

MELAKA STATE

Climate Action Plan 2020 - 2030



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الجامعة الإسلامية العالمية ماليزيا
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Garden of Knowledge and Virtue



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MELAKA STATE CLIMATE ACTION PLAN 2020 - 2030

Prepared by

Irina Safitri Zen, Haslenda Hashim & Gobi Krishna Sinniah
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Foreword by H.R. Hon. Tuan Adly bin Zahari the Chief Minister of Melaka

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ
السَّلَامُ عَلَيْكُمْ وَرَحْمَةُ اللَّهِ وَبَرَكَاتُهُ

Warm Greetings

Alhamdulillah, my heartfelt gratitude to Allah SWT for His grace and blessings, the Melaka Green Technology Corporation (MGTC) and Universiti Teknologi Malaysia (UTM) have been able to publish the Melaka State Climate Action Plan (MSCAP) 2020 - 2030. This plan reflects Melaka's long-term commitment in setting the targets beyond greenhouse gas, GHG reductions and supports the Nation's pledge to the United Nations Climate Change Conference in Copenhagen in 2009 (COP15) to reduce by 45% of GHG emissions intensity per GDP by 2030.

The Melaka State is a forerunner in adopting and developing a Climate Action Plan and making substantial efforts and investments towards a resilient and sustainable future for its generation.

I would like to call upon the people of Melaka to show their action to participate in realising the vision to transform Melaka into a Green Technology City State by 2020. In line with the state government's motto of "Melaka Berwibawa, Pintar, Hijau, Bersih", numerous green initiatives with award-winning projects are constantly being implemented.

Hence, continuous effort with well-structured plan is needed to nurture green awareness among the public and keep track the effort by various relevant parties in Melaka. It is hoped that the various green technology initiatives will facilitate efforts to conserve the environment sustainability to reduce GHG emissions.

I take this opportunity to thank and congratulate Melaka Green Technology Corporation (MGTC), Universiti Teknologi Malaysia (UTM), government officials and the task force involved in the preparation of this report.

Let us all boost our efforts to work together so as to implement and spur more green developments in Melaka.

"MELAKA BERWIBAWA", "PINTAR, HIJAU, BERSIH"

Best Regards



ADLY BIN ZAHARI

Chief Minister of Melaka



Foreword by the Vice Chancellor UNIVERSITI TEKNOLOGI MALAYSIA

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

وَالسَّلَامُ عَلَيْكُمْ وَرَحْمَةُ اللَّهِ وَبَرَكَاتُهُ and Sincere Greetings to All,

First of all, I would like to express my gratitude to Almighty Allah SWT for the initiative Universiti Teknologi Malaysia (UTM) and Melaka Green Technology Corporation (MGTC) have done in producing the Melaka State Climate Action Plans & Strategies (MSCAPS) 2020 - 2030.

The effort reflects the high commitment by UTM to serve a better society for human kind which translates the '*University for Society*' slogan. This means to share the University's expertise to do research for the benefits of the society, solve industrial problems, strengthen the University-Government partnership as well as support the Melaka State aspirations to become a Green Technology City State by 2020.

As a Malaysian public research-intensive university in engineering, science and technology, a collaborative effort between UTM and MGTC in producing the MSCAPS provides a platform for more potential collaborative works such as having relevant, robust, innovative and impactful program and activity in the future. This inspires more experts in the University to work more closely with the community in a broader context.

Finally, I would like to thank the Melaka State and MGTC for their confidence and trust to work closely with the expert from Universiti Teknologi Malaysia in advocating the collaborative works to support the implementation of Melaka Green Technology State. Let us work together for a betterment of the country's commitment to combat climate change.



Warm Regards,

Prof. Datuk Ir. Dr. Wahid Omar

Vice Chancellor, Universiti Teknologi Malaysia

Foreword by the CEO

Melaka Green Technology Corporation

Warm Greetings,

Firstly, let us extend our gratitude to the Almighty for it is with His Grace that we are endowed with good health and prosperity.

The efforts by the State of Melaka in publishing the Melaka State Climate Action Plans & Strategies (MSCAPS) 2020 -2030 restate our determination to reduce the impacts of climate change in more substantial and significant changes. The MSCAPS is an important document to couple with the Melaka State: Green House Gas Inventory Report published by our office. I would like to convey the utmost appreciations and gratitude to Universiti Teknologi Malaysia (UTM) for their efforts and contributions for ensuring the successful completion of this report.



The plan contains greenhouse gas forecast and state-wide reduction targets specifically for Melaka State based on the action to implement the Malaysia Climate Change Policy, Green Growth agenda and Sustainable Consumption Production which highly emphasise on green technology.

This report helps us to take informed decisions to formulate mitigation and adaptation climate actions to reduce the carbon emissions in Melaka, hence helping the agencies to identify strategies for mitigation and adaptation to reduce these emissions and improve the adaptive capacity and resilience of the city.

Finally, I hope this report enables the interest and supports of all parties towards green technology. Green shall be our way of life, in line with the Melaka state motto, “Melaka Berwibawa, Pintar, Hijau, Bersih”.

Thank you,

Warm Regards.

A handwritten signature in black ink, appearing to be 'S. Chandru'.

S. CHANDRU

Chief Executive Officer, Melaka Green Technology Corporation

Foreword by the Project Director

Warm Greetings and *Selamat Sejahtera*

Melaka State Climate Action Plan (MSCAP) 2020 - 2030 is developed as a state- and community-wide of climate mitigation and adaptation action based on the greenhouse gas, GHGs inventory data 2015.

The plan measures the emissions of GHGs in two ways; i. through the actions of the local government administration (government emissions) and ii. through the actions of the community (community emissions). The setