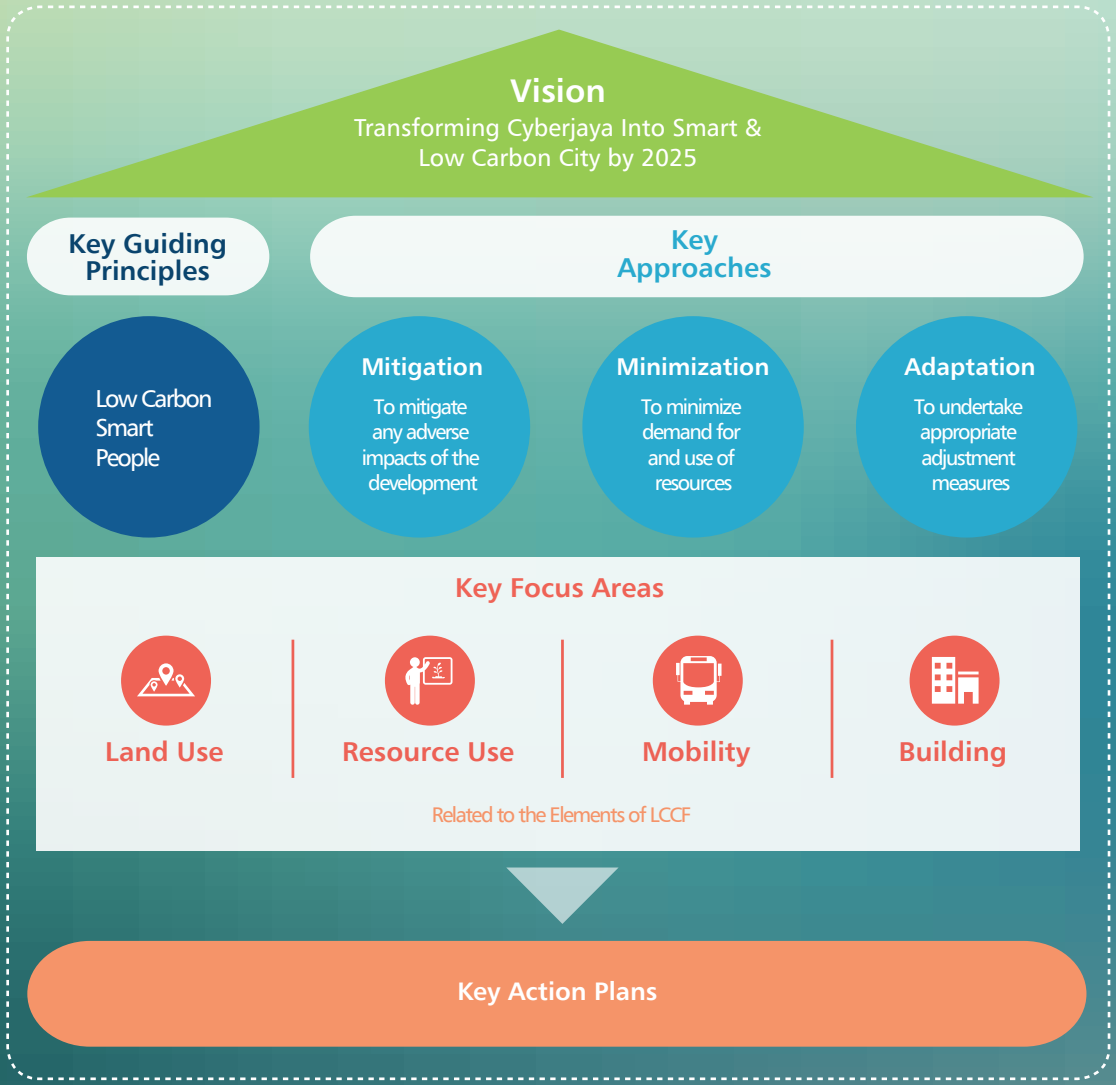
5.1.1 Smart & Low Carbon City Framework

The formulation of Key Action Plans for Cyberjaya Smart & Low Carbon City 2025 are guided by three (3) Guiding Principles that serve as support and boundaries when it comes to defining relevant measures or set of action plans to achieve the intended vision set forth in this report.

In summary, the formulation of Key Action Plans for Cyberjaya Smart & Low Carbon City 2025 is illustrated in Figure 5.1.

The Guiding Principles are also used to determine the Key Focus Areas - which are very much related to the spatial planning and key elements of LCCF - for the purpose of accessing and analysing the current conditions of Cyberjaya to derive to the Key Action Plans that would catapult Cyberjaya's aspiration to be Smart & Low Carbon City by 2025.

Figure 5.1: Smart & Low Carbon City Framework for Cyberjaya



5.1.2 Vision

A vision statement provides strategic direction and describes what to be achieved in the future. Vision is important as it serves as a clear guide for choosing current and future courses of action. A vision statement is intended to clarify the 'why' and 'how' to achieve the vision.

For Cyberjaya, the aspiration is to be a smart and low carbon city by the year 2025, whereby "smart" being defined as leveraging ICT infrastructure to :

- Improve the quality of life of its population
- Improve the well-being of its citizens
- Establish an environmentally responsible and sustainable approach to development

Whilst "low carbon" being referred to lowering the emission of CO2 amid experiencing rapid urbanization process.

This vision is to help MP Sepang and its strategic partners and/or related stakeholders to prepare, develop and execute a transformation agenda in order to make the shift to a smart and low carbon Cyberjaya by the year 2025. The aims are for everyone to actively work towards a climate smart Cyberjaya that reduces its greenhouse gas emissions and is resilient to the social, economic and environmental effects of climate change.

More often than not, this aspiration is supported by various policies and plans from the National, State, and Local level to address climate challenge that came as an aftermath of rapid urbanization.

To tap the potential of green growth, it is necessary to exploit the synergies between local and central levels of government. Lessons learnt at local level can be used to modify and fine tune national frameworks to better implement green economy strategies. Likewise, national policy frameworks can empower local governments and accelerate their policy responses on trending policies such as renewable energy, green-tech R&D and greening public services.

Imagine a Cyberjaya with a vista of vertical forests. High-rise towers of cascading shrubs and greenery. A vertical forest growing out of the buildings.

Regenerating local biodiversity, providing tons of CO2 absorption and producing kilograms of oxygen per day. Studded with trees, dripping with foliage and with rooftops that are home to verdant forests of plants, shrubs and saplings. But these are not just greenery for decoration.

These are fruit trees, herb shrubbery and aromatic leaf gardens. Each building is retrofitted for energy efficiency. Mixed development of soho suites, condominiums, detached residential units, retail centres, a central park and smaller parks everywhere.

People are walking everywhere, because it is so pleasant to do, whether from office to office or in the gated and secure residential communities. LRT, MRT, BRT provide the public mobility necessary for a carbon neutral world.

Bicycle lanes add to these smart transport methods. Trees are everywhere, not just from the benefits of beautiful landscaping but projects that work within secondary forest. Excellent air quality, urban cooling of the sidewalks, absorbing CO2, reducing storm water runoff.

Walkability. Habitat parks that promote biodiversity with wetlands for bird and animal life. A university-level youth population with a culture of freedom and creativity and energy. Innovative desire to create outside of norms. Cyberjaya 2025.

Manifesting the Vision

5.1.3 Guiding Principles

It is noted that urbanization boosted economic development, brought about fundamental social change, and helped to raise the living standards of both urban and rural populations. However, this process has also been characterized by intensive resource consumption and an emphasis on speed rather than quality of urbanization, which usually have negative impacts on the environment and people in general. Going forward, Cyberjaya has decided that urban development must adopt a smarter, greener and low-carbon approach that is focused on efficient uses of land, energy, and other resources necessary for city to thrive.

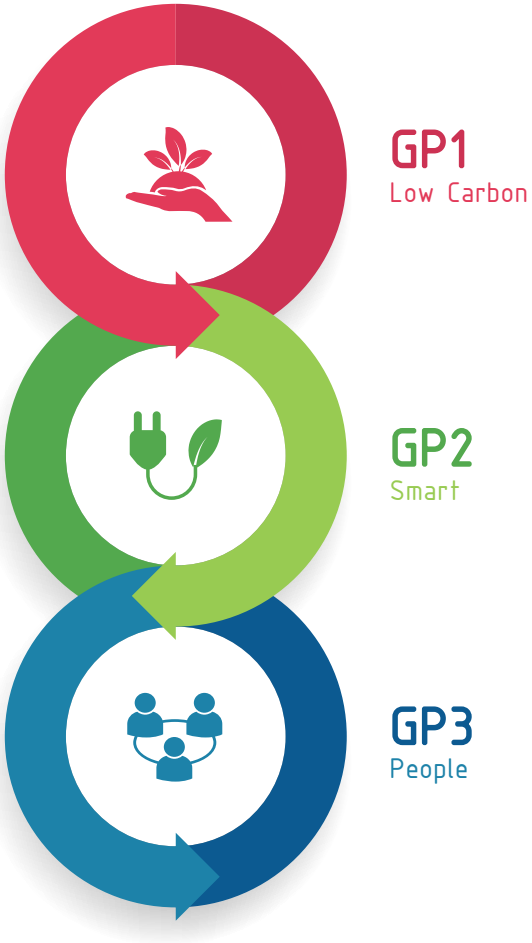
MP Sepang has recognized the need to ensure the quality of urbanization and the urgent needs to take actions. As such, this study has been initiated to provide Cyberjaya with "how to' guides as they undertake the path towards sustainable development.

Before any action plans are being formulated, it is important to define a few fundamental principles that will serve as guidance, boundaries and support towards achieving its vision. As such, the formulation of key action plans for Cyberjaya embraces three (3) key Guiding Principles, which are illustrated in Figure 3.X.

Each of the Guiding Principle has the following criteria to ensure that every key action derived from it would be relevant for and has impact after implementation:

- Beneficial - there must be direct economic, environmental, and social benefits compared to business-as-usual practices.
- Measurable - the indicator to be used must be quantitatively defined.
- Practical – to determine actions are feasible and implementable.

Figure 5.2: Guiding Principles to Formulating Key Action Plans



GP1 Low Carbon

A. Guiding Principle (1) Low Carbon

The Low Carbon Principle fully supports all the four (4) main elements established in the Low Carbon City Framework & Assessment System (LCCF). LCCF is a documented system developed by Ministry of Energy, Green Technology and Water to guide the implementation of CO2 reduction measures in cities and townships. The document was launched by the Prime Minister in 2011.

The four (4) main elements, which are a package with no principle predominating, are shown in Figure 5.3 below.

Figure 5.3: Guiding Principles to Formulating Key Action Plans

Urban Environment	Urban Infrastructure	Urban Transportation	Building
Matters related to the challenges of the growing urban population with the demands for reducing CO2 emissions at the same time.	Socio-technical systems of facilities and services that are vital to the basic functioning of cities and regions.	The ability to cope with density (i.e. people, activities and structures) while moving people and goods.	A relatively permanent enclosed construction over a plot of land, having a roof and used for any of a wide variety of activities (e.g living, manufacturing).
Performance Criteria • Site Selection • Urban Form • Urban Greenery & Environmental Quality	Performance Criteria • Infrastructure Provision • Waste • Energy • Water	Performance Criteria • Shift of Transport Mode • Green Transport Infrastructure • Clean Vehicles • Traffic Management	Performance Criteria • Low Carbon Building • Community Services

In a nutshell, LCCF aims to (1) encourage and promote the concept of low carbon cities and townships in Malaysia, (2) guide cities in making choices/decisions towards greener solutions, (3) assist stakeholders to develop action plans for low carbon development and (4) serve as a tool to calculate the carbon emissions within development.

The Key Action Plans proposed at the end of the chapter are segmented according the four (4) elements of LCCF above.

GP2 Smart

B. Guiding Principle (2) Smart

The term "smart city" was coined towards the end of the 20th century. It is rooted in the implementation of user-friendly information and communication technologies developed by major industries for urban spaces. Its meaning has since been expanded to relate to the future of cities and their development. Smart cities are forward-looking, progressive and resource-efficient while providing at the same time a high quality of life. They promote social and technological innovations and link existing infrastructures. They incorporate new energy, traffic and transport concepts that go easy on the environment.

Their focus is on new forms of governance and public participation. Smart cities forcefully tackle the current global challenges, such as climate change and scarcity of resources while simultaneously maintain their competitiveness and quality of life for the ever-rising urban populations.

In local context, Smart Selangor Blueprint 1.0 (SSB 1.0) was launched by the State of Selangor in December 2016. As the blueprint is still labelled as 1.0, it is implied that there will be more concrete plans added to the domains as it goes along. In a nutshell, SSB 1.0 tries to achieve SUSTAINABILITY, EFFICIENCY and LIVABILITY using a combination of innovative technology and sound urban design to cope with the issues of modern cities. Ultimately, the Selangor Government aspires to become a 'Smart State' by 2025. To achieve this aspiration, twelve (12) key dimensions have been identified as priority in order to turn itself into a smart state with the key aim of improving citizen's quality of life. The key dimensions are visualized in Figure 5.4.

Further examining of the SSB 1.0 reveals that only five (5) key dimensions have started Pilot Projects – i.e. Smart Governance, Smart Water Management, Smart Waste Management, Smart Transport & Mobility and Smart Education.

It is necessary to note that three (3) key elements of LCCF are also part of the twelve (12) key dimensions of SSB 1.0, which are very much related to spatial planning and development - Smart Energy, Smart Water Management, Smart Waste Management are related to URBAN INFRASTRUCTURE, Smart Building/ Development/Infrastructure is related to URBAN ENVIRONMENT, and Smart Transport & Mobility is related to URBAN TRANSPORTATION. Table 5.1 summarizes what the Key Dimensions are all about.

Figure 5.4: Key Dimensions of Smart Selangor Blueprint 1.0

Source: Selangor Smart City 2016

Table 5.1: Key Dimensions of Smart Selangor Blueprint 1.0

Key Dimensions	What It Is About
Smart Governance	The Smart Selangor initiative will be executed by the 4 governing bodies : • Smart Selangor Steering Committee – will focus on strategic governance, will set and determine directions • Project Execution Committee – will look at methods and controls adopted by implementation team • Project Management Committee – will concentrate on working methods and best practices to implement project • Project Team Committee – will concentrate on working methods and best practices to implement project
Smart Digital Infrastructure	Looking into Next Generation Networks, IoT Platforms, mobile & wireless access, data centres and disaster recovery centres, ubiquitous connectivity for citizens, government and citizens.
Smart Disaster Management	Integrated crisis management system and early warning system to enable better inter-agency coordination and prepare citizens for calamities.
Smart Development	Looking into the full cycle of buildings, from the construction methods to the operations of the building. Using a combination of building sciences and technology, the intention is to optimise energy efficiency and improve building quality.
Smart Safety & Security	Looking into implementing a range of integrated safety and security system through collaboration with public in areas related to accidents, crimes, terror incidents, etc..
Smart Agriculture	Looking into using technological solutions to maximize yield and minimizing agricultural input in order to boost efficiency and enhance food & agricultural ecosystem to meet growing food consumption in Malaysia.
Smart Energy	Looking at a suite of systems that enable Sustainable Energy infrastructure to reduce cost and reinforce energy networks, which also includes solutions for Demand Side Response, smart transmissions, and distribution networks.
Smart Water Management	Looking into minimising NRW, ensuring safe and clean water supply and river cleaning as its core focus.
Smart Mobility & Transportation	Looking into fostering seamless multi modal transportation access and efficient connectivity by interacting smart infrastructure, integrating big data and providing smart services that improve user experience.
Smart Waste Management System	Looking into minimizing waste by engaging the community. The end goal is to achieve a zero waste society.
Smart Healthcare	The Selangor government intends to invest 6%-8% of its GDP for healthcare digital transformation, which includes investments into Population Health Management, integrating case/disease management, care co-ordination and advanced tools to perform the tasks.
Smart Education	Looking into preparing human capital to capture new economy opportunities, which includes initiatives to set-up a coding academy to equip citizens with the skill to code and develop apps, coupled with the initiatives to create Smart App Development platform with Open API.

Source: www.smartcitiesasia.com

GP3
People

C. Guiding Principle (3) People

Sustainable development is a challenging social process. The different objectives of society - social, economic and environmental - need to be integrated where possible, and traded-off where they are incompatible. Institutional and individual roles and responsibilities have to change, so that new patterns of behaviour will foster sustainable development.

Every human activity to a certain extent has some impact on the environment. Within the overall framework of sustainable development, there is an increasing emphasis on the need to promote and enact sustainable development through people/community participation or involvement.

Community participation occurs when a community takes responsibility for managing its problems. Taking responsibility includes identifying the problems, developing actions, putting them into place, and following through. Community participation opens the way for community members to act responsibly. Whether a participatory approach is the primary strategy or a complementary one, it will greatly enrich and strengthen programs/projects/actions and help achieve more sustainable, appropriate, and effective outcomes/impacts.

In the context of formulating key action plans for Cyberjaya, community involvement is been factored in due to the following reasons :

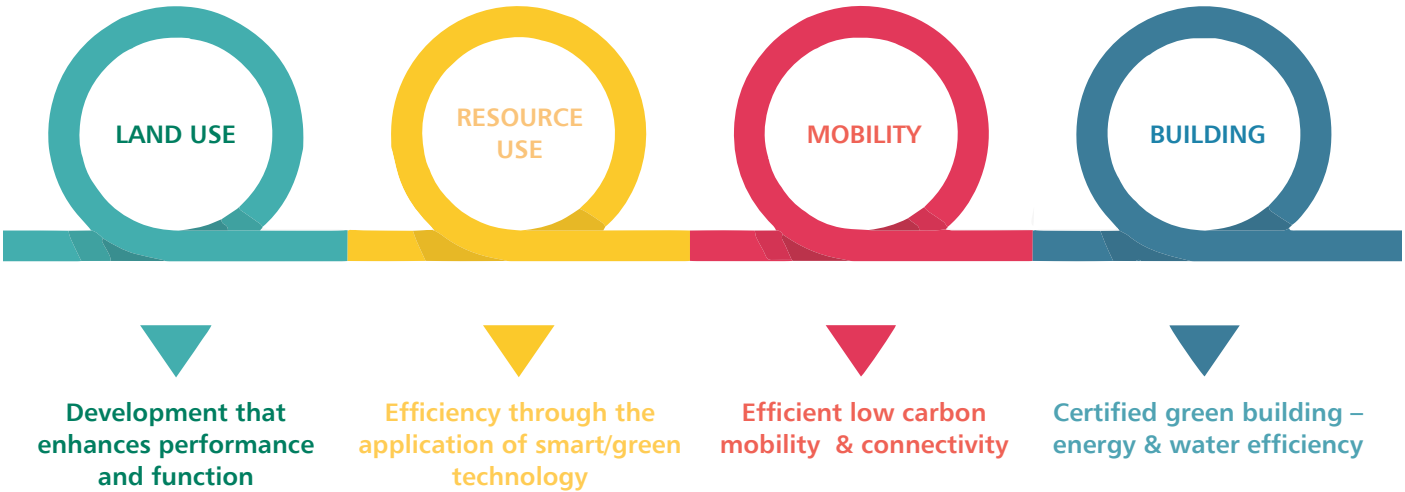
- People organize best around problems they consider most important
- Local people tend to make better economic decisions and judgments in the context of their own environment and circumstances
- Voluntary provision of labour, time, money and materials to a project is a necessary condition for breaking patterns of dependency and passivity
- The local control over the amount, quality and benefits of development activities helps make the process self-sustaining

5.1.4 Key Focus Area

Key Focus Areas are characterised by the Guiding Principles. The establishment of the Key Focus Areas are vital towards getting the right implementable actions to get desired/maximum impacts.

The four (4) Key Focus Areas related to sustainable city are as follows :

Figure 5.5: Key Elements Related to Sustainable City



All the four (4) elements are directly related to the spatial planning and development, which are also the key elements of sustainable city.

A through analysis and understanding of all the four elements will outline a more credible mitigation measures or low carbon strategies to minimize CO2 emissions both in resources and consumption. The recommended specific set of actions not only will enhance urban development but at the same time curtail negative environmental impacts. This will inevitably lead towards meeting the requirement of sustainability and enabling built environments to function in a more constructive way than at present.

Inefficient spatial planning and development can undermine liveability, affordability and environmental sustainability. But, holistic interventions or countermeasures can ensure successful desired transformation.

The related corresponding elements in LCCF under each focus area is as follows:

LAND USE

- Development within Define Urban Footprint
- Infill Development
- Brownfield & Greyfield Re-development
- Hill Slope Development
- Mixed-Use Development
- Compact Development
- Road and Parking
- Urban Heat Island (UHI) Effect
- Preserve Natural Ecology, Water Body & Biodiversity
- Green Open Space and Number of Trees

RESOURCE USE

- Land Take for Infrastructure and Utility Services
- Earthwork Management
- Urban Storm Water Management and Flood Mitigation
- Construction and Industrial Waste Management
- Solid Waste Management
- Energy Optimization
- Renewable Energy
- Side-Wide District Cooling System
- Efficient Water Management
- Sewerage Treatment

MOBILITY

- Development within Transit Nodes and Corridors
- Comprehensive Pedestrian Network
- Comprehensive Cycling Network
- Single Occupancy Vehicle (SOV) Dependency
- Public Transport
- Walking and Cycling
- Low Carbon Public Transport
- Low Carbon Private Transport
- Vehicle Speed Management
- Traffic Congestion and Traffic Flow Management

BUILDING

- Operational Energy Emissions
- Operational Water Emissions
- Emission Abatement through Retrofitting
- Building Orientation
- Shared Facilities and Utilities within Building

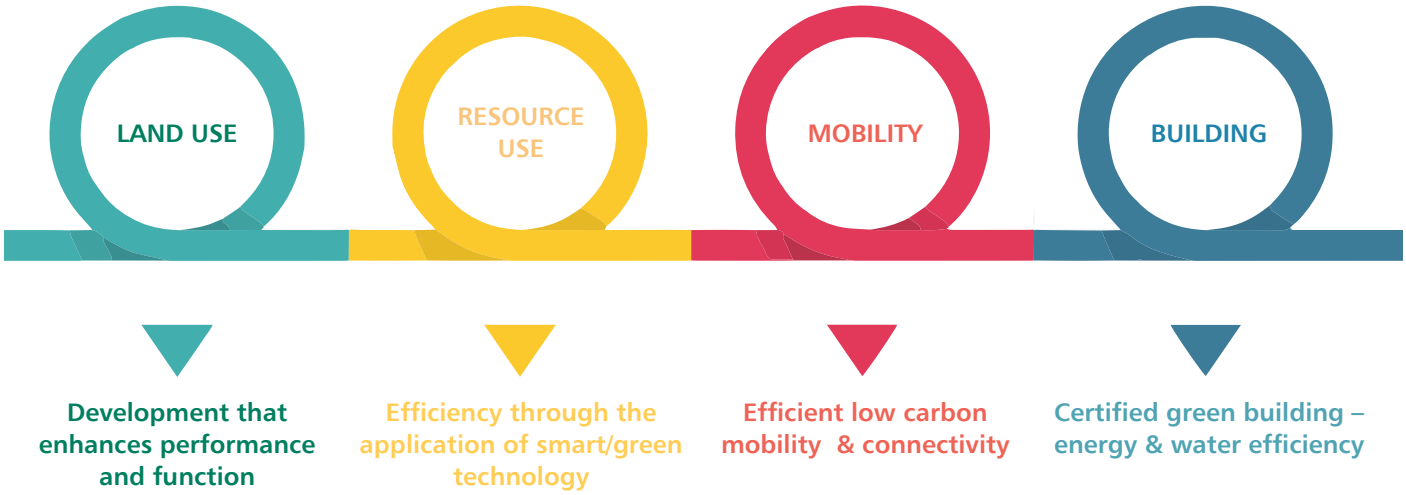
5.2 Assessment On Spatial Planning & Development

5.2.1 Introduction

The aim of this section is to understand the performance of Cyberjaya's spatial planning and development, which are the key elements of sustainable city. It is imperative to understand the performance of Cyberjaya's spatial planning and development with the overall objectives of MP Sepang in transforming Cyberjaya into Smart & Low Carbon City by 2025. The analysis will provide baseline sustainability information on existing and planned development. This information and related additional understanding will assist in the formulating of new mitigation measures and improving the existing countermeasures that will lead to a more effective emission reduction.

The review are centred around the four (4) Key Focus Areas being discussed earlier.

Inefficient spatial planning and development can undermine liveability, affordability and environmental sustainability. But, holistic interventions or countermeasures can ensure successful desired transformation.



5.2.2 Land Use

A. Development within Define Urban Footprint

Define urban footprint is to prioritize development and curb urban sprawl by designating the area inside the boundary for urban development. MP Sepang has committed and approved its overall development masterplan in 2012 and revised it in 2015. Provision of Sepang Local Plan 2025 is to meet the current and future needs / requirements towards dynamic and vibrant development of Sepang.

The land use planning of Cyberjaya is based on conventional planning model (i.e. heavy reliant on the prediction of urbanization and population growth as the basis for land-use arrangement). It is recommended for MP Sepang to consider maintaining ecological functions as the prerequisite for land-use layout - which integrate various functions of nature's services, such as water conservation, flood management, biodiversity preservation, local culture protection, leisure, aesthetic experiences, etc. - for future land use planning.

Key Highlights

Land use planning of Cyberjaya is based on conventional planning model.

- Sustainable land use planning should look into maintaining ecological functions as the prerequisite for land-use layout.
- This type of planning is able to integrate various functions of nature's services, such as water conservation, flood management, biodiversity preservation, local culture protection, leisure, aesthetic experiences, etc..

B. Greenfield Development / Mixed-Use Development / Compact Development

Cyberjaya started from a greenfield project with physical limitations over 2 decades ago. However, a lot of development has taken place within that period. As at 2016, about 61.6% of Cyberjaya has been developed, covering an area of 4,294 acres (1,737 hectares).

Figure 5.6 shows land use pattern as at 2016. The land use pattern breakdown clearly shows that Single Used dominates the land use pattern of Cyberjaya, accounted for 22.94% of total land use, whilst Compact Development and Mixed Development contributed to only 3.23% and 3.00% respectively.

A review on the land use pattern of Sepang Local Plan 2025 (new masterplan) revealed that Single Used Development made up of 53.30% of land use pattern as compared to Compact Development which accounted for only 3.43%. The Plan however, did not specify percentage of Mixed Development.

Meanwhile, a review on land use pattern of Sepang Local Plan 2020 (old masterplan) shown that Single Used Development made up of 56.89% of land use pattern.

Key Highlights

Cyberjaya was a greenfield development.

- As such, a lot of CO2 had been emitted through earthworks activities and additional infrastructure works.

The land use pattern clearly does not promote Mixed Land Uses.

- Mixed land use is one of the contributing factors in achieving sustainable urban form as it allows compatible land uses to locate in close proximity to one another and thereby decrease the travel distances between activities.

Similar to the new masterplan, the old plan also did not specify percentage of Compact and Mixed Development.

Table 5.2 shows detail comparison of land use pattern for 2020 (old masterplan), 2016 (existing) and 2025 (revised masterplan).

Table 5.2: Comparison of Land Use Pattern 2020, 2016 and 2025

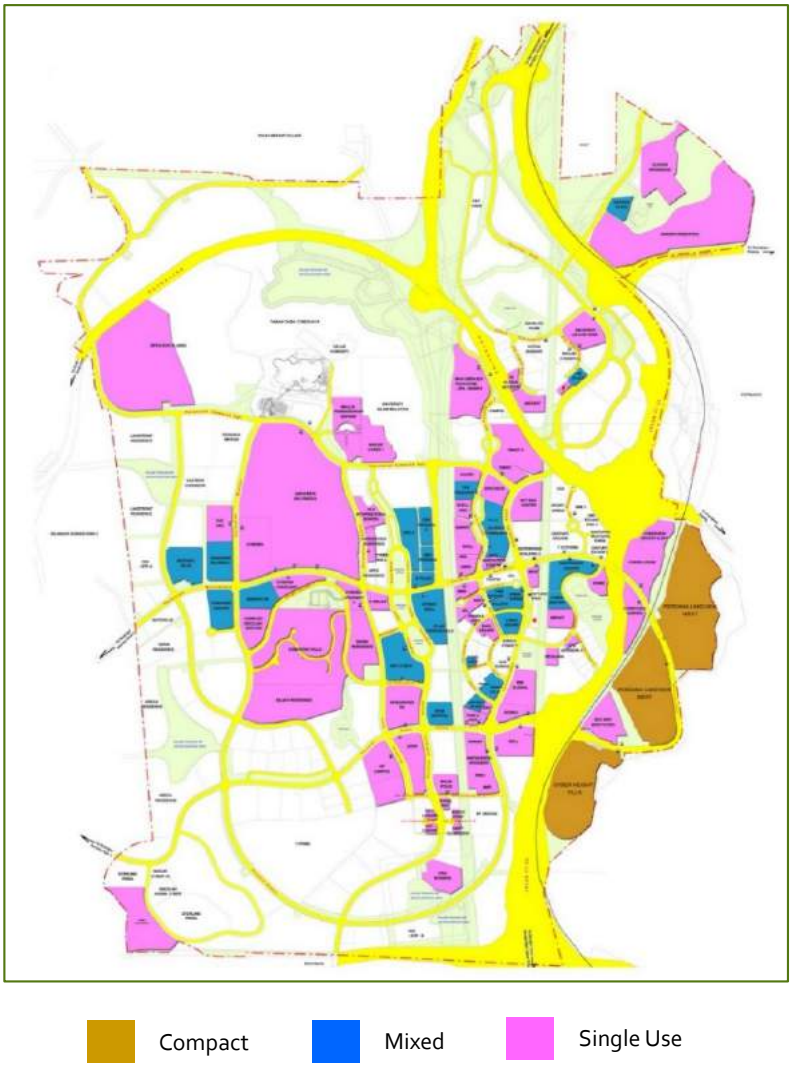
Key Dimensions	Local Plan 2020		Existing Land Use 2016		Local Plan 2025	
	Area (acres)	%	Area (acres)	%	Area (acres)	%
Compact Development	Not specified	-	224.6	3.23	238.73	3.43
Mixed Development	Not specified	-	208.97	3.00	Not specified	-
Single Used Development	3,959.90	56.89	1,596.93	22.94	3,403.30	53.30

Key Highlights

It also does not encourage compact development strategy.

- Compactness of urban space can minimize transport of energy, water, materials, products and people.

Figure 5.6: Cyberjaya's Land Use Pattern as at 2016



Single used is generally the dominant style of zoning and is often blamed for encouraging sprawl due to the fact that it splits land up into segregated residential, commercial and industrial zones. As a result, the places where people live, work, shop, and recreate are far from one another, usually to the extent that walking, transit use and bicycling are impractical that it requires the use of private vehicle or automobile to do all these activities.

Land use decisions can have a profound effect on virtually every aspect of the future, from schools to roads to economic development to housing and to the environment. The concept of sustainable land use - that is, managing land use in such a way that the needs of the present are met without compromising the ability of future generations to meet their own needs - is and should be the way forward.

For future development, it is encouraged that city leaders to move away from single-use zoning and look to land-use planning and zoning tools that avoid sprawl and ensure sustainable development.

C. Preserve Natural Ecology, Water Body and Biodiversity/ Green Open Space

Further analysis on the non-built up area reveals that Open Spaces & Recreational Area and Water Bodies accounts for about 9.0 % and 6.5% of total area respectively (totalling about 15.5%).

It can be said that the total percentage (%) of green open space and water bodies in Cyberjaya is small - way below the ideal coverage of 30%. As such, Cyberjaya should be promoting more green open space and water bodies as these have positive effect on microclimate of urban areas. Creating waterfront, water ways and urban parks not only providing vibrant public spaces but also encouraging healthy and active lifestyle to the community.

Key Highlights

Total percentage of green open space and water bodies is small.

- Increasing the percentage of green spaces in the city would increase carbon sequestration as well as reduce the urban heat island effects. Promoting more water bodies creates vibrant public spaces.

D. Number of Trees

Trees in general, offer a number of benefits to the surrounding community such as improving air quality by absorbing CO2, urban cooling, reducing storm water runoff, increasing property values, improving safety and walkability of streets, providing shade sidewalks and roads as well as offering habitats for urban wildlife that support biological diversity.

As such, it is imperative to preserve trees and the natural environment. In situation whereby the natural environment has been disturbed, a replacement strategy like tree planting, should be put in place to balance out the damages done.

Key Highlights

Tree planting efforts in Cyberjaya are implemented on ad hoc basis and not holistically strategized.

- Increasing the number of trees in cities or development would ensue quantifiable benefits such as reduction in atmospheric carbon dioxide, storm water control, improvement in air quality and helps in energy conservation.

Since 2006, Setia Haruman Sdn Bhd had organized Tree Planting Programs at various locations within Cyberjaya, in collaboration with other stakeholders such as BOMBA, Cyberview, SHELL, HSBC, LHDN, IBM and Sekolah Seri Puteri. To date, more than 10,000 trees had been planted with Setia Haruman Sdn Bhd bearing most of the cost.

MP Sepang had also organized Tree Planting Programs in collaboration with Malaysian Institute of Planners (MIP) since 2009 (Pledge & Plant A Tree Program).

Under this effort, more than 1,400 trees had been planted in a few location in Cyberjaya. Types of tree that had been planted include Pokok Jelutong, Kapur, Temak Nipis, Brazilian Ironwood, Merawan Siput Jantan, Dwarf Geometry Tree, African Mahagony, Geronggang, Pulai and Jati.

Tree planting is also one of the most cost-effective means of mitigating urban heat islands. Vegetation canopies can cool paving by direct shading of the ground surface. They also cool parking areas indirectly through transpiration of water through leaves. Approximately 1°F of temperature reduction is associated with each additional 10% of tree canopy cover (Simpson, et al. 1994). Nevertheless, it is noted that shaded/canopied trees along most main street and service roads in Cyberjaya are still lacking.

In general, tree planting efforts in Cyberjaya are implemented on a ad hoc basis. There is no certain figure how many trees have been planted and how these are being monitored.

Because recent studies in urban environmental science reported undeniable evidence that trees in cities improve the environment in many ways (such as reduction in CO2 emission, improvement in air quality, helping in energy conservation, etc.), a more strategic approach and monitoring on tree planting programs are recommended for Cyberjaya. It is also recommended that holistic and strategic tree planting program be collectively integrated with open space, green parks, landscaping and road/parking component, as part of replacement policy to maximize carbon sequestration and absorption.

E. Road and Parking

Road and parking are also part of main component of a development. Roofing and pavement generally cover large percentages of land in urban and highly developed suburban areas. Not surprisingly, as cities grow and expand their land base, the natural tree and vegetation cover is replaced by urban infrastructure.

In Cyberjaya, road and parking constitute approximately 14.67% of total land use. The LCCF has highlighted that the provision of road and parking should not exceed 20% of overall land use component. Reducing road and parking surfaces will definitely reduce the amount of CO2 being released into the atmosphere.

All the roads use conventional paving i.e. asphalt material whilst its parking surfaces use environmental-friendly permeable material i.e. grass crete. Using permeable paving in parking and pedestrian areas helps reduce the temperature, volume and velocity of storm water runoff, filters and removes pollutants and creates more sustainable communities.

Scientific study has revealed that parking lots have many environmental effects. One eminent effect is that acres of pavement can contribute to urban heat island, among other things. The introduction of shared parking concept might be able to minimize the percentage of land attributed to parking. Shared parking concept allows existing parking spaces to serve two or more individual land uses or buildings without conflict or encroachment. However, based on observation, shared parking facility is non existent in Cyberjaya. Most of the buildings have their own parking spaces either at the basement or open space.

To be sustainable, an approach towards 'green parking lot design' should be considered. This could include measurable consideration of any of these elements - pavement shading and cooling, vehicle screening, pedestrian management, habitat protection, irrigation management and tree preservation, as well as on-site storm water management practices (such as permeable paving, micro-detention of water and pollution interception).

5.2.3 Resource Use

A. Land Take for Infrastructure and Utility Services

The provision of infrastructure and utility services in cities requires land in take for the purpose of placing the utilities (such as water pipes, electric cables, telecommunication lines, etc.) or housing the services (such as sub stations, pump houses, etc.).

Cyberjaya was a planned city since its inception day. Even though it used a conventional land use planning, factors such as land resources, land suitability and demands of economic and social development have been factored in.

Land use for infrastructure and utility services takes up only 10.17% of total development area. Based on Table 2.3, about 89.5% of its infrastructure had been laid down following conventional road reserve method.

Key Highlights

Current infrastructure does not support Common Utility Trench (CUT).

- As such, a lot of CO2 had been emitted through earthworks activities and additional infrastructure works.

Table 5.3: Comparison of Land Use Take

Key Dimensions	Local Plan 2020	Existing Land Use 2016	Local Plan 2025
Existing (2016)	634.2	256.7	9.1
Planned (2025)	708.15	286.58	10.17

Current infrastructure does not support Common Utility Trench (CUT) that allows utilities to share common reserves, nor does it has future plan to install one. Implementation of CUT can bring a few benefits such as provision of easy access to utility companies for maintenance and upgrade works, as well as minimizing maintenance and operational cost through the automation of mechanical and electrical systems.

B. Urban Storm Water Management and Flood Mitigation

Efficient management of urban storm water runoff can reduce localised flooding impact. Localized flooding happens when rainfall overwhelms the capacity of urban drainage systems. All the roads in Cyberjaya use conventional paving i.e. asphalt material whilst its parking surfaces use environmental-friendly permeable material i.e. grass crete. Sustainable material such as pervious pavement able to capture, slow, filter and possibly infiltrate storm water run-off into the ground, and indirectly prevent water from overwhelming pipe networks and pooling in streets or basements.

Key Highlights

Cyberjaya uses conventional method for managing urban storm water.

- Other green technology applications to manage urban storm water includes rain gardens, green roofs, regional storm water pond, constructed wetlands and bio swales.

Potential smart and low carbon application :

- Convert storm water to demineralized water for industrial usage.

Recent studies show that implementing green storm water management techniques, such as porous pavement and green roofs, is more cost-effective compared to traditional gray storm water measures like pipes, sewers, and manholes.

Other green technology application that enhance infiltration, that can also be adopted includes rain gardens, green roofs, regional storm water pond, constructed wetlands and bio swales.

Clearly, effective urban storm water management should extend beyond centralized municipal storm water infrastructure to also include on-site catchment, treatment and usage. Single-purpose gray storm water infrastructure is largely designed to move urban storm water away from the built environment, while green infrastructure reduces and treats storm water at its source while delivering other environmental, social, and economic benefits. Introducing green infrastructure to supplement the existing gray infrastructure can promote urban livability and add to communities' bottom line.

C. Household Solid Waste Management

Solid waste management generally comprise the following elements of the system - Waste Prevention (e.g. 3R), Self-Treatment (e.g. food digester, composting, anaerobic digestion), Source Segregation (e.g. different waste types), Collection and transportation, Pre-Treatment (material recovery facility (MRF) – separation of recyclable material through size reduction, density separation, magnetic separation and densification) and Final Treatment (e.g. thermal treatment, landfill).

Cyberjaya has initiated Waste Prevention program to nurture and encourage recycling habits amongst Cyberjaya community. One of the initiatives is the cash conversion program whereby community is given a platform to convert their recycling materials into cash. The current estimated recycling rate in Cyberjaya was not being able to be established.

Cyberjaya does not enforce segregation of waste at source to its community. The benefit of Source Segregation is that it would save energy, time and money. In most western countries, disposal of waste is done in a planned manner in such a way that reusable or recyclable materials cannot be found in their landfill sites.

The main focus of solid waste management system in Cyberjaya is sole dependency on landfill (100% landfill). It is recorded that in 2016, about 4,445.05 MT of waste were sent to Tanjung 12 landfill (Source : Unit Perkhidmatan Bandar, MP Sepang) and the average amount of waste collected was between 600 MT and 700 MT per month. The CO2 emissions come from the transportation of waste to landfill (32km from Cyberjaya) and the landfill waste itself. Landfill has shown to be not the best technology in dealing with organic waste.

To reduce the amount of waste sent to landfills, Cyberjaya did attempt to provide three Compostech machines for the community's use, located at the SME Technopreneur Centre 1, MaGIC, and the Cyberjaya Community Clubhouse. These Compostech machines recycled organic kitchen and garden waste into compost within a speedy 24 hours, which is then used as nutrient-rich fertiliser for landscaping purposes around Cyberjaya. Nonetheless, the activity of composting has stopped due to the breakdown of the machines. Currently composting rate in Cyberjaya is 0%.

Key Highlights

100% dependency on landfill.

- Landfill has shown to be not the best technology in dealing with organic waste

Cyberjaya composting rate is 0%.

- Composting is nature's process of recycling decomposed organic materials into a rich soil known as compost.
- Composting is the basis of sustainable urban farming, which promotes a closed loop system where all components of a farm add to and support each other.

Recycling rate for Cyberjaya is unknown.

- To establish community-level recyclig centres
- Private sector investment in recycling system - reactivate composting

Potential smart and low carbon application :

- Conversion of plastic to diesel for public transport usage.
- Bio-chilled water generation using landscape waste.

Cyberjaya also directly benefitted from state of Selangor's new policies on restriction of using non-recyclable packaging (i.e. polystyrene packages) and plastic bag tax system in an effort to reduce the generation of non-recyclable waste from Selangor community.

However, looking at the current rate of 100% landfill (i.e. zero diversion from landfill), 0% composting rate, an approach towards sustainable waste management is crucial for Cyberjaya.

D. Energy Optimization

Energy, in the form of electricity plays a vital role in supporting the operation of a building (residential or business - either to light, cool or heat). Residential buildings consume nearly one third of Total National Energy Consumption (Source : ScienceDirect Journal). Studies show that a significant part of energy use can be optimized through occupants' awareness about energy consumption. Optimising the energy usage/consumption will subsequently reduce carbon emissions over time. A commitment towards continual efficiency upgrading impacts our electrical energy use.

As being reported in the 'Energy Audit Report for MP Sepang HQ Building' prepared by GreenTech Malaysia in February 2017, the annual energy (i.e. electricity) consumption by MP Sepang HQ building (with Gross Floor Area (GFA) of approximately 13,135m^2) for 2015 and 2016 is 1,689,062kWh and 1,734,912kWh respectively. The corresponding energy costs were RM859,377 and RM882,715 per year respectively. As part of the mitigation plan, the Audit recommended ten (10) energy saving measures that would enable potential total energy saving of 17.5% or 304,464kWh per year which is equivalent to potential annual cost saving of RM144,564, from a total investment of RM340,025 (hence, giving a payback period of 2.4 years). It is estimated that the amount of CO2 mitigated is 225.6 ton CO2 based on GHG emission factor of 0.741 kgCO2.

Data received from TNB with regards to total annual energy consumption and total annual energy consumption from streetlights in Cyberjaya for year 2011 and 2016 are illustrated in Table 5.4.

Key Highlights

Energy Audit Report for MP Sepang HQ Building.

- Implementation of Sustainable Energy Management System (SEMS) that would provide a systematic manner to monitor and control the power and energy consumption in MP Sepang.

Only 3% LED lightings usage in streetlights.

- Widespread use of LED lighting has great potential in reducing energy consumption since LEDs are energy efficient – 95% of the energy is converted into light.

About 101.72% increase in energy consumption from 2011 to 2016.

- Studies show that a significant part of energy use can be optimized through occupants' awareness about energy consumption.

Table 5.4: Comparison of Total Annual Energy Consumption in Cyberjaya

Energy Consumption	2011 (kWh)	2016 (kWh)	% Increase / (Reduction)
Total Annual Energy Consumption	65,278,906	131,681,384	101.72%
Total Annual Energy Consumption from Streetlights	1,517,868	5,475,352	260.73%

Source : ICT Division, TNB

It is apparent that Cyberjaya had experienced a glaring percentage of increase in both total annual energy consumption and total annual energy consumption from streetlights from 2011 to 2016.

From the data gathered, it is found that only 3% of streetlights in Cyberjaya is LED lights. LED is one of today's most energy-efficient and rapidly-developing lighting technologies. LED lights are up to 80% more efficient than traditional lighting such as fluorescent and incandescent lights. About 95% of the energy in LEDs is converted into light and only 5% is wasted as heat. Less energy use reduces the demand from power plants and decreases greenhouse gas emissions. Hence, widespread use of LED lighting has great potential in reducing energy consumption from streetlights in Cyberjaya.

In general, energy consumption in buildings is dependent on building characteristics and occupants' behaviour. As such, programs or initiatives on behavioural change and awareness related to energy efficiency should be implemented/intensified. The programs are recommended to involve the participation of communities as community-based initiatives could lead to long-term behaviour change because they facilitate the introduction of new, pro-environmental social norms (examples include groups sharing information to facilitate behaviour change).

Another energy efficient measure that is recommended is through smart technology interventions (or ICT-based solutions). However, this will equally have to rely on people adjusting their energy consumption behaviour to make it work successfully. The challenge is to ensure that ICT-based solutions can contribute to saving energy by motivating and supporting behavioural change of energy end-users.

With regards to energy consumption by private entities, no data is available. However, energy consumption pattern can be viewed from different perspective i.e. by looking at the green certified buildings as these buildings had already been integrated with energy efficiency practices into the building design, operation and maintenance prior to being certified. Some of the energy efficiency practices which have an effect on energy savings/consumption include building façade and orientation as well as energy saving appliances and fixtures (e.g. inverter A/C, energy saving hybrid water heater, centralized vacuum system). Currently, there are only 19 completed green buildings in Cyberjaya.

In summary, efforts towards looking into energy management system as well as implementing more energy efficiency programs and promoting green building certification are highly recommended since consumption patterns do have direct impacts on global warming and carbon emissions in particular.

E. Renewable Energy

Renewable Energy (RE) is energy which comes from natural resources such as sunlight, wind, rain, tides and geothermal heat, which is replenish-able. About 16% of global final energy consumption comes from renewables, with 10% coming from traditional biomass (which is mainly used for heating) and 3.4% from hydroelectricity.

New renewables (such as small hydro, modern biomass, wind, solar, geothermal, and biofuels) accounted for another 2.6% and are growing very rapidly.

However, the most common form of RE in Malaysia is solar photovoltaic (PV). It is reported that the cumulative installed solar PV as at September 2015 is only at 321.29 MWp (Source : SEDA, 2016) as compared to national target of 1,250 MWp by 2020 (Source : SEDA, 2012). Malaysia has implemented net energy metering (NEM) last year, which allows self-consumption of electricity generated by solar photovoltaic system while selling the excess energy to utility companies. The Sustainable Energy Development Authority Malaysia (SEDA) had said the country would be implementing its 500MW of capacity for NEM starting 2016 until 2020 with 100MW capacity limit a year in Peninsular Malaysia and Sabah. Clearly, the potential of this type of RE is yet to be fully tapped and explored.

The application of RE in Cyberjaya is only limited to the installation of solar PV. Currently, five (5) bus shelters, two (2) Green Nomad Kiosks and several rooftops, including Cyberjaya Community Recycling Collection Centre (CCRCC) have been installed with solar panels. For solar panels installed on the bus shelters, the energy stored is turned into electricity at night, lighting up the bus stand. In addition, the Cyberjaya Mosque has also been equipped with a Building-Integrated Photovoltaic (BIPV) System to harvest energy from the sun, making it the world's first mosque equipped with BIPV.

Key Highlights

Energy consumption in Cyberjaya is found to be on the high side.

- Some measures that can be undertaken include the followings : Energy Audit, Energy Efficiency Programs, Green Building Certification, Community-based Initiatives, Public Engagement Campaigns, Financing Schemes & Subsidies and Eco Design.

Potential smart and low carbon application :

- Supply side - CoGen to meet chilled water and electricity.
- Bulk sale of chilled water from waste heat recovered from TNB power plant.

Potential smart and low carbon application :

- Floating solar panel from retained water bodies.
- Energy from bio-digesters.

Given the low GHG emissions from solar power, increasing its adoption can be part of an essential strategy for Cyberjaya to reduce CO2 emissions and transform itself into low carbon city. Solar PV is energy efficient since most solar panels could convert around 15% of the sun's energy into electricity. Energy generated by solar PV can be stored in a battery or thermal and used for space heating, space cooling, lighting and operation of various equipment and machinery.

F. Side-Wide District Cooling System

SDistrict Cooling System (DCS) is the distribution of cooling energy from one or more sources to multiple buildings within a district in the form of chilled water through underground insulated pipeline, mainly for air conditioning purposes. DCS reduces energy consumption and adverse energy related to environmental effects.

Not only that DCS is the most convenient method for the production and distribution of cooling for commercial purposes, it also provides both economic and environmental benefits. DCS offers operating flexibility, since each building can use as much or as little cooling as needed, without worrying about chiller size or capacity – and the system produces no noise or vibrations. Hotels, shopping centres, industrial buildings, office buildings, residential buildings, sports centres and hospitals are examples of facilities that can benefit from the use of district cooling.

At the moment, there are two (2) plants of DCS in Cyberjaya, located at Cyber 6 (DCP 1) and Cyber 8 (DCP 2), with a 15km underground network supplying chilled water for the air-conditioning needs to 40 multi-storey buildings within Cyberjaya's flagship zone, including Wisma Shell, Malaysia Digital Economy Corporation (MDeC) and various government agencies. The system utilises off-peak electricity at night to chill water for the buildings' air-conditioning use during the day. The technique of using chill water for air conditioning reduces electricity usage by more than 65% as compared to traditional air-conditioning systems.

Key Highlights

DCSs are currently running on electricity.

- To look into the optimization of DCS integrated with sustainable energy technologies including systems integrated with RE, combined cooling, heating and power systems, and thermal storage systems.

Potential smart and low carbon application:

- Industrial water for cooling towers and landscape use – to be recovered from storm water and waste water.
- Supply of grey water to DCS.
- Bio-chilled water generation using landscape waste.
- Supply side - CoGen to meet chilled water and electricity.
- Bulk sale of chilled water from waste heat recovered from TNB power plant.

Recently, Megajana has collaborated with ENGIE Group (French energy company) to expand the capacity of existing facilities to supply round-the-clock chilled water for air conditioning to Cyberjaya township's data centres, malls and office towers.

This 2017 facilities expansion, enabling a 5% energy efficiency gain, represents a reduction of 2.3 GWh(e) of power consumption or 1,160 tons of CO2 per year (Source : Cyberview Sdn Bhd).

Installation of DCS in Cyberjaya is definitely among the most important green features to materialise the sustainability vision of Cyberjaya due to its high energy efficiency. However, since the current DCSs are running on fossil fuel, it is recommended that Cyberjaya to look into the performance and progress of DCS integrated with sustainable energy technologies including systems integrated with RE, combined cooling, heating and power systems, and thermal storage systems.

G. Efficient Water Management

Efficient water management refers to the optimization of treated water consumption through awareness of wastage and wasteful practices as well as finding alternative source of water (such as through recycle water or the use of rainwater harvesting) for non-human contact purposes.

Total water consumption in Cyberjaya could not be found at the moment. As such, the equivalent amount to Ringgit Malaysia payable to utility company also could not be established. However, the main source of water supply in Cyberjaya came from the water treatment plant in Sungai Semenyih area. This water treatment plant gets 100% supply of water from catchment area i.e. from five (5) identified reservoirs within Cyberjaya. Clearly, surface water stored in reservoirs is the main source of potable water supply in Cyberjaya.

The estimated per capita water consumption in Cyberjaya as at 2016 is yet to be ascertained. Malaysia's per capita water consumption is unsustainable, with household consumption of 211 litres per capita per day (Source : www.export.gov), which exceeded the benchmark recommended by the United Nations of 165 litres per day.

In general, only 30% of water usage is used for actual consumption such as cooking and drinking, while the remaining 70% of it is just for non-potable uses like washing and flushing for household and cooling and landscaping for industry. In the past, it was concluded that the water shortage crisis in many parts of the country occurred due to the inefficient management of the authorities as well as Malaysians' own habit of wasting the water.

Water savings can be achieved in residential and industry through a combination of changing behaviour, modifying and/or replacing equipment with water saving equipment to reduce overall water consumption as well as increase internal reuse of treated water.

With predictions of water shortages in the future, reclaimed water is being touted as something that MP Sepang should consider, alongside other options such as groundwater and storm water. Diversifying water sources helps ensure water security.

Key Highlights

100% potable water supply from surface water stored in reservoirs.

- In general, only 30% of water usage is used for actual consumption while the remaining 70% of it is just for non-potable uses .

Recycle water usage in Cyberjaya is 0%.

- With predictions of water shortages in the future, reclaimed water along with groundwater and storm water are options for diversification

Potential smart and low carbon application :

- Industrial water for cooling towers and landscape use – to be recovered from storm water and waste water.
- Supply of grey water to DCS.

H. Sewerage Treatment

Cyberjaya owns two (2) main sewerage treatment plants (STP), which are located at Persiaran Sepang (STP A) and Persiaran APEC (STP B). These main STPs are supported by seventeen (17) pump stations that use gravity flow method to transfer the sewerage to either STP A or B for processing.

These STPs are centralized STP, which represent the conventional approach to managing wastewater. It is characterized by the collection and removal of urban wastewater by a centralized sewerage to a centralized intensive treatment plant where the wastewater and sludge are treated and disposed of under controlled conditions.

The overall advantages of this management concept are perceived to be the lower investment and operational costs, incurred by a single large treatment plant as compared to several small-scale plants, as well as a more effective control of quality standards and plant operation procedures.

However, a number of disadvantages entailed especially when it comes to less densely populated areas - the costs/benefits ratio of central systems may be less favourable if the high and long-term construction and maintenance costs of the sewerage system are taken into account. If not adequately maintained, an extensive sewerage system may leak and cause contamination of soil and groundwater.

Key Highlights

Centralized STP in Cyberjaya – conventional and not sustainable (100% usage of conventional STP).

- A paradigm shift from centralized conventional wastewater systems to decentralized wastewater systems.
- Sewage as a valuable resource as opposed to a problem to be treated.

Currently in Cyberjaya, energy generated from biogas is 0%.

- Floating solar panel from retained water bodies.
- Energy from bio-digesters.

Centralized treatment systems require (multiple) pumping stations (as in the case of Cyberjaya – 17 pump stations) which must be properly operated and maintained as well. And this require vast amounts of electricity which make them not very sustainable. And lastly, centralized municipal treatment plants reduce opportunities for water, nutrients and sludge re-use in local cycles, due to their high load of harmful substances, such as chemicals, heavy metals and pathogens (especially when industrial wastewater is also collected in combined sewer).

In recent years, increasing attention has been given to modern onsite, decentralized or semi-centralized wastewater management concepts that are already applied in many developed countries. These concepts comprise collection, treatment and disposal/re-use of wastewater from small communities (from individual homes to portions of existing communities) integrated in settlement/village/town development projects.

Such approaches consist of many small sanitation/wastewater treatment facilities designed and built locally. Decentralized systems maintain both the solid and liquid fractions of the wastewater at or near the point of origin and, hence, minimize the wastewater collection network. This approach offers a high degree of flexibility, allowing modifying the design and operation of the system to fit to various site conditions and scenarios. Decentralized wastewater treatment can be a smart alternative for communities, particularly small ones as it can avoid large capital costs, use energy and land wisely and protect communities' health.

One interesting note is that although sewage contains contaminants, it also holds nutrients that can be used to improve soil fertility, along with the ability to produce natural gas. Technologies such as biogas plants that maximise sewage as an energy and nutrient source had already been implemented in developed countries. Sewage should be viewed as a valuable resource, and not just a problem to be treated.

It is recommended that Cyberjaya to look into 'Green STP' and start realising the full potential of sewage as a resource.

5.2.4 Mobility

A. Development within Transit Nodes and Corridors

Transit nodes and corridors refer to the major routes of public transport services such as rail and buses. The nodes are generally the stops, stations or terminals. These nodes are designed to be within a radius of 400m, to encourage people to walk to these facilities (Source : Draft Residential Design Guideline, Federal Department of Town & Country Planning, Malaysia).

Figure 2.7 shows mobility/connectivity within Cyberjaya. In general, connectivity within Cyberjaya is quite well or well served. Most bus stops are within 400m or walking distance from activity centres. As such, activity centres should be developed as vibrant places by focusing on mixed-use activity, main streets and public realm improvements.

Creating high quality public spaces and improving the appearance of an area are not just going to make people feel good when they visit, shop, work or live there, but it would make the area more attractive, healthier, safer and cleaner, and therefore prompting more people to go there. It also means that businesses will be more likely to invest money, to build or to trade there, which improves the economy and creates jobs.

Key Highlights

Potential smart and low carbon application :

- Develop activity centres as vibrant places by focusing on mixed-use activity, main streets and public realm improvements.

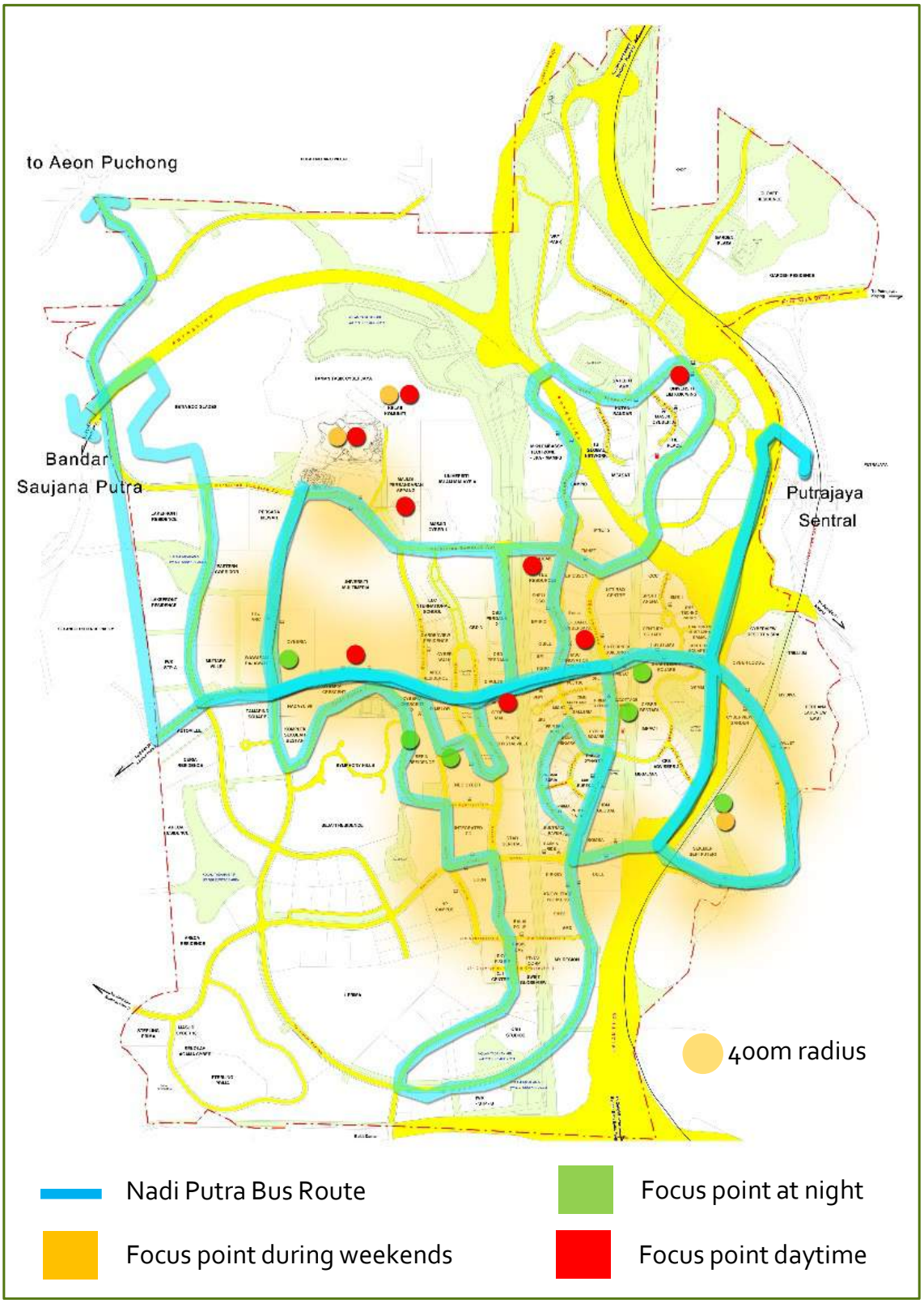
Integration with the development of Cyberjaya City Centre (CCC).

- CCC is the catalyst of anchoring Cyberjaya into a global technology hub.

Budget 2016 had seen the Prime Minister allocated RM11 billion plan to build the multi-year mega projects in Cyberjaya called Cyberjaya City Centre (CCC), and a RM7 billion airport township, dubbed as Aeropolis, around Kuala Lumpur International Airport. A new line, called MRT II, has been built from Sungai Buloh in the north-west of KL, to Putrajaya in the south, spanning 52km and costing another RM28 billion, with two MRT stations (S34 and S35) located in Cyberjaya. The development of CCC will be undertaken by Cyberview Sdn Bhd and MRCB Land Sdn Bhd, spanning 53 hectares of land located between Putrajaya Sentral and Lim Kok Wing University and would be developed in two phases over the period of 15 years.

Looking at this new occurrence, synergy and integration of plans between key stakeholders are vital to ensure that the overall development objectives are met.

Figure 5.7: Mobility/Connectivity Within Cyberjaya



B. Comprehensive Pedestrian/Cycling Network

Not only that walking and cycling are the most basic and traditional form of transportation, they are also the most efficient form of transport for short distances. Both aspects are crucial when looking at the relevance of non-motorized transport (NMT) in developing environments.

Walking is sustainable because it does not emit any carbon. Individuals are more likely to choose to walk if they see the environment as walkable – convenient, safe and pleasant. Pedestrian network for a development has to be planned at the design stage and should also be planned to be integrated with cycle and public transport network.

Key Highlights

Cycling activity is more towards recreational/leisure/health purposes.

- Currently, road marking for bicycle spanned only 5.8km.

Similar to walking, cycling is also a sustainable way to travel. It is simple, cost effective and the most efficient way of reducing emissions. A comprehensive and continuous network of cycle lanes will encourage more people to cycle for their daily activities.

With regards to pedestrian network, Sepang Local Plan 2025 indicates pedestrian lane for all roads in Cyberjaya. As at 2016, it is estimated that about 30% of pedestrian routes have been developed, excluding the pedestrian routes within development area.

With regards to cycling network, Sepang Local Plan 2025 does not have provision for dedicated cycling network in Cyberjaya. However, in 2015, MP Sepang has started marking road for bicycle lane in major population area in Cyberjaya in 2 phases :

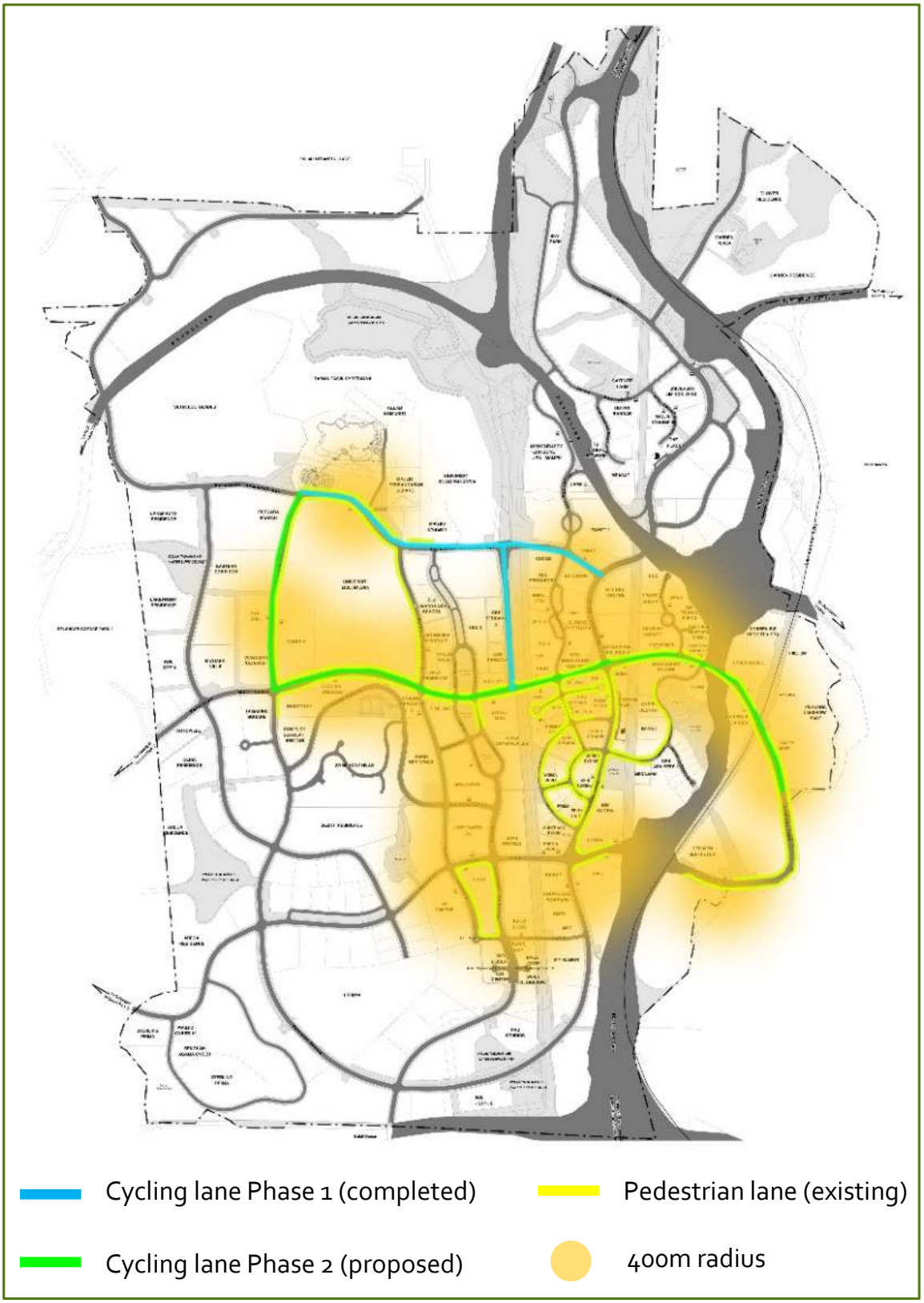
- Phase 1 – completed :
  Persiaran Semarak Api (P1) - 4 km/2 way and Persiaran Flora (P2) - 1.8km/2 way. Total length of 5.8 km / 2 way.

- Phase 2 – proposed :
  Persiaran Bestari (P1) (2.8km/2 way), Persiaran Multimedia (P2), Persiaran Tasik (P7), Lingkaran Cyberpoint Timur, Lingkaran Cyberpoint Barat and Persiaran Cyberpoint Selatan (P5). Total length is estimated at 13.4 km.

As shown in Figure 5.8, major focus areas are connected by pedestrian lane from bus stations. Nonetheless, the dedicated cycling lane was out of the way from major focus areas. It can be said that the cycling activity in Cyberjaya is more towards recreational/leisure/health purposes rather than as an alternative for motorized urban transport or as a feeder to public transport systems. Currently, there is no data to indicate the percentage rate of cycling in Cyberjaya. However, it is foreseen that cycling activities will pick up as more infrastructure and supporting facilities to provide for safe and convenient cycling are set in place.

The CCC Masterplan prepared by Cyberview Sdn Bhd promoted pedestrian and cycling as one of its key features in its development. An effort to integrate the pedestrian and cycling network between Sepang Local Plan 2025 and the CCC Masterplan should not be overlooked in order to create potential demand, promote walking and cycling on short to medium trips to residents/communities and to make central business district (CBD) area a TOD zone with perhaps 100% walkable and accessible to pedestrian.

Figure 5.8: Walking and Cycling Network Within Cyberjaya



H. Public / Private Transportation

The usage of public transport reduces energy consumption and harmful carbon dioxide (CO2) greenhouse gas emissions that damage the environment. Travelling by public transport uses less energy and produces less pollution than comparable travel in private vehicles.

Studies conducted by United States Department of Transportation shows that public transportation produces significantly less GHG emissions per passenger mile per distance travelled compared to private vehicles. Heavy rail transit such as subways and metros produce on average 76% lower greenhouse gas emissions per passenger mile than an average single-occupancy vehicle (SOV). Light rail systems produce 62% less and bus transit produces 33% less.

Key Highlights

Public transportation modal split was estimated at 7% as at 2016.

- Travelling by public transport uses less energy and produces less pollution than comparable travel in private vehicles.
- Buses and cabs remain the only form of public transportation in Cyberjaya.

Unfortunately, public transit has not been the dominate transportation mode in Cyberjaya. According to **'Traffic Impact Assessment for the Feasibility Study for the Development of Transport Terminal in Cyberjaya 2013'** (TIA Report 2013) produced by Cyberview Sdn Bhd, the public transportation modal split was estimated at 7% as at 2016. Table 5.5 shows the modal split between public and private transportation based on TIA Report 2013 :

Table 5.5: Public / Private Transportation Modal Split

Public	Private	Basis	Year
5%	95%	Baseline	2013
7%	93%	Projection	2016
10%	90%	Projection	2020
15%	85%	Projection	2033

Buses and cabs remain the only form of public transportation here in Cyberjaya at the moment. Current bus services are being provided by Nadi Putra and Cyberjaya Dedicated Transportation System (DTS). Nadi Putra is a public bus services whilst DTS is a semi public bus transportation, which only make trips when requested by passengers. Nonetheless, it can be noted that the current public transportation route and bus stops in Cyberjaya do support most of the activity centres or focus areas (refer to Figure 5.7).

In general, Cyberjaya has adequate public transportation system. The busses are popular among students and the general population who live inside this city.

Almost 75% of the bus fleet under Nadi Putra is powered by natural gas while the remaining is still using diesel. The provision of a public bus service using natural gas is an important step in providing low carbon transport services in Cyberjaya. This is because GHG emission using natural gases is 20% to 30% less compared to diesel (Source : http://www.ngvc.org).

In 2016, the total number of buses and the frequency of trips per year made by these buses have shown an increased of 42.9% and 23.5% respectively from the previous year (Table 5.6). It is calculated that the average trip per hour is 2 trips, with a 30 minute waiting time.

Table 5.6: Number of Buses and Frequency of Trips of Nadi Putra Fleet

Year	No. of Buses	%	Total Trips Per Day	Total Trips Per Year	%
2016	20	42.9	151	55,115	23.5
2015	14	-	125	44,625	-
2014	14	-	125	44,625	-
2013	14	-	125	44,625	-

As Table 5.7 indicated, the number of ridership for services under Nadi Putra experiencing an increase pattern for the past 3 years since 2014 with significant increase of 20.96% in 2015. Meanwhile, DTS ridership recorded an increase of 7.81% only in 2016 (Table 5.8).

Coming back to Table 5.5 shown earlier, the public transportation modal split was estimated at 7% as at 2016. Thus, it can be assumed that total combination of average per day ridership of 2,511 (i.e. Nadi Putra 2,446 + DTS 65) represents the 7% public transportation modal split. To obtain a 15% public transportation modal split in 2033, the average per day ridership would need to be raised to about 5,381 which is equivalent to 1,937,160 ridership per year or an average of 161,430 ridership per month.

Table 5.7: Ridership for Nadi Putra Bus Services in Cyberjaya

Year	Nadi Putra			
	# of Ridership per Year	%	Avg Per Month	Avg Per Day
2016	880.604	6.14	73,384	2,446
2015	826,503	20.96	68,875	2,296
2014	653,253	0.42	54,438	1,815
2013	650,441	-	54,203	1,807

Table 5.8: Ridership for DTS Bus Services in Cyberjaya

Year	Nadi Putra			
	# of Ridership per Year	%	Avg Per Month	Avg Per Day
2016	23,287	7.81	1,941	65
2015	21,468	-11.71	1,789	60
2014	23,981	-7.95	1,998	67
2013	25,888	-	2,157	72

Key Highlights

Cyberjaya is a low density development - population density of 6 persons per acre or 24 persons per hectare.

- Most of low density areas are extremely automobile dependent.
- The need to formulate innovative approaches to low-density transit system.
- The need to increase density to increase number of public transport ridership.

Cyberjaya is predominantly a job centre - its employment ratio is higher than its population ratio.

- This means higher mobility into and within Cyberjaya - contributes to the high percentage usage of private vehicle.

The high percentage of usage of private transport in Cyberjaya can be attributed to the following factors :

- Cyberjaya is generally a low density development as evidenced by the current population density of 6 persons per acre or 24 persons per hectare. Most of low density areas are extremely automobile dependent as it means more travel and commuting to the activity centres to meet everyday needs.
- Cyberjaya is predominantly a job centre since its employment ratio is higher than its population ratio. This means higher mobility into and within Cyberjaya and this also contributes to the high percentage usage of private vehicle in Cyberjaya.

Sustainable mobility requires the need to promote travelling through an accessible and reliable public transportation system. However, public transportation would not be viable if there is no or too few ridership. As such, Cyberjaya should find ways to increase the number of ridership for public transport services as well as formulate innovative approaches to low-density transit system so that the percentage of its public transportation modal split can be increased. Gearing towards green public and private vehicles are also recommended.

D. Traffic Flow Management

An efficient traffic management in the city will results to less congestion. An efficient traffic flow will bring smooth movement of vehicles in the city, thereby enabling less carbon emissions. Speed management is about maintaining a pre-determined speed for optimum consumption, compared to excessive speeds that consume more fuel and subsequently emit more carbon. Traffic in cities can be managed by various means through combination of mainly physical measures. A common method in this country is the road hump.

According to TIA Report 2013, the traffic flow in Cyberjaya seemed smooth and satisfactory during both morning and evening except for the following :

- Morning peak hour – Persiaran APEC north of Persiaran Semarak Api and Jalan Teknokrat 4
- Evening peak hour – Jalan Teknokrat 2 south of Jalan Teknokrat 1, Jalan Impact and Jalan Teknokrat 7.

Key Highlights

Cyberjaya has installed smart traffic management system in 2016.

- The cameras analyse the traffic situation and intelligently direct traffic at the intersection to reduce waiting time at traffic lights.
- Travel time has been reduced to between 10 to 15 minutes from 30 minutes previously.

April last year, Cyberview and Intelsec Sdn Bhd (a wholly-owned subsidiary of Telekom Malaysia Berhad), funded the installation of smart traffic management system project in collaboration with MP Sepang and MdeC. Mounted above the traffic lights are LTE-equipped controllers that run video cameras with analytic capabilities. The cameras analyse the traffic situation and intelligently direct traffic at the intersection to reduce waiting time at traffic lights.

The smart traffic management system project covered eight (8) junctions starting from from junction 1 at SK Cyberjaya / MMU to junction 8 at Shaftsbury Square along Persiaran Multimedia, covering about 3.7km. The system has improved the movement for both point from junction 1 to junction 8 and back. Travel time was previously around 30 minutes and after implementation it was reduced to between 10 to 15 minutes.

The deployment of the smart traffic system not only would smoother the traffic flow, but also would improve the management between the various authorities, agencies, transport service providers and related parties to have a better understanding of traffic in Cyberjaya.

To deal with transport problems, it is not sufficient to just look at the provision of infrastructure alone. Instead, other aspect like Traffic Flow Management seems to be an effective strategy to deal with the problems and contributes to achieve sustainable development.

Based on the principle of traffic management and international experience in ensuring sustainable transport, below are ten potential approaches towards traffic management sustainability (Source : www.sciencedirect.com) :

- **Control transport demand** – via land use control. Integrate transit and land use planning. One of the most effective strategy is TOD.
- **Control modal choice** - making the modes with lower preference less attractive and the preferred modes more attractive.
- **Use mobility pricing instruments to control demand** – e.g. vehicle and fuel taxes, city tolls, parking fees, public transport tariffs, public transport commuter pass for students and employees, road pricing scheme, etc..
- **Operate transport infrastructure dynamically and situation-responsive** – e.g. tidal-flow systems, traffic-actuated signal control, dynamic speed limits, dynamic route signs, on-demand public transport services, etc..
- **Promote new concepts of mobility** – e.g. UBER.
- **Promote the applications of Intelligent Transport Systems** - new technologies allow changes in mobility behaviour and support safe, efficient and environmentally compatible operations of traffic and transport systems. Intelligent Transport Systems (ITS) and its applications play an important role in transport as it can help improve traffic flow, road safety, security and crime reduction, public transport, freight efficiency and environmental impacts. Applications of ITS in urban public transport include : (1) pre-trip and in-trip information services via Internet and smart phone; (2) electronic displays on the remaining time that a vehicle will arrive at stop/station; (3) ticket vending machines; (4) electronic tickets; (5) security cameras; (6) electronic information signs; and (7) other passenger information services such as displaying vehicle location, walking distances between stops and parking information.
- **Pay a due attention to traffic safety and environmental impacts** – e.g. measures such as heavy vehicle bans, environmental zones and speed limits.
- **Make the quality of traffic transparent and improve it continuously** – established a comprehensive set of traffic performance measurements for the purposes of monitoring, evaluating and improving the performance of transport and traffic systems.
- **Provide sufficient and sustainable financing of transport** – stronger investment and new approaches to funding transport projects.
- **Create the right institutional framework for intermodal transport** – the needs for integrated traffic management authority that brings together the competences in public transport and road network operations on a regional level.

5.2.5 Building

A. Operational Energy Emissions / Operational Water Emissions

Operational energy and water emissions are very much related/associated to the efficiency of energy and water consumption of a building or structure. The way we design, build, renovate and operate buildings has repercussions on the environment and our planet. Sustainable buildings or green buildings are designed in such a way to reduce overall impact on environment and human health by efficiently using energy, water and other resources.

Currently, there are 19 completed green buildings in Cyberjaya whilst another 6 buildings are still under construction. The list of the buildings are shown in Table 5.9 and Table 5.10 :

Table 5.9: List of Completed Green Buildings in Cyberjaya

Completed			
Integrated DC Builders Sdn Bhd	Joyful Gateway Sdn Bhd	MyTelehaus Sdn Bhd	NTT Communications – Phase 1
NTT Communications – Phase 2	Quill Land Properties	Kompleks Terminal KLIA 2	Hotel Tune KLIA 2
Measat Broadcast Network Systems Sdn Bhd	Masjid Cyber 1	Centrus Mall @ CBD 3	Shaftbury Square – Block D
Shaftbury Square – Block E	TS Global	The Place – Tower 1	The Place – Tower 2
The Place – Retail Podium	Demi Murni – Cyber Square (SOHO)	Airasia - REDQ	

Table 5.10: List of Green Buildings Under Construction in Cyberjaya

Under Construction			
Lembaga Tabung Haji	Tujuan Gemilang Sdn Bhd – Tamarind Square (Phase 3)	Setia Haruman Sdn Bhd – Westlink (1 Block Office Suite Phase 1D)	Setia Haruman Sdn Bhd – Westlink (1 Block Office Suite Phase 1A)
Roppongi Development Sdn Bhd – CUCMS	Kenwingston – Phase 1		

Key Highlights

There are 19 completed green buildings in Cyberjaya whilst another 6 buildings are still under construction.

- Sustainable buildings or green buildings are designed in such a way to reduce overall impact on environment and human health by efficiently using energy, water and other resources.
- Conducting energy audit for buildings is recommended for discovering ways to make buildings much more energy efficient.

These green buildings in Cyberjaya are being certified by either Green Building Index (GBI) Malaysia or Leadership in Energy and Environmental Design (LEED) USA. GBI and LEED-certified buildings are resource efficient. They use less water and energy and reduce greenhouse gas emissions.

GBI and LEED are criteria-based rating tools. They are based upon a points system. The more points you earn, the higher your rating is. However, they do not measure the actual performance of energy consumption or efficiency of the building.

Conducting energy audit for buildings is recommended for discovering ways to make buildings much more energy efficient. Energy audit is a professional audit that is performed by utility company or other outside consultant to determine energy saving opportunities for one building. Since every building is unique, it is important to have an audit to assess each building unique needs.

As discussed earlier, MP Sepang has done an energy audit for its HQ building in February 2017 being undertaken by GreenTech Malaysia.

An energy audit will begin with an inspection of lighting, air conditioning, heating and ventilation, refrigeration, water-consuming equipment, controls, and anything else that uses energy.

- The building will then be provided with an energy report outlining the existing energy-consuming equipment and the energy balance. In addition, a presentation of energy conservation measures (ECM), which outlines the expected annual savings, the expected cost to implement the ECM, and the return on investment for your business, will also be provided.
- Efficiency in operational water emissions is attributed to water consumption. Practical measures to manage water consumption include :
- Water metering - the argument for water metering is that measurement facilitates water management and encourages consumers to save water.
- Low-consumption sanitary fittings and controls – such as low flush toilets (compared with standard toilets, they reduce water use through flushing by 35%), low-water or waterless urinals (operated with sensors, flushes can be reduced by 50%), water conservation fittings (e.g. spray taps, low-flow shower head).
- Sustainable urban drainage systems (SUDS) - sustainable urban drainage systems provide plenty of opportunities for rainwater capture and storage, as well as mitigating storm water run-off.
- Rainwater harvesting system - rainwater harvesting involves using some or all of a scheme's catchment for the capture and storage of rainwater for reuse.
- Greywater recycling - greywater recycling is concerned with the capture, treatment, storage and reuse of waste water. Only lightly contaminated water can be used in greywater systems, typically sourced from baths, showers and basins.

It is recommended that the energy audit exercise to be expanded to other government or public buildings in Cyberjaya in discovering ways to make buildings much more energy/resource efficient.

B. Emission Abatement through Retrofitting

Retrofitting is the process of modifying something after it has been manufactured. For buildings, this means making changes to the systems inside the building or even the structure itself at some point after its initial construction and occupation.

Typically, this is done with the expectation of improving amenities for the building's occupants and/or improving the performance of the building. The development of new technologies mean that building retrofits can allow for significant reductions in energy and water usage.

Undertaking a green retrofit of a building is the sustainable way of retrofitting. It brings about both tangible and intangible benefits to the owner and tenants. It can reduce the energy consumption, utilities and water consumption. It also improves the building's indoor environment quality and reduces the negative impacts of buildings on occupants, especially work-environment related illnesses or 'sick building' syndrome.

Retrofitting can reduce emissions from buildings by extending the life cycle of existing building stock and enhancing the building performance.

C. Building Orientation

Building orientation affects air conditioning and heating energy requirements through solar radiation (heating effects on walls and rooms) and ventilation (associated with the direction of prevailing winds and building orientation). In hot humid climates, the solar influence on energy consumption in buildings is significant; therefore design strategies are focused on reducing heat gain.

Well-orientated buildings maximise day lighting through building facades, reducing the need for artificial lighting. Some typologies especially housing can be zoned to ensure different functional uses receive sunlight at different times of the day. Buildings that maximise sunlight are ideal for the incorporation of passive solar techniques that can reduce carbon use and enhance user comfort. Careful strategies can also mitigate overheating and glare when sunlight is excessive.

Optimise passive and active design strategies to reduce heat gain in buildings.

D. Shared Facilities and Utilities Within Building

This sub-criteria is about sharing and integrating community service centers with other building uses. The main idea is to saves green area and ensure sustainable land uses. Common practice in Malaysia using the traditional way through land take which results to dispersion of development and single zoning – residential, commercial, industrial, institutional, etc.

Instead of using the traditional land uses, sharing and integrating should be applied. Facilities and community services such as kindergartens, post office and town hall should be integrated with other building uses such as offices. By doing this, it is not only a sustainable choice of land use planning, instead, it helps reduce inappropriate land take as well as reduce C02 emissions.

Reduce land take for community services and encourage flexibility of use of buildings and simultaneously reduce carbon emissions due to sprawl and change of land uses.

Chapter 6.0 Smart & Green Action Plans

6.1 Introduction

6.1.1 Definition of Type of Actions

As being discussed in the previous chapter, the formulation of Key Action Plans for Cyberjaya Smart & Low Carbon City 2025 are guided by three (3) Guiding Principles – Low Carbon, Smart and People. These Guiding Principles are also used to determine the key focus area for accessing current spatial conditions of Cyberjaya to draw relevant Key Action Plans needed for the transformation.

For the purpose of having much more practical action plans, the recommended key actions have been grouped together into two (2) type of actions according to their intended pursuit, as visualized in Figure 6.1 below :

Figure 6.1 : Type of Actions

New

Actions related to **"establishing of new physical things/programs/projects/activities/ investment"** for improving function and vitality.

Enhance

Actions related to **"restoring/enhancing existing components/programs/projects/activities"** - such as buildings, infrastructure, streetscape etc., - for improving or enhancing current condition.

Each type of action is important as it determines the followings :

- Relevant spatial and program strategies that will guide low carbon development in Cyberjaya;
- Inter-relation between various type of policies and guidelines from national, state and local levels;
- Physical locations where initiatives come together to respond to the key opportunities and challenges,
- Proposed delivery timeline or type of delivery timeline; and
- Proposed targets so that performance can be measured and monitored.

6.1.2 Technology and Mechanism

Technology and Implementation Mechanism are critical enablers to ensure that the approach is holistic and the actions are successfully implemented as planned.

Figure 6.2 : Key Enablers

TECHNOLOGY

Technology or "smart" interventions will be a key enabler in the implementation of key actions via supporting delivery of high environmental performance and helping to monitor and maintain operations.

- The role of technology must be considered in the key actions to ensure it is in line with the current agenda of Selangor State Government.

MECHANISM

Implementation mechanisms need to be considered as they are critical to the success of the key actions and the transformation.

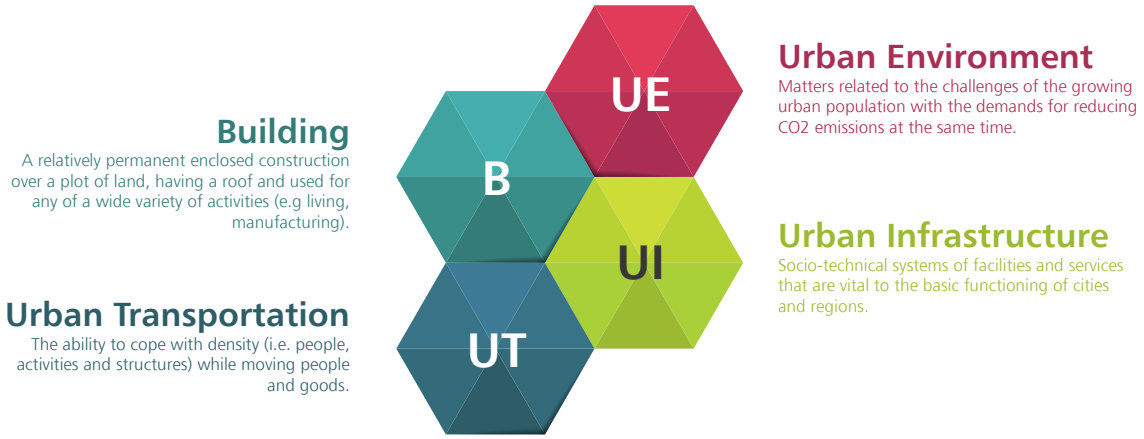
- Part of the implementation mechanism is to monitor and manage performance to keep the sustainability path on track.
- This may require policy interventions, leadership, collaboration with communities and partnership with private sectors.

6.1.3 Relationship with LCCF

It is important that the key actions are linked to LCCF, mainly for the purpose of measuring the performance of the proposed key actions in terms of CO2 emission.

To re-cap, LCCF has four (4) key elements as illustrated in the diagram below :

Figure 6.3 : Key Elements of LCCF



6.1.4 Link to Smart Selangor Agenda

As being discussed earlier, technology or "smart" interventions must be considered in the key actions to ensure it is in line with the current agenda of Selangor State Government.

To re-cap, Smart Selangor emphasizes on twelve (12) key dimensions as indicated in the diagram below :

Figure 6.4 : Key Dimensions of Smart Selangor Blueprint

6.1.5 Link Between LCCF and Smart Selangor

It is necessary to note that all the four (4) key elements of LCCF are inter-related with the twelve (12) key dimensions of Smart Selangor Blueprint, as being illustrated in the diagram follows :

Figure 6.5 : Correlation Between LCCF and Smart Selangor Blueprint

6.2 Synopsis of Key Actions

6.2.1 Key Strategies

For the purpose of expediting the implementation and measuring the performance, the Key Action Plans have been divided into seven (7) distinguished Strategies as being illustrated below :

Figure 6.6 : Key Strategies of Cyberjaya Smart & Low Carbon City 2025

Collaborative Actions

The full-circle approach expedites the implementation of all the key and sub-actions in a collaborative manner. As such, every action becomes a group effort and responsibilities are shared. Ultimately, it is a win-win situation for every stakeholders involved.

1	7	24	62
Vision	Key Strategies	Key Actions	Sub-Actions

6.2.2 Linking Key Strategies to Type of Actions

Key Strategies are being mapped to Type of Actions for the guidance towards implementation.

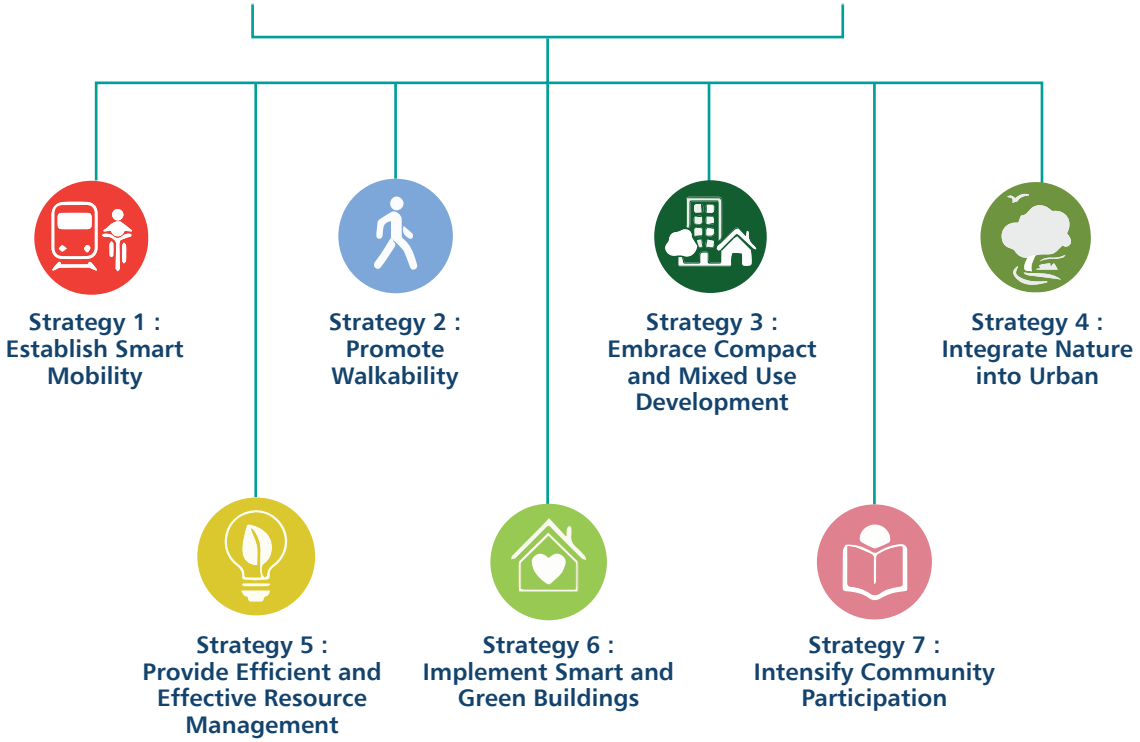
Figure 6.4 : Mapping Key Actions to Type of Actions

New

Actions related to **"establishing of new physical things/programs/projects/activities/ investment"** for improving function and vitality.

Enhance

Actions related to **"restoring/enhancing existing components/programs/projects/activities"** - such as buildings, infrastructure, streetscape etc., - for improving or enhancing current condition.



6.3 Details of Key Action Plans

The seven (7) Key Strategies have been formulated based on the three (3) Guiding Principles and through assessment on the spatial planning and development of Cyberjaya. The Key Actions together with their sub-actions have also been dialogued with key stakeholders of Cyberjaya during a Focus Group Discussion held on 3rd August 2017, at Marriot Putrajaya.

Each Key Action together with its Sub-Actions are further detailed out in the following section.

A. Strategy 1 : Establish Smart Mobility

Overall Target

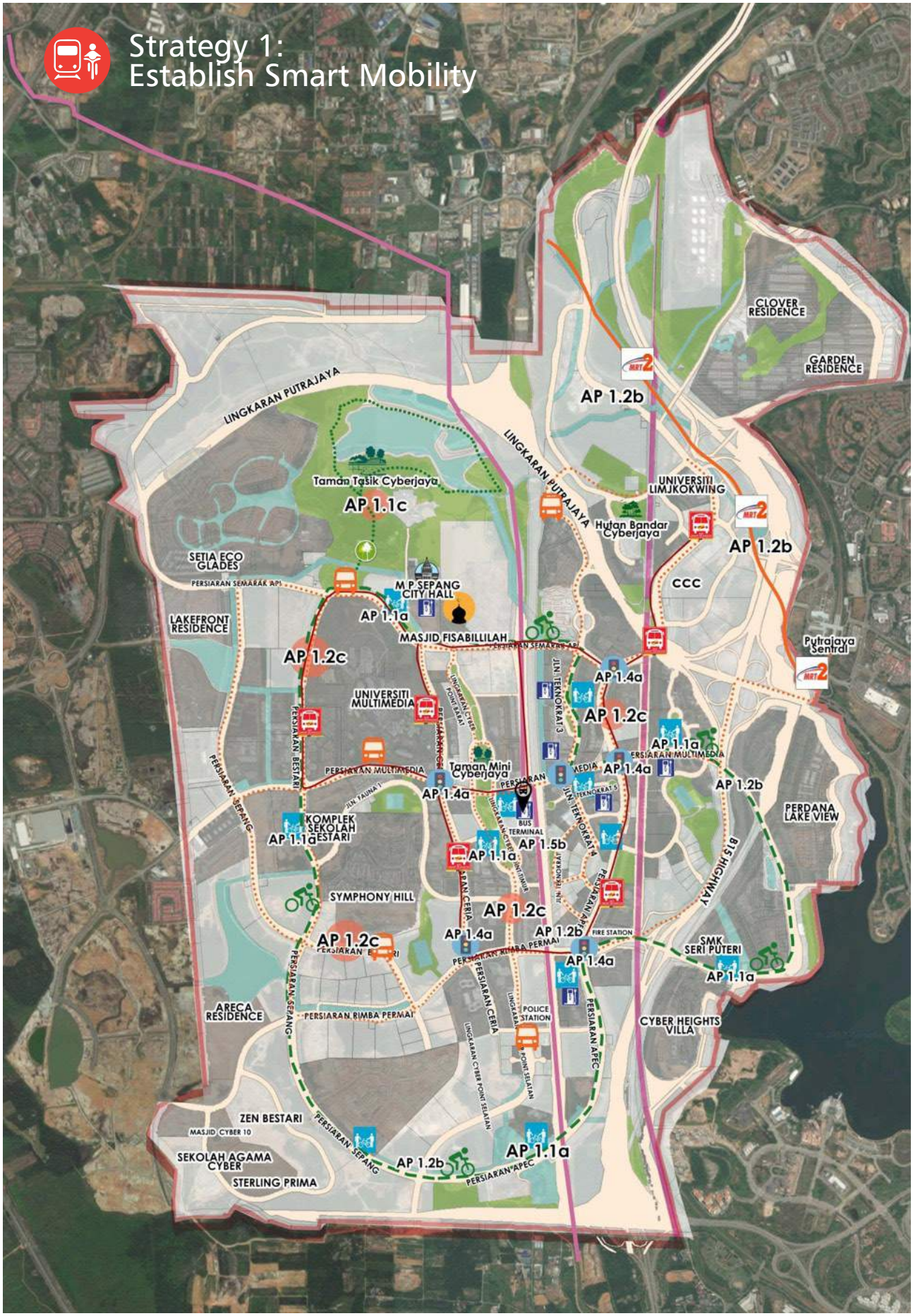
80% coverage of integrated green mobility network by 2025.

Benefit

A more comfortable commute & real time transport updates to mobile phones can help navigate overcrowding and congestion on busy routes.

Mobility and transport are crucial for a city to function properly. Cyberjaya will be the capital of smart and intelligent systems of mobility.

Figure 6.4 : Locations of Sub-Actions Under Strategy 1



Strategy 1: Establish Smart Mobility

Target : 80% coverage of integrated green mobility network by 2025

	Sub- Actions	Type of Actions	Link to LCCF	Link to Smart Selangor	Targets
Key Action 1.1 : Creating A Bike-Friendly Cyberjaya					
1.1a	Enhance existing bike sharing program with OBike and encourage more users to ride bicycles by improving access to rental bike locations (e.g. integrate bike stations with bus stops/TOD).	E	UT	Smart Mobility & Transportation	▪ Increase the number of bike users to 20% (2020), 30% (2025) and 50% (2030)
1.1b	Review, improve and expand the current bike routes and ensure their functionality and connectivity.	E	UT	Smart Mobility & Transportation	▪ Phase 1 : ✓ 5.8 km ✓ Location - Persiaran Semarak Api (P1) and Persiaran Flora (P2) ▪ Phase 2 : ✓ 13.4 km ✓ Location - Persiran Bestari, Persiran Multimedia, Persiaran Tasik, Lingkaran Cyberpoint Timur, Lingkaran Cyberpoint Barat and Persiaran Cyberpoint Selatan
1.1c	Construct "Cyberjaya Green Parkway" with quality facilities/amenities (e.g. rental bicycles), improvement on the landscape and creating nodes of activities.	E	UE	Smart Mobility & Transportation	▪ 1.3 km bike-way ▪ Location : Cyberjaya Lake Gardens
Key Action 1.2 : Defining Bus Priority Systems And Smart Services In Cyberjaya					
1.2a	Plan for bus stops that are well integrated with land use activities.	E	UE	Smart Mobility & Transportation	▪ Number of bus stops in city centre (TOD) : 20 ▪ Overall number of bus stops in Cyberjaya : 54
1.2b	Integrate with future MRT or Regional Transit System.	E	UT	Smart Digital Infrastructure	▪ 50% increase in public transport ridership by 2025
1.2c	Install smart apps (e.g. GPS, Real Time Info, Real Time Tracking Devise) in all public transports.	N	UT	Smart Mobility & Transportation	▪ Increase modal split from current 7% to 15%
1.2d	Invoke aggressive promotion and advertisement on the usage of public transport to increase more ridership.	E	UT	Smart Mobility & Transportation	▪ Over 50% of trips are made by foot, bicycle and public transport

Strategy 1: Establish Smart Mobility

Target : 80% coverage of integrated green mobility network by 2025

Sub- Actions		Type of Actions	Link to LCCF	Link to Smart Selangor	Targets
Key Action 1.3 : Making Alternative Vehicle Mode Sharing System Works In Cyberjaya					
1.3a	Increase , improve and promote the usage of existing Smart Car Sharing Scheme under GoCar as well as promote the cars run by EV.	E	UT	Smart Digital Infrastructure	▪ Increase current number of GoCars from 10 to 30 ▪ Expand current locations which are Shaftsbury Residences, Burger King, Prima Avenue (Starbucks) and Tan'Yaa Hotel
1.3b	Introduce EV Scooter Sharing Service/Scheme.	N	UT	Smart Mobility & Transportation	▪ 40% reduction of road space
Key Action 1.4 : Implementing More Efficient Traffic Flow And Environmental Conditions.					
1.4a	Install more smart traffic management system to control congestion during peak hours.	E	UT	Smart Digital Infrastructure	▪ Increase current coverage from 3.7 km (from junction 1 at SK Cyberjaya/MMU to junction 8 at Shaftsbury Square along Persiaran Multimedia) to 8.0 km ▪ Reduce traffic by 10 to 15 minutes
Key Action 1.5 : Promoting Clean And Energy Efficient Vehicles					
1.5a	Improve visibility of EV charging stations for private vehicles along prominent roads.	N	UT	Smart Mobility & Transportation	▪ 50% increase in smart vehicle ridership by 2025
1.5b	Provide EV charging station facilities for buses at terminal hub and Park & Ride.	N	UT	Smart Development	▪ Wide and efficient coverage of charging facilities for usage of electric vehicles
1.5c	Convert conventional public transport vehicles to green vehicles (e.g electric bus, hybrid taxi) by 2025.	N	UT	Smart Development	▪ 100% usage of electric buses by 2025 ▪ 70% usage of hybrid/electric taxis by 2025 ▪ Increase number of buses from 20 to at least 100

A Conventional bus : 38.7 kg a day
An E-bus : 23.52 kg a day
Increase number of buses to encourage more usage of public transport over private car. Buses carry 9 times the passengers that cars can carry and therefore are a better choice of transport out of the two. By converting to E-buses, Cyberjaya will **save 40%** of unnecessary CO^2 emissions.

B. Strategy 2 : Promote Walkability

Overall Target

Walking to account for 60% of total trips by 2025

Benefit

People who live in walkable neighbourhoods are

2 Times

as likely to get enough physical activity as those who don't

Our aim is to make cyberjaya a demonstration of "walkable urban district" with "good connectivity of green mode transport", which ultimately enable it to reduce the CO2 emission significantly.

Figure 6.5 : Locations of Sub-Actions Under Strategy 2

Strategy 2: Promote Walkability

Target : Walking to account for 60% of total trips by 2025

Sub- Actions		Type of Actions	Link to LCCF	Link to Smart Selangor	Targets
Key Action 2.1 : Making Walk Interesting And Safe					
2.1a	Create "Cyberjaya Link" to increase pedestrian vibrancy (e.g. covered walkway or shaded trees, parklets and public arts) – to encourage people to walk for leisure as well as business.	N	UE	Smart Development	▪ 40% of street edges with active activities along the main street of Cyberjaya ▪ Phase 1 - 8 km (along the Pesiaran Multimedia, Jalan Teknokrat 3, 4 & 5, Jalan semarak Api & Jalan Perdana)
		Impact - reduce private car travel by 10% and decrease total daily private transport emissions from **81,776 kg** to **73,599 kg** of CO2.			
2.1b	Ensure comfortable and safe walkways by providing 24-7 surveillance and proper lightings as well as creating new nodes as places to rest before people continue walking to their final destination.	E	UE	Smart Development	▪ 50% accessible and comfortable walkaways by 2025 ▪ Increase walking to account for 60% of trips by 2025 ▪ Total walkway for entire Cyberjaya – 39 km
2.1c	Encourage flexible sidewalk cafes (on utilities corridor) that add visual appeal to attract people and to slow down vehicle speed.	E	UE	Smart Development	▪ 40% of street edges with active activities along the main street of Cyberjaya ▪ Total length of 7 km - along the Pesiaran Multimedia, Jalan Teknokrat 3, 4 & 5, Jalan semarak Api & Jalan Perdana
		Impact – reduce vehicular transport by 15%, reduce emissions from **88,706 kg** to **75,400 kg a day** and reduce carbon footprint by **30,342 tons a year.**			
Key Action 2.2 : Making Walk Convenient, Quick And Easy Through Local Connection					
2.2a	Integrate and connect public and private green open spaces with pedestrian and cycling networks.	N	UT	Smart Development	▪ 2 hectares of open spaces and parks per 1,000 population ▪ Parks are located within 400 m and within walking distance ▪ 7 km total length of green connector (Setia Eco Park, Clover Residence, Lakeside Residence, Areca Park Area)
2.2b	Impose through block connector in between private and public buildings.	E	UE	Smart Development	▪ 30% reduction of door to door journey within Cyberjaya

Strategy 2: Promote Walkability

Target : Walking to account for 60% of total trips by 2025

Sub- Actions		Type of Actions	Link to LCCF	Link to Smart Selangor	Targets
Key Action 2.3 : Making Pedestrian Priority Zone					
2.3a	Organise a monthly event like Cyberjaya Car Free Festival.	E	UE	Smart Development	▪ Inculcate transport behavior shift from car to public transport
		With no private cars travel for one day a month, Cyberjaya is expected to reduce its carbon foot print by 81,776 kg. Annually, this will accumulate to **981,312 kg or 1,082 tons of CO2 a year.**			
2.3b	Impose guideline for efficient block size as well as guideline to integrate pedestrian and cycling network within the pedestrian priority zone (i.e. area within 250m distance from TOD/ Nodes) to increase permeability.	E	UT	Smart Mobility & Transportation	▪ Reduce parking provision at TOD areas by 50% at 250 m radius from transit stop ▪ Maximum 5 minutes walk to public transport stops (380 m)
		By making walking and cycling easier options than private travel, this could see a 30% decrease in private car travel and a 20% increase in public transport travel. Total carbon footprint reduction - **23,052 kg a day** or **276,618 kg/year (305 tons of CO2 a year).**			

C. Strategy 3 : Embrace Compact & Mixed Use Development

Overall Target

Reduce door to door journey time within Cyberjaya by 20 minutes

Benefit

The creation of the modern compact city demands the rejection of single-function development and the dominance of cars.

Cyberjaya will be a future ready built environment with all amenities and activities spread vertically and horizontally. Everything is within reach to create a sustainable lifestyle.

Figure 6.6 : Locations of Sub-Actions Under Strategy 3

Strategy 3: Embrace Compact & Mixed Use Development

Target : Reduce door to door journey time within cyberjaya by 20 minutes

Sub- Actions		Type of Actions	Link to LCCF	Link to Smart Selangor	Targets
Key Action 3.1 : Promoting Compatible Land Use Mix					
3.1a	Create neighbourhood scale commercial activity closer to residential area (i.e. at the edges of Cyberjaya or at least 5 km away from the CBD).	N	UE	Smart Development	▪ Reduce door to door journey time within Cyberjaya that eventually reduces CO2 emissions
3.1b	Increase mixed use development in enterprise zone with 70% commercial and 30% enterprise as well as add service apartments to increase population/density and ridership of public transport.	E	UE	Smart Development	▪ Enable journey time for basic needs within 20 minutes ▪ Bring jobs and commercial activities closer to 60 % residents of Cyberjaya ▪ Increase population density
Key Action 3.2 : Fostering Efficient Use of Urban Spaces					
3.2a	Identify TOD Zone for areas around major transit hubs with transit supportive guidelines such as: ▪ increasing intensities and concentration of developments with adequate mix of use; ▪ introducing reduction in parking spaces for TOD Area; ▪ providing clear and comfortable pedestrian access to areas around transit stops.	N	UE	Smart Development	▪ Maximum 5 minutes walk to public transport stops (380 m) ▪ 90% public transport coverage ▪ Encourage walking ▪ 40% reduction of CO2 emission from private vehicles ▪ 40% cleaner air
3.2b	Integrate Community Centre as one-stop amenities hub with new and innovative elements of integrated development such as hawker centre, library, Day-care, Clinic and other community facilities.	E	UE	Smart Development	▪ Reduce door to door journey time within Cyberjaya

D. Strategy 4 : Integrate Nature Into Urban

Overall Target

35% increase in carbon sequestration from baseline and 30% increase in ecological biodiversity (Eco-D) by 2025

Benefit

Nature improves city's air, water and visual appeal.

Cyberjaya will bring biodiversity back to urban area as it provides vibrant public spaces, encourage healthy lifestyle as well as create value to surrounding developments.

Figure 6.7 : Locations of Sub-Actions Under Strategy 4

Strategy 4: Integrate Nature Into Urban

Target : 35% increase in carbon sequestration from baseline and 30% increase in ecological biodiversity (Eco-D) by 2025

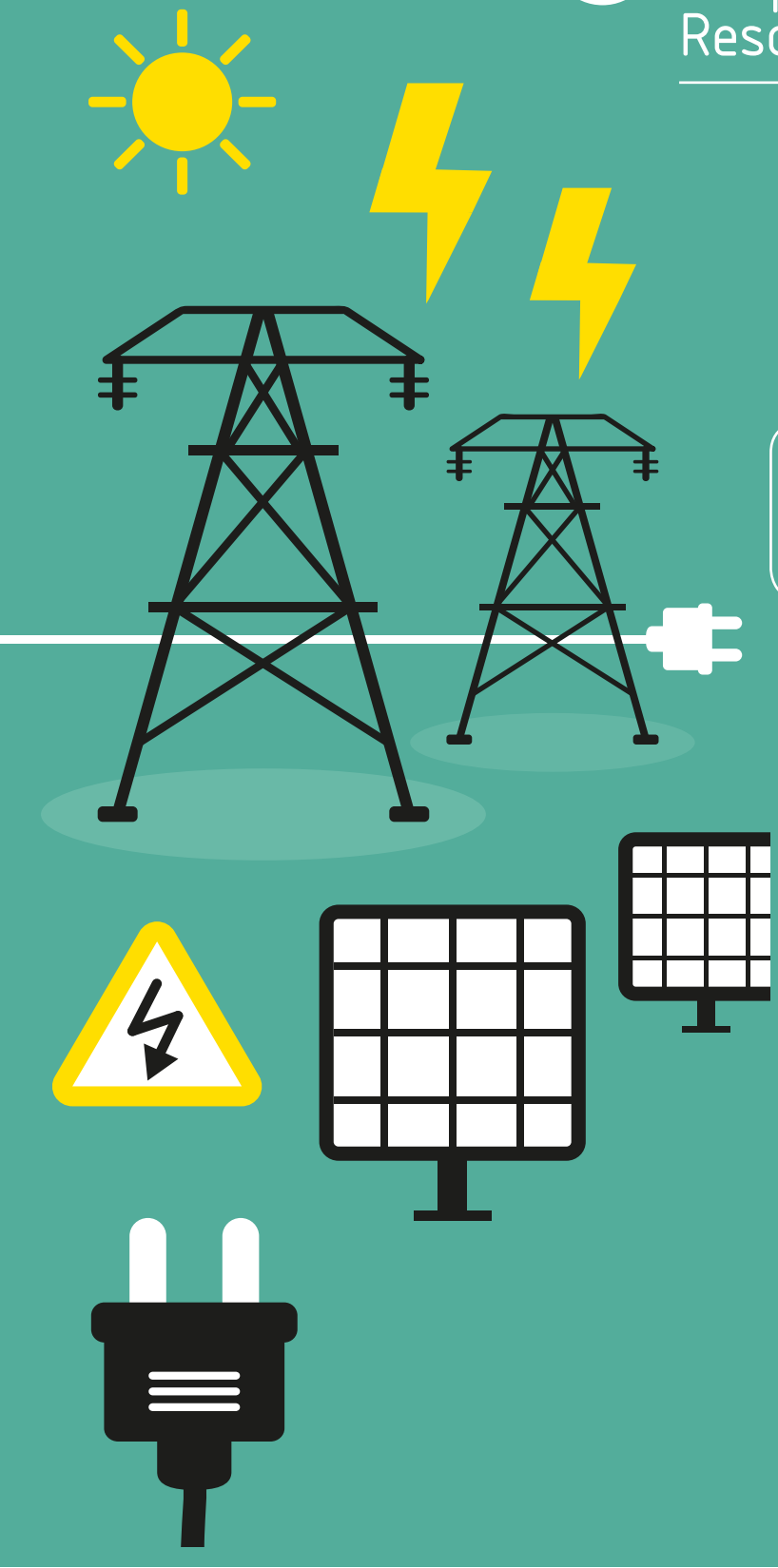
Sub- Actions		Type of Actions	Link to LCCF	Link to Smart Selangor	Targets
Key Action 4.1 : Enhancing The Environmental Quality					
4.1a	▪ Convert conventional drainage to Sustainable Urban Drainage System (such as Bio-ecods, Bioswales) to ensure effective water detention & retention,as well as improve water quality & biodiversity. ▪ Turn it to be used as recreational spaces. ▪ Add smart sensors to detect pollution.	E	UE	Smart Development	▪ Improve River Water Quality to Class 1 and Class 2 by treating storm water run-off before discharging it into regional ponds & rivers ▪ 4 km of waterway / main drain
4.1b	▪ Plant specific tree types/species that increase urban canopy and urban biodiversity. ▪ Encourage xeriscaping for sustainable landscape maintenance.	E	UE	Smart Development	▪ Reduce UHI Effect at street sidewalks by 2 ˚Celsius ▪ Over 50% shaded pedestrian walkways ▪ Increase rate of carbon sequestration from tree planting by 35% from baseline by 2025 ▪ Plant 5,000 trees per year
Key Action 4.2 : Providing Quality And Functional Recreational Facilities					
4.2a	Establish and encourage Urban Farming activities in every neighborhoods, schools and city parks.	E	UE	Smart Development	▪ Increase awareness on environmental issues ▪ Decrease 10% carbon emission for not transporting foods into Cyberjaya
4.2b	Rejuvenate existing parks that cater for all ages and conduct new activities and new amenities/facilities (e.g movie park, music park, etc.).	E	UE	Smart Development	▪ Increase the area of green spaces and parks to absorb more carbon ▪ 2 Parks (Taman Mini Cyberjaya South and North)

Strategy 4: Integrate Nature Into Urban

Target : 35% increase in carbon sequestration from baseline and 30% increase in ecological biodiversity (Eco-D) by 2025

Sub- Actions	Type of Actions	Link to LCCF	Link to Smart Selangor	Targets
Key Action 4.3 : Imposing Smart Planning Tools For Low Carbon Planning				
4.3a Develop and enforce Smart Planning Tools Guideline on KM2 Submission with modelling tools to help Local Authority to simulate environmental conditions (such as wind flow, sun and shade) for better city planning.	N	UE	Smart Digital Infrastructure Smart Governance	▪ Increase commitment and participation from private sectors and developers ▪ Increase efficiency for processing downtime ▪ Support MP Sepang's sustainability agenda
4.3b ▪ Develop smart apps for Nature Interpretation and Park Activities for recreational and education purposes. ▪ Develop smart apps for tree measurements to estimate ecosystem services (economic and environmental value).	N	UE	Smart Digital Infrastructure	▪ Increase awareness on environmental issues ▪ Increase rate of efficiency in performance monitoring

E. Strategy 5 : Adopt Efficient and Effective Resource Management Practices



Overall Target

Wide application of smart/green technology in managing resources

Benefit

The use of renewable energy significantly reduces harmful co2 emissions.

Efficient resource management reduces co2 emissions significantly and can be achieved through the application of smart/green technology.

Figure 6.8 : Locations of Sub-Actions Under Strategy 5

Strategy 5: Adopt Efficient and Effective Resource Management Practices

Target : Wide application of smart/green technology in managing resources

Sub- Actions		Type of Actions	Link to LCCF	Link to Smart Selangor	Targets
Key Action 5.1 : Improving Solid Waste Collection And Treatment					
5.1a	▪ Introduce 3 bin system for separating organic waste, recycle and non recycle materials at residential, public buildings (e.g. schools, bus stops, etc.) and main roads. ▪ Enforce separation at source. ▪ Introduce e-waste program to dispose electronics waste (like mobile phones).	N	UI	Smart Waste Management System	▪ Increase recycling rate by 10% ▪ Divert waste dumping to landfill by 30%
5.1b	Introduce pre-treatment system such as MRF for waste minimization and segregation.	N	UI	Smart Waste Management System	▪ Divert waste dumping to landfill by 30% ▪ Increase recycling rate by 10%
Key Action 5.2 : Greening The Waste Water System					
5.2a	Adopt to Sustainable Sewerage Treatment Plant (STP) by : ▪ Converting existing STP to sustainable STP systems; ▪ Constructing future new STP with sustainable STPs; ▪ De-centralizing future STPs to encourage the utilization of recycle water to local area neighborhood.	N	UI	Smart Waste Management System	▪ Increase usage of recycle water by 10% ▪ Increase production of energy generated from biogas by 5% ▪ Reduce energy consumption to operate plant ▪ Reduce sludge
Key Action 5.3 : Implementing Integrated Waste to Energy/Wealth Project					
5.3a	▪ Conduct Feasibility Study on waste to energy (WTE) project leveraging on the GTALCC Fund & Assistance. ▪ To include Microgrid study and Smart Grid Implementation. ▪ Set up WTE project that potentially generates biogas, synthetic fuel (diesel) and engineered soil.	N	UI	Smart Development Smart Waste Management System	▪ Reduce dependency on landfill ▪ Promote green economics ▪ Generate streams of revenue
Key Action 5.4 : Improving Telecommunication Services					
5.4a	Make Cyberjaya a city-wide high speed wireless connection leveraging on existing and new platform like LORA.	E	UI	Smart Digital Infrastructure	▪ High speed free Wi-Fi in Cyberjaya by 2020

Strategy 5: Adopt Efficient and Effective Resource Management Practices

Target : Wide application of smart/green technology in managing resources

Sub- Actions		Type of Actions	Link to LCCF	Link to Smart Selangor	Targets
Key Action 5.5 : Improving Water Management System					
5.5a	▪ Introduce advanced water like underground water extraction. ▪ Encourage the utilization of recycle water from STPs to local area neighbourhood.	N	UI	Smart Water Management	▪ Reduce total dependency of potable water supply from surfaced water stored in reservoirs
Key Action 5.6 : Reducing Energy Consumption					
5.6a	Convert existing conventional District Cooling System (DCS) to green DCS by using recycle water and running on Renewable Energy.	E	UI	Smart Waste Management System Smart Energy	▪ Reduce usage of potable water by 50% ▪ Increase usage of recycle water ▪ Reduce energy consumption
5.6b	Increase more innovative use of solar panel in Cyberjaya for common area consumption : ▪ Floating solar panel on retained water bodies; ▪ Façade and roofs of public buildings; ▪ Car park areas; and ▪ Utility buildings.	E	UI	Smart Energy	▪ Increase usage of Renewable Energy

F. Strategy 6 : Implement Smart & Low Carbon Buildings

Overall Target

40% energy reduction from buildings by 2025

Benefit

Studies on green buildings found that employees had fewer illnesses and were more comfortable, happy & productive.

Encourage energy efficient buildings in cyberjaya by designing buildings that causes less energy and explains opportunities to produce renewable energy to offset the annual co2 emmision associated with building operations.

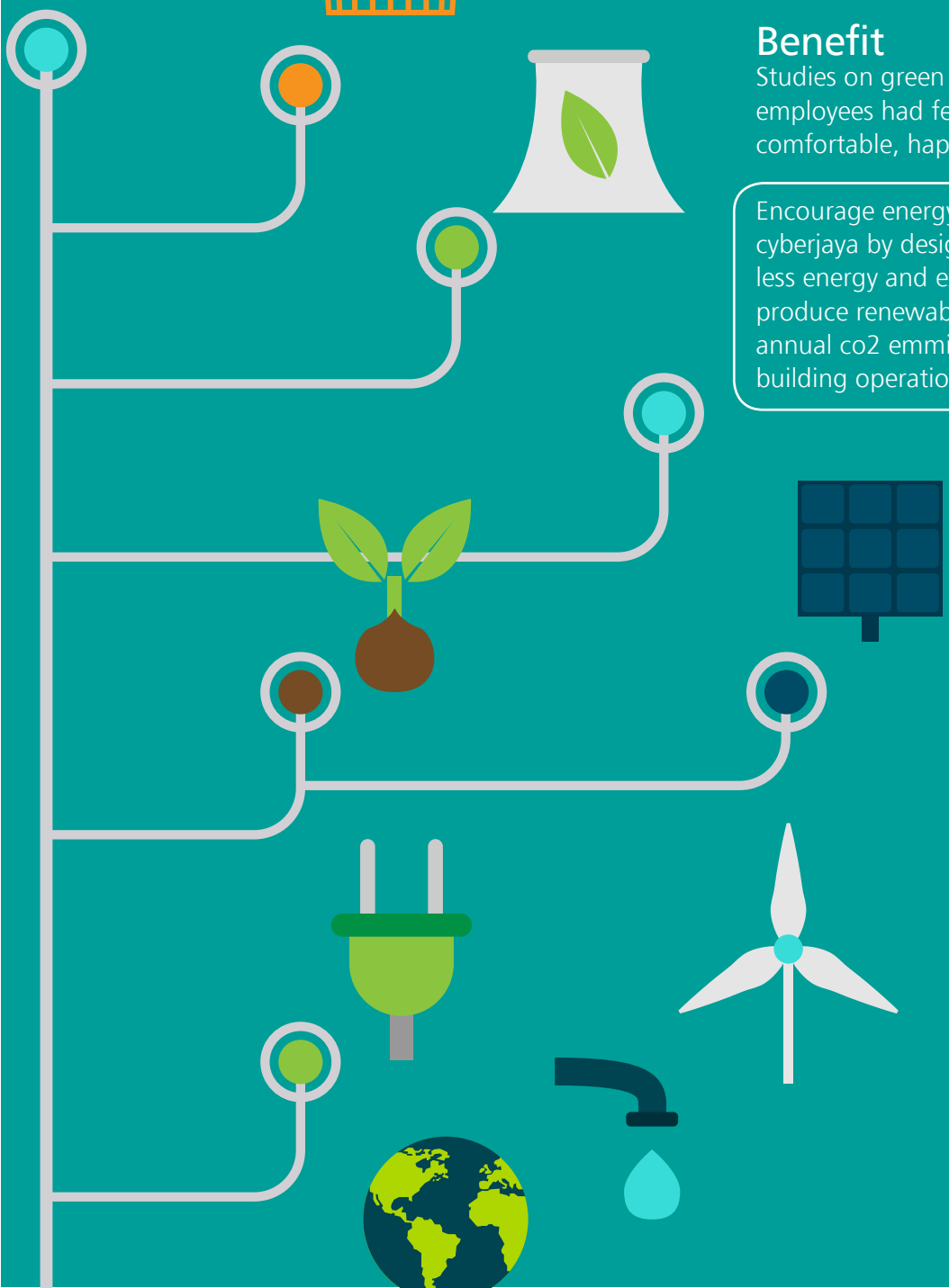


Figure 6.9 : Locations of Sub-Actions Under Strategy 6

Strategy 6: Implement Smart & Low Carbon Buildings

Target : 40% energy reduction from buildings by 2025

Sub- Actions		Type of Actions	Link to LCCF	Link to Smart Selangor	Targets
Key Action 6.1 : Implementing Energy Reduction Practices In All Buildings					
6.1a	Conduct energy audit as the first step in identifying opportunities to reduce energy consumption and carbon footprints.	N	B	Smart Energy	▪ 100% of public buildings have conducted energy audit ▪ 50% of commercial buildings have conducted energy audit ▪ An average of 20% reduction of energy consumption in buildings over current levels by 2025
6.1b	Impose installation of water and energy efficient fixtures/appliances/apparatus to all buildings.	E	B	Smart Energy	▪ An average of 10% reduction of energy and water consumption in residential buildings
6.1c	Promote the usage of solar energy in residential areas of Cyberjaya using the NEM scheme.	N	B	Smart Governance	▪ Reduce dependency on power grid
6.1d	Provide Passive Design Toolkits and Low Carbon Home Renovation Guidebook to educate and update homeowners with information on sustainable material providers.	N	B	Smart Governance	▪ 50% of home owners engaged in the 'Home Energy Program' by 2025
6.1e	Replace existing conventional electricity consumption measurement systems with respective smart meters.	E	B	Smart Energy	▪ 5% annual reduction on energy consumption using 2016 as baseline
6.1f	Implement energy management system (EMS) on public buildings and eventually expand to commercial buildings.	N	B	Smart Energy	▪ An average of 20% reduction of energy consumption in buildings
6.1g	Encourage buildings to produce on-site carbon free Renewable Energy in the amount to offset the annual CO_2 emission associated with the buildings' operations.	N	B	Smart Energy	▪ An average of 60% reduction of energy consumption in buildings over current levels by 2025
6.1h	Develop/install/use more smart apps on real- time information through intelligent and wireless connection especially at public buildings (e.g. parking sensors at mall and hospital, LED advertisements on buildings, etc..).	E	B	Smart Energy	Increase efficiency and convenience to end-users

Strategy 6: Implement Smart & Low Carbon Buildings

Target : 40% energy reduction from buildings by 2025

Sub- Actions		Type of Actions	Link to LCCF	Link to Smart Selangor	Targets
Key Action 6.2 : Imposing Compulsory Low Carbon Building Regulations At City Council Level					
6.2a	Impose rule of "passive design first then active".	N	B	Smart Governance	▪ 100% of newly constructed buildings to incorporate "passive design first" rule
6.2b	Enforce the adoption of MS1525 (Energy Efficiency And Use Of Renewable Energy For Non- Residential Buildings) to all public buildings and eventually expand to commercial buildings.	E	B	Smart Energy	▪ An average of 20% reduction of energy consumption in buildings ▪ 100% public buildings adopt MS1525 ▪ 20% of commercial buildings adopt MS1525
6.2c	Impose additional 5% vertical greenery to the existing 10% of green on ground level within building plot.	N	B	Smart Governance	▪ Cooler buildings and surroundings ▪ Reduce energy consumption
6.2d	Impose low carbon certification requirement for public buildings and on developers for commercial buildings.	E	B	Smart Governance	▪ Increase the number of green certified building from the current 19 buildings ▪ 100% for public buildings ▪ 40% for commercial buildings

A conventional building (typical consumption) : 200- 300 kWh/m^{2}year
A Low Carbon Building : 35 to 65 kWh/m^{2}year
In a conventional building, the embodied energy or carbon represents 15-20% of total carbon emission in a life cycle of building. Whilst, operational energy or carbon represents 80% of energy usage. Hence, emphasis should be placed on reducing operational carbon. This can be achieved through initiatives like sustainable energy management program and energy auditing to explore potential savings and identify energy saving measures. Low carbon building will save and reduce 56% of unnecessary CO^2 emissions of operational carbon.

G. Strategy 7 : Intensify Community Participation

Overall Target

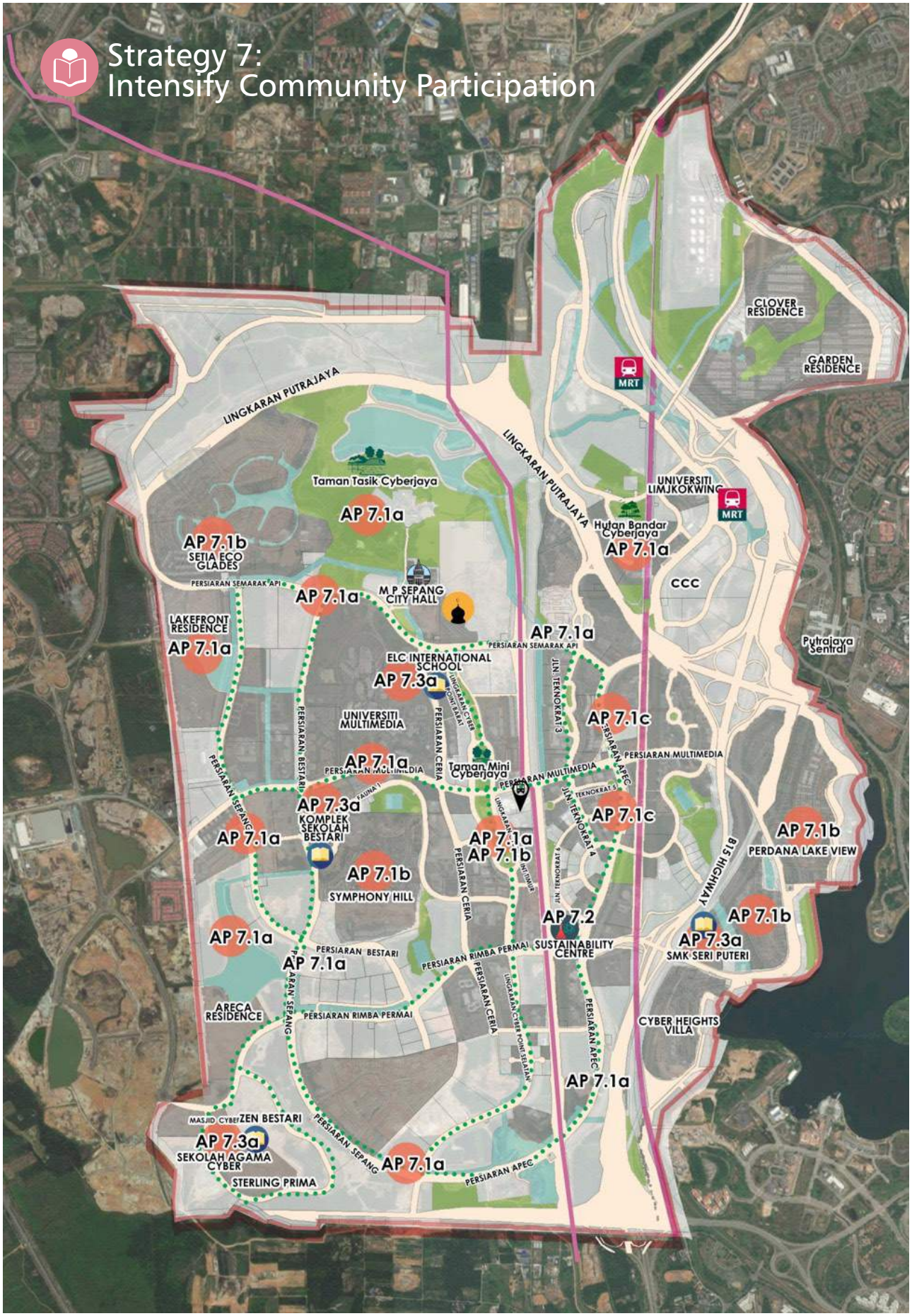
Increase awareness and develop low carbon community

Benefit

Building a community surrounded by people who share similar values

Cyberjaya is set to become a smart and green living in malaysia. Through participation of sustainable events by community and various stakeholders, cyberjaya will create a sense of well being and inclusiveness.

Figure 6.10 : Locations of Sub-Actions Under Strategy 7



Strategy 7: Intensify Community Participation

Target : Increase awareness and develop low carbon community

Sub- Actions		Type of Actions	Link to LCCF	Link to Smart Selangor	Targets
Key Action 7.1 : Organizing Various Community Projects					
7.1a	Introduce community empowerment and ownership projects : ▪ "Cyberjaya : Tree for Life" Program - a fun tree planting program to increase green spaces; ▪ "Adopt -A -Park" Program – whereby volunteers from schools, community and individuals participate/contribute to make adopted parks more vibrant and attractive.	N	UE	Smart Education	▪ Plant 10,000 trees per year to absorb more CO^2 ▪ Increase Public and Private Participation ▪ Empower community to take responsibility
7.1b	Initiate Urban Community Gardens Program or Rooftop Gardens Program.	N	UE	Smart Agriculture	▪ Increase environmental awareness ▪ Phase 1 - 20% of buildings in Cyberjaya with Rooftop Gardens
7.1c	Organize "Recycling Competition" event between Enterprises and residential neighbourhoods in Cyberjaya.	N	UE	Smart Waste Management System	▪ Contribute to increase the overall recycling rate in Cyberjaya ▪ Increase environmental awareness and participation ▪ Reduce waste dumping to landfill
7.1d	Develop an Award Program to reward good environmental behaviour and to recognize substantial contribution/initiatives towards the environment and low carbon development : ▪ Low Carbon Office Building Award ▪ Low Carbon Neighbourhood Award ▪ Low Carbon School/University Award	N	UE	Smart Education	▪ Encourage participation from public ▪ Increase publicity and coverage ▪ Create awareness

Strategy 7: Intensify Community Participation

Target : Increase awareness and develop low carbon community

Sub- Actions		Type of Actions	Link to LCCF	Link to Smart Selangor	Targets
Key Action 7.2 : Establishing Community Sustainability Centre					
7.2a	Diversify function and waste collection at the Recycling Centre – e.g. point of collection of cooking oil, e-waste products, furniture, etc..	N	UE	Smart Development Smart Education Smart Waste Management System	▪ Inculcate environmental awareness in the community ▪ Increase participation and support from the public ▪ Act as a Demonstration Project for Cyberjaya ▪ Model of Sustainability Centre in Selangor
7.2b	Provide anaerobic digester facility for composting.	N			
7.2c	Enhance and implement green features in the existing center to promote/demonstrate green building.	E			
7.2d	Place WSUD (Water Sensitive Urban Design) at the site to demonstrate and educate people on water efficiency.	N			
7.2e	Exhibit smart features at the center to demonstrate and educate people on the integration between smart and green initiatives.	N			
7.2f	Integrate urban farming area with composting activities at the center.	N			
7.2g	Built a library section and put old recycled books to good use at the center.	N			
Key Action 7.3 : Developing Smart & Low Carbon Education Program For Youngsters					
7.3a	Nurture young generations on smart and green living : ▪ Work with schools/colleges to deliver education packs and to involve them in environmental related activities.	N	UE		▪ Inculcate environmental awareness in young people ▪ Increase participation from young people

Chapter 7.0 Implementation Timeline

7.1 Introduction

The implementation timeline is given for each sub-action to indicate the priority of project delivery and the timing. There are four (4) categories of projects based on the implementation and delivery timeline namely :

- Quick Win (QW);
- Short-Term (S);
- Medium-Term (M); and
- Long-Term (L).

The description of the categories are as follows :

Quick Win
Projects that can be implemented and completed within about one (1) year time.

Bring quick impact/result to intended beneficiaries, environment, etc..

Small or minimum budget is required to implement the projects.

Short Term
Projects that can be implemented and completed within three (3) years time.

Feasibility studies may or may not be required.

Medium Term
Projects that can be implemented and completed within three (3) to five (5) years time.

Feasibility/impact studies may or may not be required.

Long Term
Projects that require more than 5 years to be implemented and completed.

Feasibility/impact studies shall be required.

7.2 Timeline of Action Plans

Strategy 1: Establish Smart Mobility

Target : 80% coverage of integrated green mobility network by 2025

	Sub- Actions	Type of Actions	Timeline	Collaborating Partner(s)
Key Action 1.1 : Creating A Bike-Friendly Cyberjaya				
1.1a	Enhance existing bike sharing program with OBike and encourage more users to ride bicycles by improving access to rental bike locations (e.g. integrate bike stations with bus stops/TOD).	E	QW	▪ Obike Service Provider ▪ Community Associations ▪ Cyberview Sdn Bhd
1.1b	Review, improve and expand the current bike routes and ensure their functionality and connectivity.	E	QW ST	▪ Community Associations ▪ Cyberview Sdn Bhd
1.1c	Construct "Cyberjaya Green Parkway" with quality facilities/amenities (e.g. rental bicycles), improvement on the landscape and creating nodes of activities.	E	QW ST	▪ Rental Bicycle Providers ▪ NGOs ▪ Community Associations
Key Action 1.2 : Defining Bus Priority Systems And Smart Services In Cyberjaya				
1.2a	Plan for bus stops that are well integrated with land use activities.	E	QW ST	▪ Cyberview Sdn Bhd ▪ Developers ▪ Nadi Putra
1.2b	Integrate with future MRT or Regional Transit System.	E	ST MT	▪ SPAD ▪ Prasarana ▪ MRT Corp ▪ Nadi Putra
1.2c	Install smart apps (e.g. GPS, Real Time Info, Real Time Tracking Devise) in all public transports.	E	ST	▪ MBI ▪ SPAD ▪ Public Bus Operators (Nadi Putra & DTS)
1.2d	Invoke aggressive promotion and advertisement on the usage of public transport to increase more ridership.	E	QW	▪ Selangor State Government ▪ Developers ▪ SPAD ▪ Nadi Putra ▪ Rapid KL ▪ DTS ▪ MRT ▪ Community Associations

Strategy 1: Establish Smart Mobility

Target : 80% coverage of integrated green mobility network by 2025

Sub- Actions		Type of Actions	Timeline	Collaborating Partner(s)
Key Action 1.3 : Making Alternative Vehicle Mode Sharing System Works In Cyberjaya				
1.3a	Increase , improve and promote the usage of existing Smart Car Sharing Scheme under GoCar as well as promote the cars run by EV.	E	ST MT	▪ GoCar Service Provider ▪ Cyberview Sdn Bhd ▪ MiGHT
1.3b	Introduce EV Scooter Sharing Service/Scheme.	N	ST	▪ Electric Scooter Sharing Scheme Providers ▪ MiGHT
Key Action 1.4 : Implementing More Efficient Traffic Flow And Environmental Conditions.				
1.4a	Install more smart traffic management system to control congestion during peak hours.	E	QW	▪ Cyberview Sdn Bhd ▪ ICT Solution Providers ▪ MBI
Key Action 1.5 : Promoting Clean And Energy Efficient Vehicles				
1.5a	Improve visibility of EV charging stations for private vehicles along prominent roads.	N	ST	▪ EV Charging Station Providers ▪ GreenTech Malaysia ▪ SPAD
1.5b	Provide EV charging station facilities for buses at terminal hub and Park & Ride.	N	ST MT	▪ EV Charging Station Providers ▪ SPAD ▪ MiGHT ▪ TNB
1.5c	Convert conventional public transport vehicles to green vehicles (e.g electric bus, hybrid taxi) by 2025.	N	MT LT	▪ Electric Bus Manufacturers ▪ Prasarana ▪ GreenTech Malaysia

Strategy 2: Promote Walkability

Target : Walking to account for 60% of total trips by 2025

Sub- Actions		Type of Actions	Timeline	Collaborating Partner(s)
Key Action 2.1 : Making Walk Interesting And Safe				
2.1a	Create "Cyberjaya Link" to increase pedestrian vibrancy (e.g. covered walkway or shaded trees, parklets and public arts) – to encourage people to walk for leisure as well as business.	N	QW	▪ Cyberview Sdn Bhd ▪ Food Truck Operators ▪ NGOs ▪ Developers ▪ Community Associations ▪ Think City
2.1b	Ensure comfortable and safe walkways by providing 24-7 surveillance and proper lightings as well as creating new nodes as places to rest before people continue walking to their final destination.	E	QW ST	▪ Cyberview Sdn Bhd ▪ SPAD ▪ Police Department ▪ JPJ
2.1c	Encourage flexible sidewalk cafes (on utilities corridor) that add visual appeal to attract people and to slow down vehicle speed.	E	QW ST	▪ Developers ▪ Setia Haruman Sdn Bhd ▪ Young Entrepreneurs ▪ Community
Key Action 2.2 : Making Walk Convenient, Quick And Easy Through Local Connection				
2.2a	Integrate and connect public and private green open spaces with pedestrian and cycling networks.	N	QW ST	▪ Setia Haruman Sdn Bhd ▪ Developers ▪ JLN ▪ ILAM
2.2b	Impose through block connector in between private and public buildings.	E	MT	▪ Developers ▪ Setia Haruman Sdn Bhd ▪ MIP
Key Action 2.3 : Making Pedestrian Priority Zone				
2.3a	Organise a monthly event like Cyberjaya Car Free Festival.	E	QW	▪ Event Planners/Organizers ▪ NGOs ▪ Developers
2.3b	Impose guideline for efficient block size as well as guideline to integrate pedestrian and cycling network within the pedestrian priority zone (i.e. area within 250m distance from TOD/ Nodes) to increase permeability.	E	MT	▪ Setia Haruman Sdn Bhd ▪ Developers ▪ MIP ▪ Plan Malaysia Selangor

Strategy 3:
Embrace Compact & Mixed Use Development

Target : Reduce door to door journey time within cyberjaya by 20 minutes

Sub- Actions		Type of Actions	Timeline	Collaborating Partner(s)
Key Action 3.1 : Promoting Compatible Land Use Mix				
3.1a	Create neighbourhood scale commercial activity closer to residential area (i.e. at the edges of Cyberjaya or at least 5 km away from the CBD).	N	MT	▪ Cyberview Sdn Bhd ▪ Food Truck Operators ▪ Entrepreneurs ▪ NGOs ▪ Developers ▪ Community Associations
3.1b	Increase mixed use development in enterprise zone with 70% commercial and 30% enterprise as well as add service apartments to increase population/density and ridership of public transport.	E	LT	▪ Cyberview Sdn Bhd ▪ Setia Haruman Sdn Bhd ▪ MIP ▪ Plan Malaysia ▪ Developers
Key Action 3.2 : Fostering Efficient Use of Urban Spaces				
3.2a	Identify TOD Zone for areas around major transit hubs with transit supportive guidelines such as: ▪ increasing intensities and concentration of developments with adequate mix of use; ▪ introducing reduction in parking spaces for TOD Area; ▪ providing clear and comfortable pedestrian access to areas around transit stops.	N	MT LT	▪ Setia Haruman Sdn Bhd ▪ Developers ▪ MIP ▪ Plan Malaysia ▪ Cyberview Sdn Bhd
3.2b	Integrate Community Centre as one-stop amenities hub with new and innovative elements of integrated development such as hawker centre, library, Day-care, Clinic and other community facilities.	E	MT	▪ Developers ▪ Setia Haruman Sdn Bhd ▪ Community Associations ▪ NGOs

Strategy 4: Integrate Nature Into Urban

Target : 35% increase in carbon sequestration from baseline and 30% increase in ecological biodiversity (Eco-D) by 2025

Sub- Actions		Type of Actions	Timeline	Collaborating Partner(s)
Key Action 4.1 : Enhancing The Environmental Quality				
4.1a	▪ Convert conventional drainage to Sustainable Urban Drainage System (such as Bio-ecods, Bioswales) to ensure effective water detention & retention,as well as improve water quality & biodiversity. ▪ Turn it to be used as recreational spaces. ▪ Add smart sensors to detect pollution.	E	MT	▪ Cyberview Sdn Bhd ▪ Setia Haruman Sdn Bhd ▪ Technology Providers ▪ Developers ▪ SPAN ▪ JLN ▪ ILAM ▪ DOE
4.1b	▪ Plant specific tree types/species that increase urban canopy and urban biodiversity. ▪ Encourage xeriscaping for sustainable landscape maintenance.	E	QW ST	▪ Developers ▪ JLN ▪ ILAM ▪ FRIM ▪ MiGHT
Key Action 4.2 : Providing Quality And Functional Recreational Facilities				
4.2a	Establish and encourage Urban Farming activities in every neighborhoods, schools and city parks.	E	QW ST	▪ NGOs ▪ Developers ▪ JLN ▪ ILAM ▪ Community Associations
4.2b	Rejuvenate existing parks that cater for all ages and conduct new activities and new amenities/facilities (e.g movie park, music park, etc.).	E	QW ST	▪ Cyberview Sdn Bhd ▪ Setia Haruman Sdn Bhd ▪ NGOs ▪ Developers ▪ JLN ▪ ILAM ▪ Private Companies ▪ Event Managers

Strategy 4: Integrate Nature Into Urban

Target : 35% increase in carbon sequestration from baseline and 30% increase in ecological biodiversity (Eco-D) by 2025

Sub- Actions	Type of Actions	Timeline	Collaborating Partner(s)
Key Action 4.3 : Imposing Smart Planning Tools For Low Carbon Planning			
4.3a Develop and enforce Smart Planning Tools Guideline on KM2 Submission with modelling tools to help Local Authority to simulate environmental conditions (such as wind flow, sun and shade) for better city planning.	N	ST MT	▪ ICT Solution Providers ▪ Developers ▪ JLN ▪ ILAM ▪ Investors ▪ Cyberview Sdn Bhd ▪ MAGIC ▪ MCMC
4.3b ▪ Develop smart apps for Nature Interpretation and Park Activities for recreational and education purposes. ▪ Develop smart apps for tree measurements to estimate ecosystem services (economic and environmental value).	N	ST MT	▪ PLAN Malaysia ▪ Developers ▪ MIP ▪ PAM ▪ ICT Solution Providers ▪ Technology Providers ▪ MiGHT ▪ MCMC

Strategy 5: Adopt Efficient and Effective Resource Management Practices

Target : Wide application of smart/green technology in managing resources

Sub- Actions		Type of Actions	Timeline	Collaborating Partner(s)
Key Action 5.1 : Improving Solid Waste Collection And Treatment				
5.1a	▪ Introduce 3 bin system for separating organic waste, recycle and non recycle materials at residential, public buildings (e.g. schools, bus stops, etc.) and main roads. ▪ Enforce separation at source. ▪ Introduce e-waste program to dispose electronics waste (like mobile phones).	N	QW ST	▪ Developers ▪ Alam Flora ▪ Community Associations ▪ MCMC
5.1b	Introduce pre-treatment system such as MRF for waste minimization and segregation.	N	MT	▪ Alam Flora ▪ Investors ▪ Technology Providers
Key Action 5.2 : Greening The Waste Water System				
5.2a	Adopt to Sustainable Sewerage Treatment Plant (STP) by : ▪ Converting existing STP to sustainable STP systems; ▪ Constructing future new STP with sustainable STPs; ▪ De-centralizing future STPs to encourage the utilization of recycle water to local area neighborhood.	N	LT	▪ IWK ▪ SPAN ▪ JPSPN ▪ Investors ▪ Developers ▪ Technology Providers
Key Action 5.3 : Implementing Integrated Waste to Energy/Wealth Project				
5.3a	▪ Conduct Feasibility Study on waste to energy (WTE) project leveraging on the GTALCC Fund & Assistance. ▪ To include Microgrid study and Smart Grid Implementation. ▪ Set up WTE project that potentially generates biogas, synthetic fuel (diesel) and engineered soil.	N	QW MT	▪ SEDA ▪ Investors ▪ Technology Providers ▪ KeTTHA
Key Action 5.4 : Improving Telecommunication Services				
5.4a	Make Cyberjaya a city-wide high speed wireless connection leveraging on existing and new platform like LORA.	E	QW	▪ Telekom Malaysia ▪ Cyberview Sdn Bhd (LORA System)

Strategy 5: Adopt Efficient and Effective Resource Management Practices

Target : Wide application of smart/green technology in managing resources

Sub- Actions		Type of Actions	Timeline	Collaborating Partner(s)
Key Action 5.5 : Improving Water Management System				
5.5a	▪ Introduce advanced water like underground water extraction. ▪ Encourage the utilization of recycle water from STPs to local area neighbourhood.	N	LT	▪ IWK ▪ SPAN ▪ Investors ▪ Technology Providers ▪ Developers ▪ KeTTHA
Key Action 5.6 : Reducing Energy Consumption				
5.6a	Convert existing conventional District Cooling System (DCS) to green DCS by using recycle water and running on Renewable Energy.	E	LT	▪ IWK ▪ SPAN ▪ Investors ▪ Technology Providers
5.6b	Increase more innovative use of solar panel in Cyberjaya for common area consumption : ▪ Floating solar panel on retained water bodies; ▪ Façade and roofs of public buildings; ▪ Car park areas; and ▪ Utility buildings.	E	ST	▪ Investors ▪ Technology Providers ▪ SEDA ▪ GreenTech Malaysia

Strategy 6: Implement Smart & Low Carbon Buildings

Target : 40% energy reduction from buildings by 2025

Sub- Actions		Type of Actions	Timeline	Collaborating Partner(s)
Key Action 6.1 : Implementing Energy Reduction Practices In All Buildings				
6.1a	Conduct energy audit as the first step in identifying opportunities to reduce energy consumption and carbon footprints.	N	QW	▪ SEDA ▪ BSEEP ▪ Community Associations ▪ Developers ▪ NGOs ▪ Energy Audit Companies ▪ GreenTech Malaysia ▪ TNB
6.1b	Impose installation of water and energy efficient fixtures/appliances/apparatus to all buildings.	E	ST	▪ TNB ▪ SYABAS ▪ SEDA ▪ Community Associations ▪ Developers ▪ KETTHA
6.1c	Promote the usage of solar energy in residential areas of Cyberjaya using the NEM scheme.	N	ST	▪ SEDA ▪ Community Associations ▪ Developers
6.1d	Provide Passive Design Toolkits and Low Carbon Home Renovation Guidebook to educate and update homeowners with information on sustainable material providers.	E	ST	▪ SEDA ▪ MGBC ▪ JKR ▪ Developers ▪ CIDB ▪ MiGHT ▪ GreenTech Malaysia ▪ TNB
6.1e	Replace existing conventional electricity consumption measurement systems with respective smart meters.	E	QW	▪ TNB ▪ SEDA ▪ Community Associations ▪ Developers ▪ KETTHA ▪ ST
6.1f	Implement energy management system (EMS) on public buildings and eventually expand to commercial buildings.	N	QW	▪ PAM ▪ TNB ▪ Developers ▪ KETTHA ▪ Building Managers ▪ Energy Management Managers
6.1g	Encourage buildings to produce on-site carbon free Renewable Energy in the amount to offset the annual CO2 emission associated with the buildings' operations.	N	MT	• Developer • SEDA • TNB • MiGHT
6.1h	Develop/install/use more smart apps on real- time information through intelligent and wireless connection especially at public buildings (e.g. parking sensors at mall and hospital, LED advertisements on buildings, etc..).	E	ST	• Cyberview Sdn Bhd • LoRa Network • ICT Solution Providers • MBI

Strategy 6:
Implement Smart & Low Carbon Buildings

Target : 40% energy reduction from buildings by 2025

Sub- Actions		Type of Actions	Timeline	Collaborating Partner(s)
Key Action 6.2 : Imposing Compulsory Low Carbon Building Regulations At City Council Level				
6.2a	Impose rule of "passive design first then active".	N	ST	• Developers ▪ Architects ▪ MyCrest JKR ▪ CIDB
6.2b	Enforce the adoption of MS1525 (Energy Efficiency And Use Of Renewable Energy For Non-Residential Buildings) to all public buildings and eventually expand to commercial buildings.	E	QW	▪ GBI Facilitators ▪ PAM ▪ TNB ▪ SEDA ▪ MiGHT ▪ Developers ▪ KETTHA ▪ Building Managers ▪ Energy Management Managers
6.2c	Impose additional 5% vertical greenery to the existing 10% of green on ground level within building plot.	N	MT LT	▪ ILAM ▪ JLN ▪ Developers ▪ Building Managers
6.2d	Impose low carbon certification requirement for public buildings and on developers for commercial buildings.	E	ST MT	▪ GBI Facilitators ▪ Developers ▪ Architects ▪ Building Managers

Strategy 7: Intensify Community Participation

Target : Increase awareness and develop low carbon community

Sub- Actions	Type of Actions	Timeline	Collaborating Partner(s)
Key Action 7.1 : Organizing Various Community Projects			
7.1 a Introduce community empowerment and ownership projects : ▪ "Cyberjaya : Tree for Life" Program - a fun tree planting program to increase green spaces; ▪ "Adopt -A -Park" Program – whereby volunteers from schools, community and individuals participate/contribute to make adopted parks more vibrant and attractive.	N	QW	▪ Setia Haruman Sdn Bhd ▪ Cyberjaya Resident Association (JPP) ▪ ILAM ▪ Developers ▪ NGOs ▪ Students ▪ Persatuan Belia ▪ MIP
7.1 b Initiate Urban Community Gardens Program or Rooftop Gardens Program.	N	ST	▪ Community Associations ▪ ILAM ▪ NGOs ▪ Developers ▪ Building Managers
7.1 c Organize "Recycling Competition" event between Enterprises and residential neighbourhoods in Cyberjaya.	N	ST	▪ Private Companies ▪ Building Managers ▪ KETTHA ▪ Developers ▪ NGOs ▪ MIP ▪ Event Manager/Organizer ▪ Media
7.1 d Develop an Award Program to reward good environmental behaviour and to recognize substantial contribution/initiatives towards the environment and low carbon development : ▪ Low Carbon Office Building Award ▪ Low Carbon Neighbourhood Award ▪ Low Carbon School/University Award	N	ST	▪ Developers ▪ NGOs ▪ KeTTHA ▪ MIP ▪ Event Manager/Organizer ▪ Media

Strategy 7: Intensify Community Participation

Target : Increase awareness and develop low carbon community

Sub- Actions		Type of Actions	Timeline	Collaborating Partner(s)
Key Action 7.2 : Establishing Community Sustainability Centre				
7.2 a	Diversify function and waste collection at the Recycling Centre – e.g. point of collection of cooking oil, e-waste products, furniture, etc..	N	QW	▪ MIGHT ▪ WAQAF ▪ Setia Haruman Sdn Bhd ▪ Cyberview Sdn Bhd ▪ Developers ▪ Private Companies ▪ Cyberjaya Resident Association ▪ NGOs ▪ MCMC ▪ MIP ▪ MBI
7.2 b	Provide anaerobic digester facility for composting.	N	QW	
7.2 c	Enhance and implement green features in the existing center to promote/demonstrate green building.	E	ST MT	
7.2 d	Place WSUD (Water Sensitive Urban Design) at the site to demonstrate and educate people on water efficiency.	N	ST MT	
7.2 e	Exhibit smart features at the center to demonstrate and educate people on the integration between smart and green initiatives.	N	ST MT	
7.2 f	Integrate urban farming area with composting activities at the center.	N	QW	
7.2 g	Built a library section and put old recycled books to good use at the center.	N	QW	
Key Action 7.3 : Developing Smart & Low Carbon Education Program For Youngsters				
7.3 a	Nurture young generations on smart and green living : ▪ Work with schools/colleges to deliver education packs and to involve them in environmental related activities.	N	ST	▪ iCycle by Cyberview Sdn Bhd ▪ NGOs ▪ Community Associations ▪ Ministry of Education ▪ Pejabat Pelajaran Daerah ▪ Private & Public Institutions ▪ Schools ▪ Students ▪ Persatuan Belia ▪ MIP

Chapter 8.0 Carbon Assessment

8.1 Introduction

8.1.1 Global Issue

Climate change is one of the major challenges of our time and adds considerable stress to our societies and to the environment. From shifting weather patterns that threaten food production, to rising sea levels that increase the risk of catastrophic flooding, the impacts of climate change are global in scope and unprecedented in scale. Without drastic action today, adapting to these impacts in the future will be more difficult and costly. (Source : United Nations)

Greenhouse gases occur naturally and are essential to the survival of humans and millions of other living things, by keeping some of the sun's warmth from reflecting back into space and making Earth livable. A century and a half of industrialization, including clear-felling forests and certain farming methods, has driven up quantities of greenhouse gases in the atmosphere.

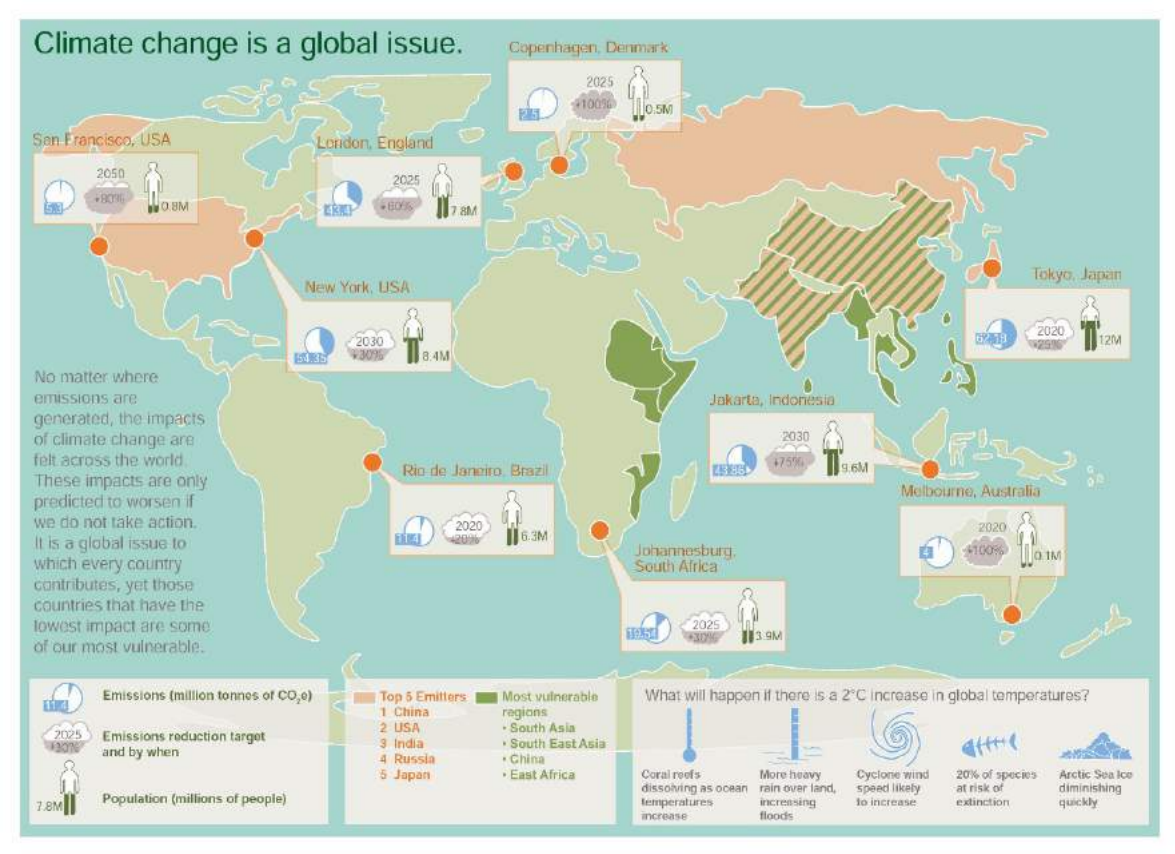
As populations, economies and standards of living grow, so does the cumulative level of greenhouse gases (GHGs) emissions. (Source : United Nations)

There are some basic well-established scientific links :

- The concentration of GHGs in the earth's atmosphere is directly linked to the average global temperature on Earth;
- The concentration has been rising steadily, and mean global temperatures along with it, since the time of the Industrial Revolution; and
- The most abundant GHG, carbon dioxide (CO2), is the product of burning fossil fuels.

Source: United Nations

Figure 8.1 : Global Impact of Climate Change



8.1.2 Local Action

Malaysia ratified the pledge to reduce its greenhouse gas emission intensity by 45% by 2030. This new interim climate goal shall now be viewed as a reference target to any mitigation actions by authorities in the country to deliver cities performance with a climate safe future.

In local context, Cyberjaya's vision to transform the city into smart low carbon city is clearly an urban-innovation initiative for sustainability, efficiency, resiliency, circularity, and connectivity of a city. This city model incorporates strategic urban growth while keeping under control (or reducing) GHG emissions and vulnerability to climate change, bringing about growth benefits, in particular with the use of automation and Internet control system technology development.

Smart cities are deemed intelligent and efficient in their use of resources, resulting in cost and energy savings, improved service delivery and quality of life and reduced environmental footprint – all supporting innovation and a low-carbon economy.

As being demonstrated in the key action plans, the complexity of a smart low-carbon urban development can be addressed and managed through connected networking and information sharing with ICT applications in areas such as transport, land-use planning, energy, water and waste management under an integrated holistic approach.

To assist with this ambition and the implementation of key action plans, a carbon assessment study was undertaken for Cyberjaya to examine :

- Current emission level for the proposed base year (2016);
- Future emission level if, no climate actions are undertaken; and
- Potential mitigation measures to reduce the emissions.

This carbon assessment comprises of a baseline study conducted for 2016 and projected scenarios for the 2025 masterplan - both vital to city level climate actions planning and development of strategies for mitigation and adaptation towards climate change.

Figure 8.2 : Carbon Emission Per Capita of Selected Cities Around the World

Seoul at 3.8

Tokyo at 4.8

Copenhagen at 1.3

New York at 7.1

Jakarta at 4.8

8.2 Understanding Emissions Profile

Taking action on climate change begins with a thorough understanding of greenhouse gas (GHG) emissions as well as understanding the contribution of different activities within the city thus allowing cities to determine where to best direct mitigation efforts, set emission reduction targets, create strategies to address climate change, and monitor progress.

The GHG emissions of Cyberjaya is quantified using the Atkins methodology originated from United Kingdom. However, the parameters being used have been localised using the LCCF as well as Malaysian standard. The calculation is organised around the core themes of land use, construction, energy, water, waste and transport; based on an internationally recognised GHG accounting and principles.

Cyberjaya's GHG emission profile comprises of the following important elements :

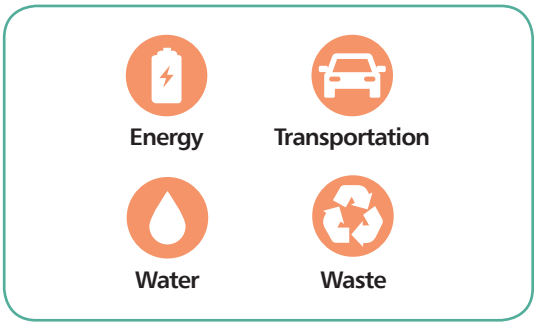
- Carbon emissions – which consists of Operational Carbon (OC) and Embodied Carbon (EC); and
- Carbon sequestrations.

A. Carbon Emissions

The total amount of greenhouse gases produced to directly and indirectly support human activities is usually expressed in equivalent tons of carbon dioxide (CO2). The carbon footprint is the sum of all emissions of CO2, which were induced by human activities in a given time frame. Usually a carbon footprint is calculated for the time period of a year, in metric tonne equation. The carbon emission can be categorized into Operational Carbon (OC) and Embodied Carbon (EC).

Operational Carbon refers to CO2 emitted during the life of a building, from the 'regulated' and 'unregulated' loads associated with the use of a building. This includes the emissions from heating, cooling, lighting, and using ICT.

Four (4) main sectors of operational carbons are :



Embodied Carbon refers to CO2 emitted during the manufacture, transport and construction of building materials together with end of life emissions. Two (2) main sectors of embodied carbons are :

Land Clearing

Construction Activity

B. Carbon Sequestrations

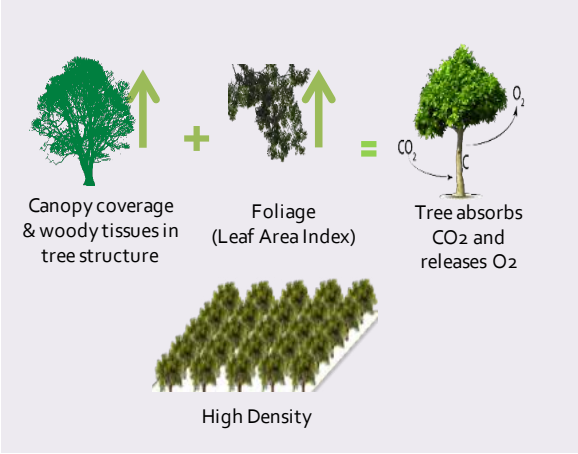
Carbon sequestration refers to capturing and storing carbon. Capture can occur at the point of emission (e.g. from power plants) or through natural processes (such as photosynthesis), which remove CO2 from the earth's atmosphere and which can be enhanced by appropriate management practices.

Urban green reserves are effective in carbon sequestration to absorb and store carbon emission for an extended term. Through the natural process of photosynthesis, mature trees planted in urban green reserves/open space can act as a carbon sink.

Carbon sequestration analysis emphasizes on the tree biomass and the carbon content estimation which are significant for carbon reduction in urban areas.

Urban trees and forests affect climate change, but are often disregarded because their ecosystem services are not well-understood or quantified. Trees act as a sink for CO2 by fixing carbon during photosynthesis and storing carbon as biomass. The net long-term CO2 source/sink dynamics of forests change through time as trees grow, die, and decay (Source : Nowak et al., 2002). Human influences on forests (e.g., management) can further affect CO2 source/sink dynamics of forests through such factors as fossil fuel emissions and harvesting/ utilization of biomass. Urban trees are able to influence air temperatures and building energy use, and consequently alter carbon emissions from numerous urban sources (e.g. power plants) (Source : Nowak, 1993). In short, urban trees have substantial influence on local climate, carbon cycles, energy use as well as climate change issue.

Figure 8.3 : Influence of Trees on Carbon Sequestration



The equation that we use to quantify or measure CO2 is by using weight scale i.e. metric tonne.

Picturing a metric tonne CO2 :

1 metric tonne of CO2 is equivalent to a 10 meters tall balloon.

Or equivalently to :

8.3 Baseline Year 2016

8.3.1 Operational Carbon for Baseline Year 2016

Table below shows carbon emission profile for Cyberjaya for baseline year 2016 :

Table 8.1 : Breakdown of GHG Emissions According to Sector

Sector	Total Emissions (metric tonneCO2/Year)	Percentage of Total Emissions
Energy	**97,969.76**	**52.71%**
Annual Energy Consumption (from buildings)	94,058.80	
Street Lighting	3,920.00	
Transport	**69,871.00**	**38.30%**
Split modal - Private (93%)	59,696.00	
Bus (7%)	10,175.60	
Waste	**12,067.42**	**6.61%**
Municipal Solid Waste	7,334.87	
Waste from Commercial and Enterprise	4,732.55	
Water	**2,496.96**	**1.36%**
Building Indoor Consumption	2,277.96	
Outdoor Irrigation (parks, landscapes, etc.)	219.00	
Total Emissions	**182,405.14**	**100%**

Cyberjaya's largest source of GHG emissions is obviously from the Energy sector, which accounts for more than half of total operational carbon emissions for Cyberjaya. The baseline for Operational Carbon for baseline year 2016 stands at 182,404.72 metric tonne per year.

Typically, buildings' energy consumption and private vehicles are expected to contribute to a large share of overall emissions (UNEP 2007) when compared across a range of other sectors.

From the above table, energy consumption from building registered the highest amount of carbon emission. This is mainly due to the fact that Cyberjaya highly dependent on energy generated by TNB powerplant as well as influence from the land use activity which is significantly Enterprise (i.e. Cyberjaya is a job-centred enclave). The registered emission from Transport sector is also reasonably high due to the split modal that is 93% dependent on private vehicles. Emission from Water sector is relatively small but its inclusion in the carbon analysis is more towards managing the water consumption efficiently rather than calculating the emission. Emissions from municipal solid waste are expected to be growing fast in tandem with the population growth by 2025, and main factors that would cause high carbon emission from the Waste sector include dependency on landfill, percentage of recycling and transportation for waste dumping.

8.3.2 Details Calculation for Operational Carbon for Baseline Year 2016

The following section explains the calculation of carbon emission for the previously discussed Table 8.1 :

A. Energy

Table 8.2 : Calculation of Operational Carbon Emissions for Energy Sector

	Consumption	Assumptions/Variables	Result in Metric Tonnes CO2/Year
Energy	Buildings	▪ Operational carbon factor per kWh is generating carbon of **0.741 kgCO2/kWh** (SEDA, 2015) ▪ Data TNB (utility company) was 131,681 kWh	94,058.80
	Street Lightings	5,475 kWh	3,910.00

The energy consumption in buildings is influenced by building typologies, operational hours, building size, age, service demands, building services , climatic conditions including occupant behaviour.

In 2016, the operating energy of buildings in Cyberjaya, based on actual data given by TNB (utility company) was 131,681 kWh thereby releasing emissions as much as 94,058.8 metric tonnes/year.

A back calculation based on the given electrical consumption and Gross Floor Area (GFA) of completed buildings revealed energy intensity values much less than usually characterised by building typologies for residential or offices. This observation implies two possibilities :

- a large fraction of the buildings in Cyberjaya is not occupied, therefore do not contribute to the consumed energy; or
- the reported energy consumption figures did not represent the actual total electricity supply to the whole city.

The emissions released for the reported electrical consumption is only approximately half of that predicted through calculations. However, in going forward with the carbon analysis, it is assumed that non-occupancy may be a valid reason for the low electrical consumption.

The energy consumption and emissions produced by street lights in 2016 stood at 3,910.0 metric tonnes/year. These are the results of replacing a small fraction of incandescent lights with LED.

B. Transport

Table 8.3 : Calculation of Operational Carbon Emissions for Transport Sector

	Transport Type	Assumptions/Variables	Result in Metric Tonnes CO2/Year
Transport	Split Modal - 93% Private	▪ For an average car – 1 km travelled produces 0.18 kg of CO2 (Atkins, 2016) ▪ Cyberjaya has a radius of 16 km ▪ For every 5 people there is an average of 2.1 cars = 30,532 cars (93% = 28,395 cars) ▪ Average car ownership in Selangor is 2.1 (JPJ, 2015) ▪ 3 trips daily (SPAD,2016)	59,696.00
	7% Public	▪ For each 1km travelled, a normal capacity of 35 people bus produces 2.42 kg of CO2 (Atkins, 2016) ▪ Currently there are 20 buses operating in Cyberjaya ▪ Bus time frequency is every 30 minutes, operating for 18 hours (6 am – 12 pm) -> 18 hours x 2 trips = 36 trips daily	10,175.60

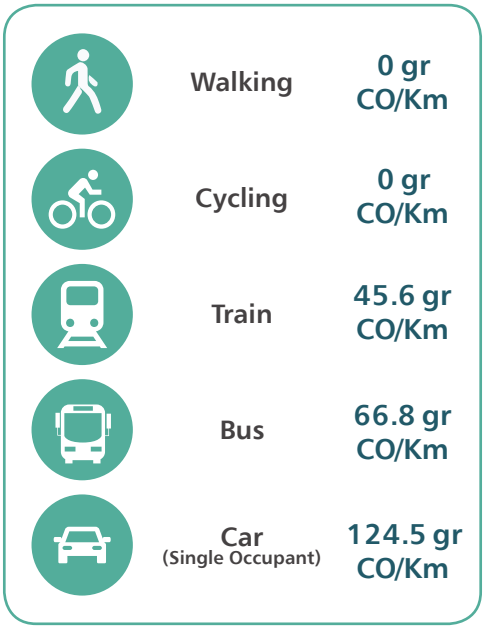
Note : Summary of Assumptions/Variables :
- Total distance
- Total trip per day
- Split modal (from Inception Report)

Rapid growth in transportation's GHG emissions is unavoidable in most developing countries as transport plays a crucial role in urban development by providing access for people to the main key services such as education, markets, employment, recreation, health care and others.

Transport is responsible for 22% of energy-related GHG emissions and its emissions are increasing at a faster rate than any other sectors (Source : World Resources Institute, 2014). As Table 8.1 shows, transport contributes 38.3% of total emissions for Cyberjaya, slightly higher than the average percentage of 22%. This is clearly due to high dependency on private vehicles as shown by the split modal of 93%.

Definitely, there is an urgent need to avoid, shift, and improve – avoid the need for motorized travel, shift trips to the most sustainable mode, and improve existing technologies and systems.

Figure 8.4 : Comparison of Carbon Footprint by Modes



C. Waste

Table 8.4 : Calculation of Operational Carbon Emissions for Waste Sector

	Source	Assumptions/Variables	Result in Metric Tonnes CO2/Year
Waste	Municipal Solid Waste	▪ For every 1000 litre, 3 kg of CO2 is produced ▪ 1 tonne of waste emits 0.29 kg of CO2 ▪ 1 person contributes to 1.64 kg of waste/day	7,334.60
	Commercial / Enterprise		4,732.50

Note :

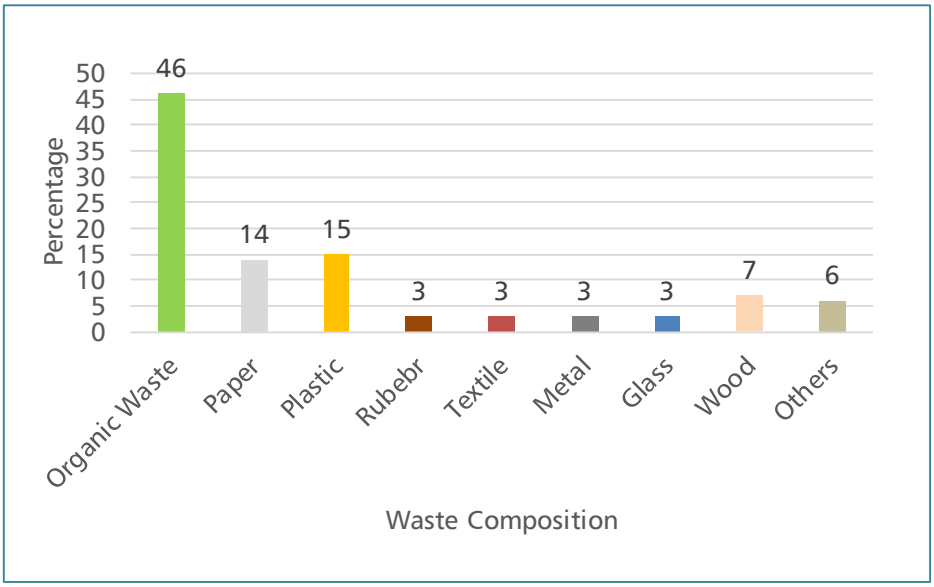
- The waste stream in Cyberjaya mainly consists of municipal solid waste (MSW) and construction debris from building and infrastructure built for the city.

The MSW disposed to landfill in Cyberjaya in 2016 for a population of 42,252 persons was approximately 25,292 tonnes/year generating emissions of about 7,334.6 metric tonnes CO2/year.

Research indicated that the solid waste produced in most cities in Malaysia is typically made up of 46% organics (putrescible components) and the remaining portion comprised paper and plastic based waste (Sakawi, 2011; Agamuthu & Fauziah, 2007).

Typically in Malaysia, about 5% of the MSW generated are recycled but this rate is even lower for Cyberjaya.

Figure 8.5 : Average Waste Composition Received by Malaysia Landfills (Agamuthu & Fauziah, 2007)



D. Water

Table 8.5 : Calculation of Operational Carbon Emissions for Water Sector

	Source	Assumptions/Variables	Result in Metric Tonnes CO2/Year
Water	Water Consumption	▪ Each individual uses 212 litres of water (SPAN, 2015) & (UN-Habitat, 2015) ▪ For every 1 m3, 0.7 k g of CO2 is produced per day (Atkins, 2015)	2,277.90
	Irrigation		219.00

Note :
- The calculation is based on water consumption per household, public buildings, commercial buildings and outdoor landscape irrigation.

The processes of abstraction, conveyance and treatment of fresh water and wastewater all demand energy therefore contributing to emissions.

These emissions vary with water processing and treatment plants, however for this study a typical emission factor is adopted where every cubic metre of water produced emit 0.7 kgCO2 (Atkins, 2015).

The water consumption in Cyberjaya in 2016 estimated for indoor use and landscape irrigation were 8,785 cubic metres per day and 857 cubic metres per day respectively, generating emissions of 2,277.9 tCO2/year and 219.0 tCO2/year.

Studies on water consumption in Malaysian homes in 2007 highlighted that potable water savings can be as high as 70%, if other non-kitchen activities uses other water sources.

Meanwhile, studies conducted in government office buildings in Singapore demonstrated that the two areas that used the most water are cooling towers and toilet flushing (PUB Singapore).

Figure 8.6 : Typical Home Water Use in Malaysian Homes (2007)

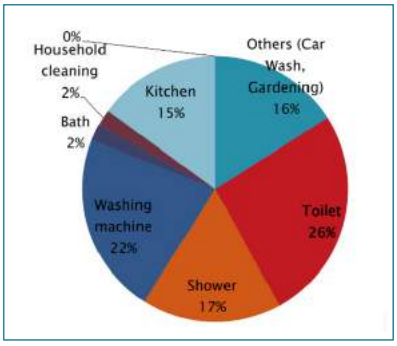
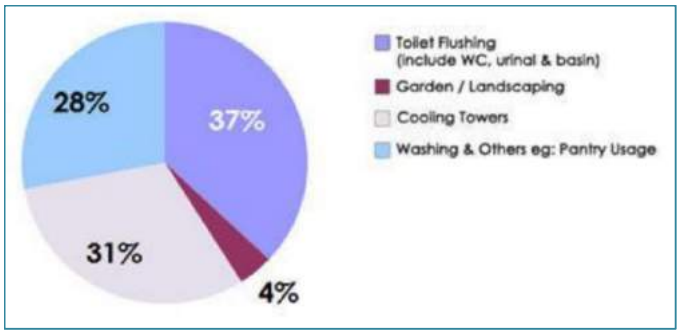


Figure 8.7 : Water Usage in Government Buildings in Singapore (PUB Singapore).



8.4 Projection 2025 Business as Usual (BAU)

8.4.1 Operational Carbon for BAU 2025

Projections are made to estimate the emissions for 2025 under Business As Usual (BAU) using the Baseline 2016 results discussed in Section 8.3.1. BAU projection is when no mitigation actions are taken to curb the emissions.

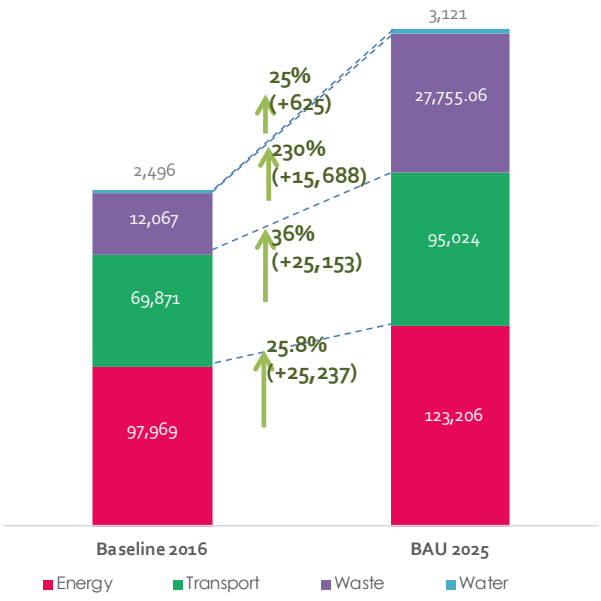
Assumptions for the projections are built on the following basis :

- Annual GDP growth of approximately 4% from 2011 to 2020, based on World Average reported by Price Waterhouse Coopers (PWC, 2015); and
- The GDP growth is assumed to remain the same from 2020 until 2025.

Figure 8.8 shows the projection of carbon emissions for BAU 2025.

The increment in emission for Energy Sector is due to the assumption that by 2025 all buildings are completed and occupied. There is not much increment registered by Energy Sector in BAU 2025 due to the fact that at Baseline 2016 the built-up area was already at 61.6%.

Figure 8.8 : Projected Operational Carbon Emissions For BAU 2025 in tCO2



The increment in emission for Transport Sector is quite significant because it was projected that the dependency on private vehicle would still be high. In addition, it was also assumed that other green mobility like walking and cycling would not be encouraged/promoted.

The significantly high increase in percentage for emission under the Waste Sector was due to substantial increase in residential (household waste) and completion of buildings (construction waste). It is estimated that the residential will be increased by 115% from the baseline 2016. From the waste profile, it is a known fact that household waste is the highest contributor for landfill dumping.

The Water Sector also shown substantial increment in terms of percentage to correspond to the increase of residents/ population in Cyberjaya which indirectly influence the process of abstraction, conveyance and treatment of fresh water and waste water which requires energy and produces emissions.

8.5 Projection 2025 (Mitigation Potentials)

8.5.1 Low Carbon Strategy (LCS)

Low Carbon Strategy (LCS) is basically actions taken to reduce the amount of CO2 emissions and aimed to contribute to the realisation of low-carbon city in a global context. Typically, it focuses on reducing emissions in resources and consumption and increasing carbon sequestration through improved greenery management. Going back to the 2011 Report, some of the LCS stated in the report included an increased usage of solar photovoltaic (PV) & district cooling, a reduction usage of private vehicles and increased percentage of green open space to occupy at least 10% of the total development area.

In the context of this Report, LCS comprises of all the key actions and sub-actions previously discussed in Chapter 6. All these actions are mitigation potentials to reduce CO2 emissions. The following sections discuss potential CO2 reductions based on actions and the four (4) main sectors of operational carbons – Energy, Transport, Waste and Water.

8.5.2 Operational Carbon for Projection Year 2025

Table below shows carbon emission profile for Cyberjaya for projection year 2025 and comparison being made to baseline year 2016 :

Table 8.6 : Comparison of GHG Emissions According to Sector for Year 2025 and 2016

Sector	Projection 2025 Total Emissions (metric tonne CO2/Year)	Baseline 2016 Total Emissions (metric tonne CO2/Year)	Total Amount & % of Reduction
Energy	**80,832.50**	**97,969.76**	**17,137.30 (17.5%)**
Annual Energy Consumption (from buildings)	77,598.51	94,058.80	
Street Lighting	3,234.00	3,920.00	
Transport	**41,923.56**	**69,871.00**	**27,947.44 (40.0%)**
Split modal - Private (93%)	35,817.60	59,696.00	
Bus (7%)	6,105.96*	10,175.60	
Waste	**9,050.56**	**12,067.42**	**3,016.86 (25.0%)**
Municipal Solid Waste	5,501.15	7,334.87	
Waste from Commercial and Enterprise	3,551.66	4,732.55	
Water	**1,373.50**	**2,496.96**	**1,123.65 (45.0%)**
Building Indoor Consumption	1,252.87	2,277.96	
Outdoor Irrigation (parks, landscapes, etc.)	120.45	219.00	
Total Emissions	**133,180.12**	**182,405.14**	**(32.0%)**

Note :
*Increased usage of electric bus

8.5.3 Details Calculation for Operational Carbon for Projection Year 2025

The following section explains the calculation of carbon emission for the previously discussed Table 8.6 :

A. Energy

Reduce CO_2
17,137.30 tons/yr

Table 8.7 : Operational Carbon Emissions for Energy Sector

	Consumption	Major Contributing Factor(s) for Emission Reduction	Result in Metric Tonnes CO2/Year
Energy	Buildings	▪ Passive Design to reduce energy consumptions on lighting and cooling	77,598.51
	Street Lightings	▪ Changing from conventional to LED streetlighting	3,234.00

Building energy consumption is the largest contributor in the carbon emissions profile for Cyberjaya. It accounts for approximately 52.7% of our cities carbon footprint. The focus on reducing the carbon intensity of our buildings therefore, must be on improving energy efficiency in existing buildings. In Malaysia, only a small percentage of energy is currently generated from non-renewable sources. As such, reducing the current level of energy consumption is the primary focus in order to meet the reduction targets.

Figure below shows the related key and sub-actions associated with the reduction of CO2 under the Energy Sector.

Figure 8.9 : Corresponding CO2 Reduction According to Sub-Actions

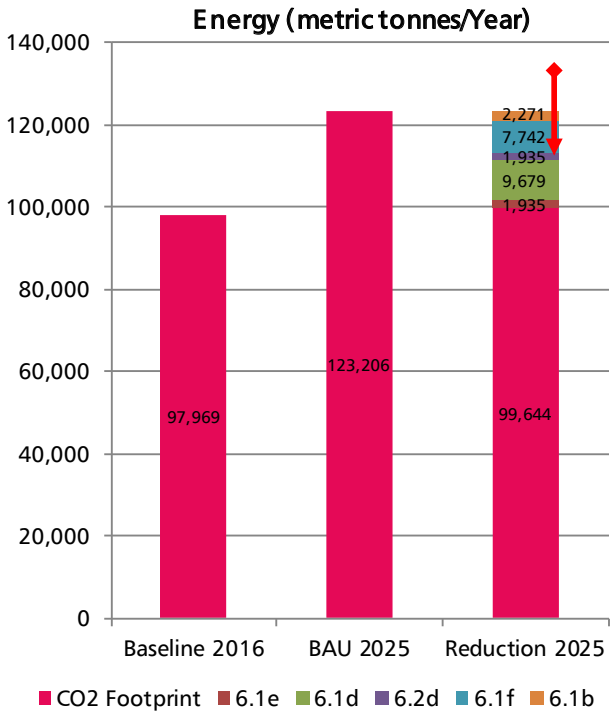


Figure 8.10 : Tangible Key and Sub-Actions Under Energy Sector

Key Action 6.1 : Implementing Energy Reduction Practices In All Buildings

6.1b	Impose installation of water and energy efficient fixtures/appliances/apparatus to all buildings.
6.1d ★	Provide Passive Design Toolkits and Low Carbon Home Renovation Guidebook to educate and update homeowners with information on sustainable material providers.
6.1e	Replace existing conventional electricity consumption measurement systems with respective smart meters.
6.1f	Implement energy management system (EMS) on public buildings and eventually expand to commercial buildings.

Key Action 6.2 : Imposing Compulsory Low Carbon Building Regulations At City Council Level

6.2d	Impose low carbon certification requirement for public buildings and on developers for commercial buildings.

B. Transport

Reduce CO_2
27,947.44 tons/yr

Table 8.8 : Operational Carbon Emissions for Transport Sector

	Transport Type	Major Contributing Factor(s) for Emission Reduction	Result in Metric Tonnes CO2/Year
Transport	Private Transport	▪ Changes in modal split – 60% Private and 40% Public from the baseline of 93/7 ▪ Promoting other green mobility such as public transport, walking and cycling	35,817.60
	Other Green Mobility		6,105.96

The emission reduction is projected from the proposed action plans that emphasize on promoting smart and integrated mobility as well as encouraging cycling and walkability elements. As shown in the table above, changes in the modal split that reduces dependency on private vehicles have resulted in a significant decrease in CO2 emissions. In addition, promotion on other green mobility like walking and cycling further reduces the amount of CO2 emission from the Transport Sector.

Figure below shows the related key and sub-actions associated with the reduction of CO2 under the Transport Sector.

Figure 8.11 : Corresponding CO2 Reduction According to Sub-Actions

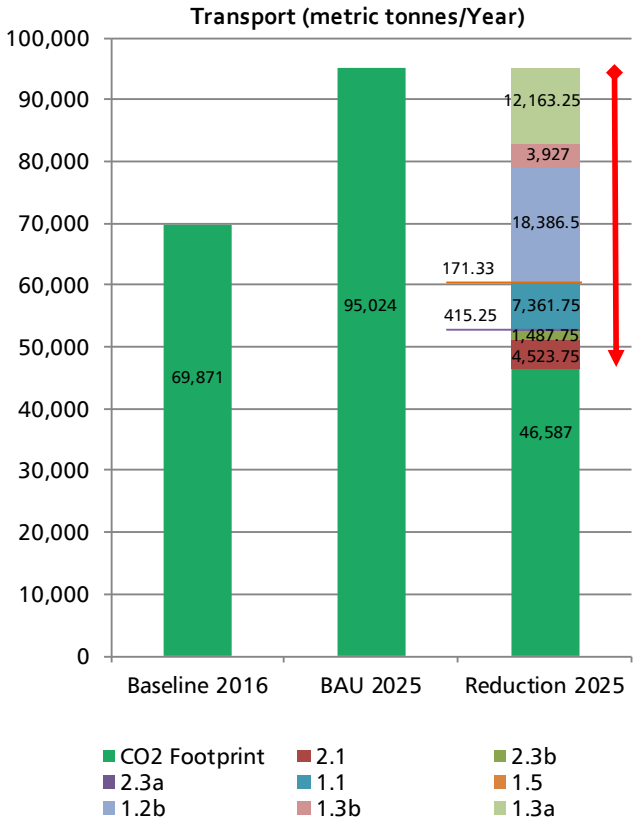


Figure 8.12 : Tangible Key and Sub-Actions Under Transport Sector

Key Action 1.1 : Creating A Bike-Friendly Cyberjaya

Key Action 1.2 : Defining Bus Priority Systems And Smart Services In Cyberjaya ★

1.2b	Integrate with future MRT or Regional Transit System.

Key Action 1.3 : Making Alternative Vehicle Mode Sharing System Works In Cyberjaya

1.3a	Increase , improve and promote the usage of existing Smart Car Sharing Scheme under GoCar as well as promote the cars run by EV.
1.3b	Introduce EV Scooter Sharing Service/Scheme.

Key Action 1.5 : Promoting Clean And Energy Efficient Vehicles

Key Action 2.1 : Making Walk Interesting And Safe

Key Action 2.3 : Making Pedestrian Priority Zone

2.3a	Organise a monthly event like Cyberjaya Car Free Festival.
2.3b	Impose guideline for efficient block size as well as guideline to integrate pedestrian and cycling network within the pedestrian priority zone (i.e. area within 250m distance from TOD/ Nodes) to increase permeability.

C. Waste

Reduce CO_2
3,016.86 tons/yr

Table 8.9 : Operational Carbon Emissions for Waste Sector

	Source	Major Contributing Factor(s) for Emission Reduction	Result in Metric Tonnes CO2/Year
Waste	Municipal Solid Waste	▪ Recycling of organic waste contributes significantly in reducing emissions and dependency of waste dumping to landfill	5,501.15
	Commercial / Enterprise		3,551.66

The average Malaysian disposes about 1.64 kg of waste per day as compared to the global average of 1.2 kg per day. Referring back to Figure 8.8, Waste Sector is expected to increase by 230% by 2025 under the BAU scenario. In Malaysia, more than 95% of our waste goes to landfill. Definitely, the strategy of 4R (i.e. Reduce, Reuse, Recycle and Recover) will significantly reduce Cyberjaya's 100% dependency on landfill. The introduction of segregation/minimization/pre-treatment of waste at source as well as conversion of waste to wealth/energy are projected to reduce 25% of carbon emission from Waste Sector.

Investment on waste to energy/wealth project can be quite expensive but it is an important step in delivering effective solid waste management mechanism in Cyberjaya.

Figure below shows the related key and sub-actions associated with the reduction of CO2 under the Waste Sector.

Figure 8.13 : Corresponding CO2 Reduction According to Sub-Actions

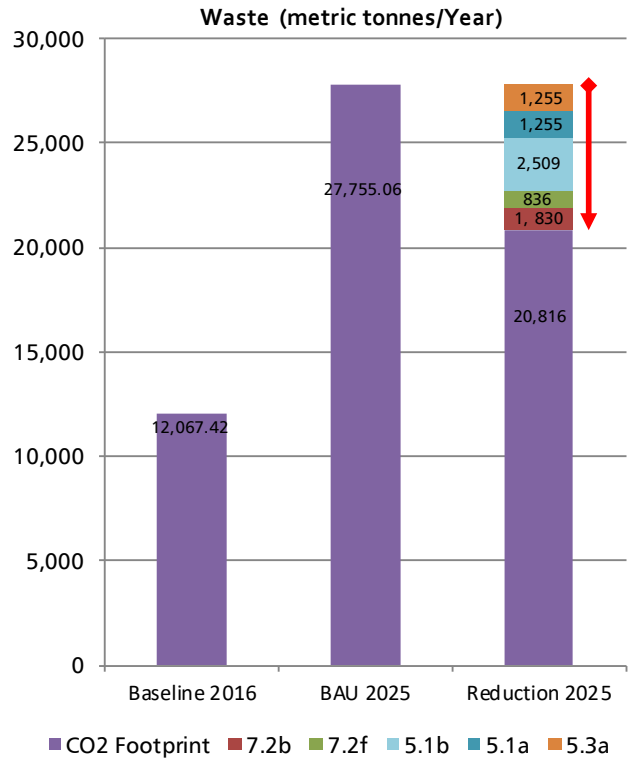


Figure 8.14 : Tangible Key and Sub-Actions Under Waste Sector

Key Action 5.1 : Improving Solid Waste Collection And Treatment

5.1a ★	▪ Introduce 3 bin system for separating organic waste, recycle and non recycle materials at residential, public buildings (e.g. schools, bus stops, etc.) and main roads. ▪ Enforce separation at source. ▪ Introduce e-waste program to dispose electronics waste (like mobile phones).
5.1b	Introduce pre-treatment system such as MRF for waste minimization and segregation.

Key Action 5.3 : Implementing Integrated Waste to Energy/Wealth Project ★

5.3a	▪ Conduct Feasibility Study on waste to energy (WTE) project leveraging on the GTALCC Fund & Assistance. ▪ To include Microgrid study and Smart Grid Implementation. ▪ Set up WTE project that potentially generates biogas, synthetic fuel (diesel) and engineered soil.

Key Action 7.2 : Establishing Community Sustainability Centre

7.2b	Provide anaerobic digester facility for composting.
7.2f	Integrate urban farming area with composting activities at the center.

D. Water

Reduce CO_2
1,123.65 tons/yr

Table 8.10 : Operational Carbon Emissions for Water Sector

	Source	Major Contributing Factor(s) for Emission Reduction	Result in Metric Tonnes CO2/Year
Water	Water Consumption	▪ Alternative sources of water will contribute significantly to water management efficiency	1,252.87
	Irrigation		120.45

Water distribution systems comprise the supply and treatment of drinking water from source to final consumption. Efficient use of potable water can reduce level of emissions since small amount of energy is needed to treat and distribute water. One of the recommended strategies to manage water efficiently is through diversifying main water sources and recycling grey water or waste water. In a study conducted by REDAC, underground water extraction can increase water management efficiency by up to 45%.

The usage of recycle water to operate the existing District Cooling System (DCS) saves significant amount of potable water. Planting the xeriscaping species that are drought-tolerant also promotes water savings. The average water consumption in Malaysia is 212 litres/day, whereby every 1000 litre will generate approximately 1.5 kg of CO2.

Figure below shows the related key and sub-actions associated with the reduction of CO2 under the Waste Sector.

Figure 8.15 : Corresponding CO2 Reduction According to Sub-Actions

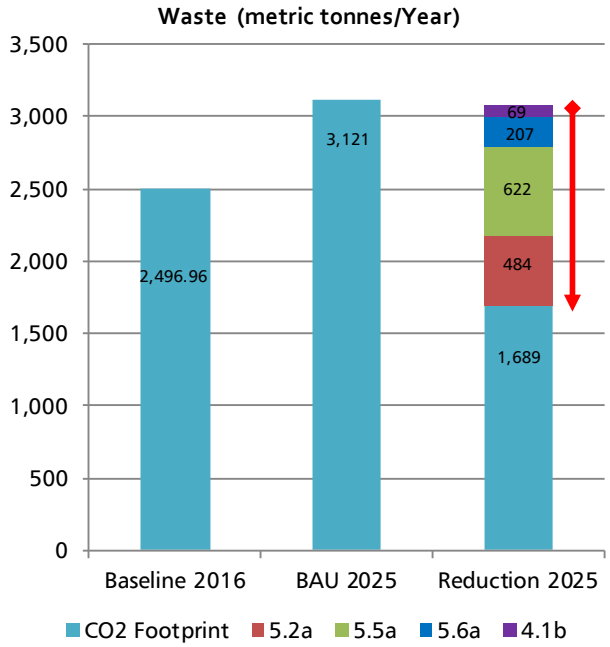


Figure 8.16 : Tangible Key and Sub-Actions Under Transport Sector

Key Action 4.1 : Enhancing The Environmental Quality

4.1b	▪ Plant specific tree types/species that increase urban canopy and urban biodiversity. ▪ Encourage xeriscaping for sustainable landscape maintenance.

Key Action 5.2 : Greening The Waste Water System

5.2a	Adopt to Sustainable Sewerage Treatment Plant (STP) by : ▪ Converting existing STP to sustainable STP systems; ▪ Constructing future new STP with sustainable STPs; ▪ De-centralizing future STPs to encourage the utilization of recycle water to local area neighborhood.

Key Action 5.5 : Improving Water Management System ★

5.5a	▪ Introduce advanced water like underground water extraction. ▪ Encourage the utilization of recycle water from STPs to local area neighbourhood.

Key Action 5.6 : Reducing Energy Consumption

5.6a	Convert existing conventional District Cooling System (DCS) to green DCS by using recycle water and running on Renewable Energy.

8.6 Embodied Carbon

As being mentioned in Section 8.2, carbon emissions consist of Operational Carbon (which has been discussed in Sections 8.3, 8.4 and 8.5) and Embodied Carbon. Two (2) main sectors of embodied carbons are Land Clearing and Construction Activity.

Table 8.11 shows the breakdown of existing land use as at 2016. It is noted that in 2016, buildings and infrastructures comprised nearly 53% of the whole development. Parks, recreational areas, water bodies and some developable land which had not been developed made up for the remaining 47%.

Until 2016, as much as 32% of the total area was still not developed. With this development, about 182,405.14 metric tonnes CO2 per year was emitted

Sepang Local plan 2025 marks the completion of development in Cyberjaya. Buildings and infrastructure will cover about 85% of the total area. The commercial sector will become the largest development (26%), followed by residential sector (23%) and transportation (19%). These will increase 36% of embodied carbon.

A. Land Clearing

In order to make way for these development, 1,487 acres of land were cleared, releasing one-off emissions of approximately 37,575 metric tonnes CO2.

B. Construction Activity

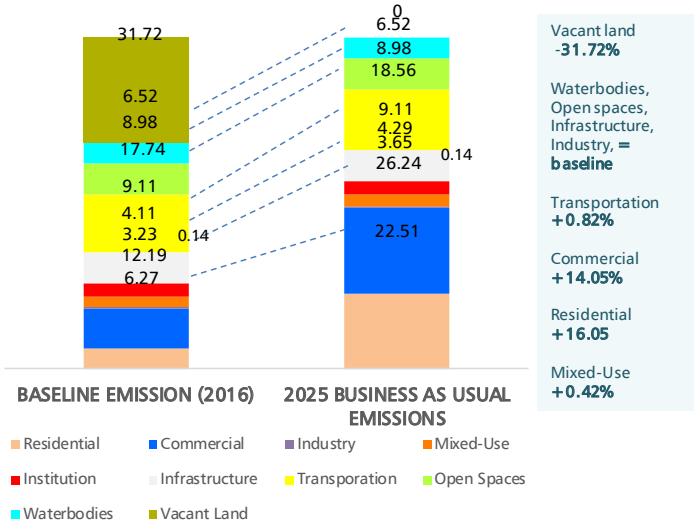
Embodied Carbon for buildings and construction activity is about 20% from total Operational Carbon emission (SEDA, 2016) which is 36,480 metric tonnes CO2/year with land use profile of Residential (75%), Commercial (22%) Mixed Use (1%) and Institution (1.8%).

Therefore, total Embodied Carbon is 74,055 metric tonnes CO2 per year.

Table 8.11 : Percentage of Land Use as at 2016

Land Use	Land Area (Acres)	%
Residential	436.55	6.27
Commercial	848.38	12.19
Industry	10.00	0.14
Mixed-Use	90.91	3.23
Institution & Public Amenities	115.87	4.11
Infrastructure	256.67	9.11
Transportation	499.65	17.74
Sub Total	**1,487.14**	**52.79**
Open Spaces	624.75	8.98
Water Bodies	453.56	6.52
Vacant Land	2,207.68	31.72
Sub Total	**5,473.62**	**47.20**
GRAND TOTAL	**6,960.76**	**100**

Figure 8.17 : Land Use Changes Projection



8.7 Net Emission of Cyberjaya

The emission per capita (EPC) for Cyberjaya in 2016 with 42,252 population and evaluated based on Operational Carbon is 3.98 metric tonnes CO2/year. If to be worked on net carbon basis (including Embodied Carbon), the EPC increases to 6.07 metric tonnes CO2/year. In principle, most countries evaluated their EPC values from operational emissions. This is especially true when knowledge on embodied carbon is still scarce at large and many questions left unanswered.

In 2025, population is expected to increase to 210,000 (projection in 2020), but with the same residents ratio (44.5% or 93,408 persons). Despite larger emission, it will be shared with the simultaneous expansion in population, therefore bringing down the EPC values to about 3 times lower compare to of 2016. This trend applies to both operational and net carbon.

Figure 8.18 : Cyberjaya – Net Emission

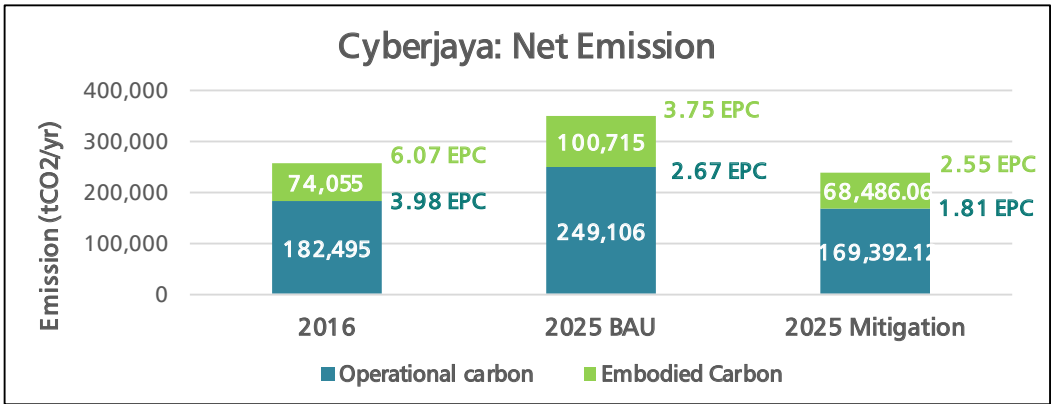
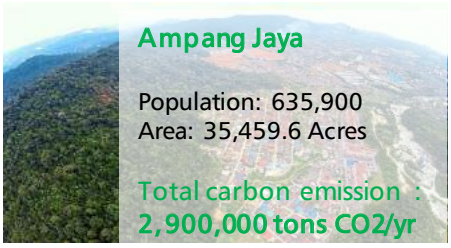
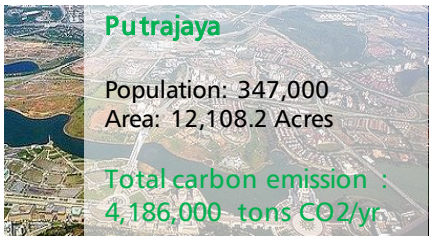


Figure 8.19 : EPC Comparison With Other Cities in Malaysia



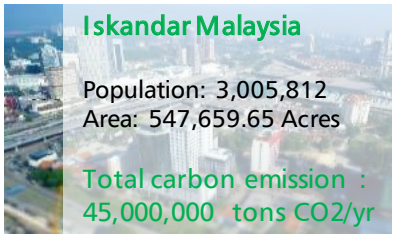
EPC **4.56** tons CO2/yr (2016)

Source: MPAJ Low Carbon Action Plan 2017



EPC **12** tons CO2/yr (2012)

Source: Putrajaya Low Carbon Green City initiatives Report, 2012



EPC **15** tons CO2/yr (2015)

Source: Iskandar Malaysia Low Carbon Society Blueprint , 2015

Figure 8.20 : EPC Comparison With Other Cities in the World

Emission Per-capita **7** tons CO2/yr

Emission Per-capita **4.5** tons CO2/yr

Emission Per-capita **2** tons CO2/yr

Emission Per-capita **16** tons CO2/yr

Emission Per-capita **6.5** tons CO2/yr

Emission Per-capita **9** tons CO2/yr

Source: C40-Cities-Citywide-Emissions, 2015

8.8 Cyberjaya's Projected Reduction 2030

There are considerable opportunities of lowering carbon emissions in Cyberjaya. Of the many sources, buildings (from embodied to operational carbon) present the biggest share contributing to the overall emissions, therefore mitigating through building-related GHG is the most effective measure to bring down emissions (UNEP 2007).

Reductions in building-related GHG emissions can be achieved in many different ways : by increasing the amount of electricity generated from low- and zero-carbon technologies, by retrofitting existing buildings to reduce energy consumption and improve energy efficiency, and by constructing new buildings to be low- or zero-energy buildings. Many factors influence the level of emission reductions achieved. Significant improvements in energy efficiency are attainable and can reduce building-related emissions to very low levels or, when coupled with renewable energy sources, to zero. Pairing these measures with greeneries to provide sinks is the most economical and effective way to slash emission. Planting trees with high sequestration properties will elevate sequestration to a higher level beneficial for a safe environment.

The second major contributor to CO2 emission is the transport sector as a result of high dependency on private vehicles. Recommended mitigation measures include encouraging people to use public transport and other means of green mobility (including walking and cycling). As such, public transport services (buses and upcoming rails) need to be efficient and convenient to draw ridership. Facilities and amenities for people to walk and cycle need also be convenient, safe and vibrant to encourage more people to walk and cycle.

This study undertaken by MP Sepang provides a thorough understanding of greenhouse gas (GHG) emissions as well as an understanding on the impact of CO2 reduction contribute by various and different activities within the city. This would allow the authority to determine where to best direct mitigation efforts, set emission reduction targets, create strategies to address climate change and monitor progress. The maxim "if you can't measure it, you can't manage it" applies here, and so the idea that urban fabric and activity can be 'instrumented' and measured in detail, and acted upon instantly, enables a new form of management, operation and engagement.

Cyberjaya
& Smart Low Carbon City
2025

40%
Carbon emission
reduction by 2030

8.9 Review of 2011 Baseline Report

8.9.1 Overview of 2011 Report

A. Background

This section presents an overview of the CO2 Baseline Data Report 2011 studies in respective to results, limitation and conclusion drawn from the carbon assessment exercise conducted in Cyberjaya in 2011, undertaken by the Ministry of Energy, Green Technology and Water (KeTTHA), Malaysian Institute of Planners (MIP) and related stakeholders. The report, titled Low Carbon City Action Plan for Cyberjaya, provides an insight on the state of carbon emissions and baseline in Cyberjaya outlined by the four elements of Low Carbon Cities Framework & Assessment System (LCCF) namely, Urban Environment (UE), Urban Transportation (UT)), Urban Infrastructure (UI) and Buildings (B), Figure 8.21.

The studies examined the carbon baseline for 2011, forecasted emissions in 2020 in a Business as Usual Scenario (BAU) and mitigated emissions through the use of Low Carbon Strategies (LCS).

Low Carbon Strategies (LCS) typically focuses on reducing emissions in resources and consumption and increasing carbon sequestration through improved greenery management. Some of the LCS stated in the 2011 Report were the use of solar photovoltaic (PV), district cooling, reduction in the use of private vehicles and designing green open space to occupy at least 10% of the total development area.

The overall emissions were estimated from a Land Use distribution indicated by Sepang Local Plan 2020 (Table 8.12).

Figure 8.21 : Four (4) Elements in LCCF For CO2 Reduction

Source : Low Carbon Framework & Assessment System (LCCF)

CO2 Baseline Data Report 2011

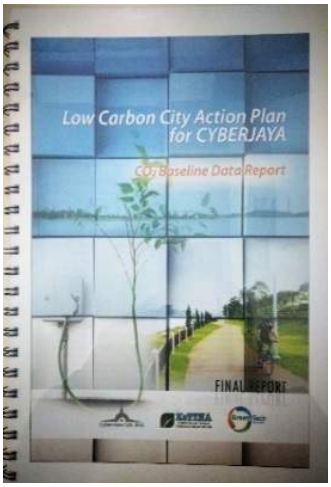


Figure 8.12 : Breakdown of Land Use Pattern in accordance to Cyberjaya Masterplan 2020

Land Use	Unit	Hectare	Acre	%
Residential	36,046	701.88	1,734.37	24.92
Commercial	395	644.25	1,591.97	22.87
Industry	1	4.04	9.98	0.14
Private Institution	8	124.70	308.13	4.43
Public Institution	20	123.11	304.21	4.37
Open Space	-	256.71	634.34	9.11
Infrastructure and Utility	86	286.58	708.15	10.17
Road Reserve	-	675.62	1,699.48	23.99
Total	36,556	2816.89	6,960.65	100

Source : Sepang Local Plan 2020

Meanwhile, the baseline emissions for 2011 were calculated in accordance to the progress of the city development as at end of 2011 (Table 8.13). The land use distribution as of today's development is shown in Figure 8.22. A brief profile of Cyberjaya including land area, population and day time temperature at the time of the study is given in Table 8.14.

Table 8.13 : Development in Cyberjaya As At End 2011

Land Use of Cyberjaya	Total Lot	Area (Ha)	Planned Lot	Area (Ha)	Comple-ted	Area (Ha)	Committed	Area (Ha)
Enterprise	175	478.86	119	-	50	-	6	-
Housing	26	632.95	15	342.41	3	16.75	8	273.79
Mixed Use	7	117.28	-	14.35	4	70.75	3	46.53
Commercial	36	142.30	27	87.23	6	15.08	3	39.99
Institution	8	124.70	5	30.19	1	80.81	2	83.64
Light Industry	1	4.05	1	4.05	0	-	0	-
Total	253	1499.34	167	478.23	64	183.39	22	443.95

Source : Sepang Local Plan 2020

Figure 8.22 : Land Use Distribution as of Today's Development

Source : Cyberjaya Global Technology Blueprint

Table 8.14 : Profile of Cyberjaya

Background Profile of Cyberjaya	
Total Land Area	28.85 km²
Population 2012 (Day-time)	51,000
Population 2012 (Night-time)	14,000
Population Density (based on daytime)	1,767/km²
Temperature	24˚C

Source : Sepang Local Plan 2020

B. Results

The carbon assessment were broken down into Embodied Carbon and Operational Carbon.

Embodied Carbon refers to CO2 emitted during the manufacture, transport and construction of building materials, together with end of life emissions. Whilst Operational Carbon is the term used to describe the emissions of CO2 during the operational or in-use phase of a building or development.

The emissions estimated in the 2011 Report were based on net CO2 from Embodied Carbon, Operational Carbon and Carbon Sequestration from greeneries (Carbon Sinks). The Baseline Study conducted for 2011 had considered the effects of Embodied Carbon summing to approximately 1.4 million tCO2 (Table 8.15) Under the Business As Usual (BAU) scenario, the emissions in 2020 rose to more than 128% above the baseline level. Mitigation actions through Low Carbon Strategies (LCS) reduced the emissions by 140%.

Table 8.15 : Emissions with Embodied Carbon

	UE (tCO_2)	UT (tCO_2)	UI (tCO_2)	B (tCO_2)	TOTAL (tCO_2)
Baseline 2011	883,620	246,681.60	57,687.4	213,361	1,401,350
BaU 2020	2,446,662	379.889.7	143,415.6	230,942	3,3200,909
LCS 2020	630,771	278,585	278,585	145,442	1,333,383

Source : 2011 Report

Some of the LCS Strategies

The studies demonstrated that the LCS approach for 2020 has a great impact upon carbon reduction, lowering its emissions to almost the same level as the baseline in 2011 despite the substantial increase in development. The dramatic increase in carbon sequestration by greeneries from extensive planting programs played a significant role in lowering emissions, as evident in the case of LCS.

The emissions produced by the Urban Environment (UE) sector appear to have the greatest impact upon the whole emission of Cyberjaya. In addition to the emission from land clearing activities, the relatively high emissions in the UE sector can be explained by the presence of Embodied Carbon from the built environment, particularly from construction of roads and open parking.

In this study, the emissions produced by other elements outlined by LCCF are dedicated solely to Operational Carbon.

Summary

In summary, the 2011 carbon assessment is inconclusive and the report is limited to its own findings without citation of other works in similar areas to justify the report findings. While the robustness of data and stakeholders' buy-in remained as outstanding issues pertaining to the comprehensiveness and quality of acquired data, it is felt that the results could have been presented in a more argumentative manner and aggressively scrutinised to support the objectives of the work.

In this context, a synthesis of the results is deemed necessary to pull the information together in generating essential knowledge for the benefits of future carbon assessment. A true understanding of the status quo ensures more effective measures can be undertaken in the next step of actions in terms of delivery and strategy. Only then, the dream of turning Cyberjaya into Smart & Low Carbon City by 2025 can become a reality,

A synthesis of the results is reported and discussed Section 3.4 (Cyberjaya 2016 & 2020) of this Chapter.

A list of shortfalls of the report are identified and discussed in the following segment. Understanding the deficiencies will also help in synthesising the existing report towards available information which could be extracted for beneficial gains of the following carbon assessment exercise.

8.9.2 Limitations of 2011 Report

The 2011 Report presented a wealth of information for assessing carbon emissions. However, there are limitations that need to be addressed and improved for future applications.

Several shortfalls ranging from methodology to carbon analysis have been identified. The list includes the following :

a. The attempts to quantify carbon emissions using the fully comprehensive LCCF checklist for an 'apple to apple' comparison and to justify the application of LCCF in the carbon accounting complicates the analysis. The LCCF listed all its sub-element containing tangibles and non-tangible items to guide in the master planning design process. However, the carbon accounting could only cater for the tangible elements. An alternative approach should be considered - such as categorising the intangibles as Pre-Requisites to the overall framework.

b. Another obvious problem in using the LCCF checklist for carbon quantification lies in the nature of the framework and how it has been structured. Repeatable sub-elements under different sectors made it almost impossible to analyse the impacts of individual parameters on the whole carbon assessment, unless grouped together. Systemising sub-elements in groups ensure that elements are taken care off effectively, and leaving nothing astray for double counting. The risk of double counting due to overlapping sub-elements in the case of using the LCCF checklist to quantify carbon is high, if not careful.

c. The carbon assessment has attempted to include Embodied Carbon but this is only demonstrated in the Urban Environment sector while other sectors were relegated to Operational Carbon. A consistent methodology approach would require the same treatment by including Embodied Carbon in all sectors.

d. The adopted methodology of quantifying carbon based on the LCCF list deprived the opportunity to directly analyse the impacts of sub-elements on overall emissions. The contribution and impacts of the sub-elements on whole carbon emissions is not clearly visible as they are summed and rounded to a single number under each sector. Additional works will be required to disaggregate the sub-elements under systematised headings as explained earlier in (a) and (b).

e. A major deficiency lies with the carbon assessment of Urban Transportation (UT) whereby estimates were deduced from the number of registered vehicles. This is erroneous because registered vehicles do not necessarily mean that they are mobilised. On the other hand, using traffic surveys conducted in selected zones in the area provides some indication on the state of mobility in the area and the data can be further scrutinised to estimate the vehicle mile travel (VMT) or vehicle km travel (VKT) which form a significant information to the accuracy of the assessment.

f. The carbon assessment on Urban Infrastructure (UI) needs to be reviewed in a more specific manner to imply the effects of the individual infrastructure parameters on carbon emissions. In the existing structure, some of the UI sub-criteria are repeated elsewhere in other elements adding confusions.

g. The report highlighted the concerns of data limitation both at local and national levels. These are from the perspectives of (i) national/local carbon inventory and (ii) site specific data to support the evaluation of Operational and Embodied Carbon. Poor contribution from stakeholders to support data gathering appears to be the main setbacks in realising the full delivery of the assessment works reported for 2011. In practice, the carbon inventory can be developed and continuously updated over time, but the site specific data cannot be compromised as they present the key and basic information for carbon quantification.

h. The carbon assessment has not been formatted to categorise Operational Carbon, Embodied Carbon and Carbon Sequestration. While such step may be considered unnecessary, this simple layout will lead to a better understanding of the mathematical analyses for the whole carbon emissions. This is significantly important in order to rake the interests from stakeholders.

8.9.3 Synthesis of 2011 Report

A. Cyberjaya 2011 & 2020

As highlighted above, the 2011 baseline report is rather inconclusive despite the wealth of information presented by the studies. This section aims to synthesise the results by pulling together information from the report, generating new knowledge from meaningful conclusions, in addition to providing background information and definite foundation for the next step of actions.

The 2011 Report attempted to evaluate the emissions per capita with the effects of Embodied Carbon but in practice, the emissions per capita published annually by authorities such as World Bank and similar organisations do not include Embodied Carbon. The carbon emissions per capita with Embodied Carbon for Cyberjaya under the respective carbon scenario are shown in Table 8.16

These values were derived using day time population of the city. Taking into account of the Embodied Carbon, the emissions per capita in 2011 were reported to be 27.47; exceeding more than three times the national emissions per capita. The reported value of emission per capita for 2020 is erroneous because a day time population of 2011 was applied instead of the projected population in 2020. With larger population, these should generate lower emissions than those indicated in the former report.

Table 8.17 also provides the corrected emissions per capita of the 2011 Report. The increase in population in 2020 reduces the emissions per capita to below the baseline value in 2011.

Table 8.16 : Emissions Per Capita for Cyberjaya With Embodied Carbon For 2011 and 2020

Carbon Scenarios	Emissions Per Capita With Embodied Carbon (tCO2 per capita) (Reported)	Emissions Per Capita With Embodied Carbon (tCO2 per capita) (Corrected)	National Emissions Per Capita
Baseline 2011	27.47	27.47	7.9
BAU 2020	62.76	21.47	12.1
LCS 2020	26.14	8.94	-

Source : N/A

Table 8.17 : Emissions Per Capita for Cyberjaya Without Embodied Carbon For 2011 and 2020

Carbon Scenarios	Emissions Per Capita Without Embodied Carbon (tCO2 per capita)	National Emissions Per Capita
Baseline 2011	7.77	7.9
BAU 2020	11.32	12.1
LCS 2020	10.36	-

Source : N/A

If Embodied Carbon is ignored, as in other conventional carbon assessments, the carbon baseline of Cyberjaya for 2011 will be lowered to 514,274 tCO2, which equates to 7.7 tCO2 per capita (Table 8.17). This is comparatively similar to the published national emissions per capita of 7.9 tCO2 for 2011 (World Bank, 2011).

The Business As Usual (BAU) scenario in 2020 caused the emissions to rise to 11.32 tCO2 per capita and curbing it with Low Carbon Strategies (LCS) tend to reduce it to 10.36 tCo2 per capita (Table 8.17). The projected national emissions per capita for 2020 stood at 12.1 (Ministry of Natural Resources & Environment, 2015).

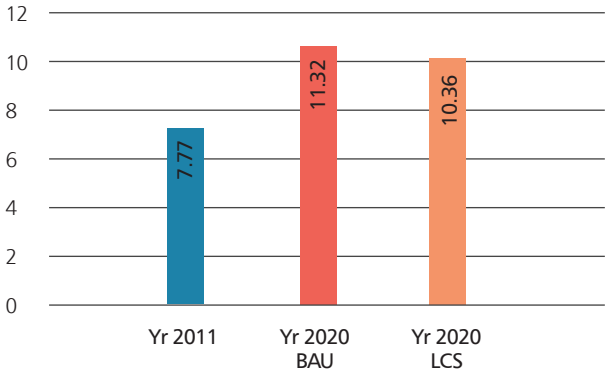
A graphical illustration of these results is shown in Figure 8.23.

Initially, Malaysia pledges to cut its emissions by 40% in 2020 from its 2005 levels. However, this reduction is now raised to 45% by 2030. It would be useful to examine the emissions per capita values of Cyberjaya against the new national reduction target and whether they are contained within the national permissible limits.

Figure 8.24 compares the emission for each scenario with the 2005 emission level. In summary, the emission per capita for Cyberjaya in 2011 and 2020 are above the 2005 level.

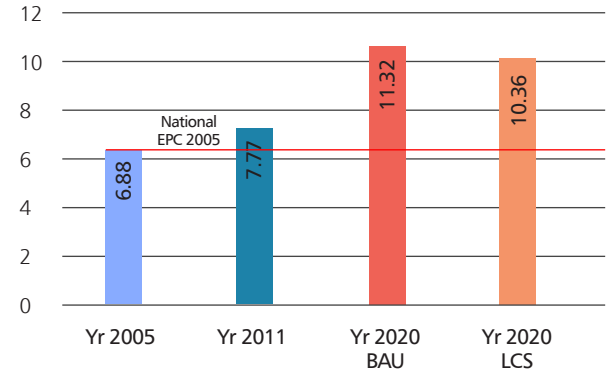
The baseline in 2011 and 2020 BAU scenario are higher by 13% and 65% respectively, than the national emissions per capita in 2005. Curbing emissions through LCS has the potential of reducing these differences. Emissions per capita values capped against the 45% reduction relative to 2005 level provides a means for controlling measures within the target defined by each scenario. This is discussed in more detailed in the next section.

Figure 8.23 : Emissions Per Capita of Cyberjaya in 2011 and 2020



Source : N/A

Figure 8.24 : Comparison of Emissions Per Capita For Cyberjaya in 2011 and 2020 with 2005 Level



Source : N/A

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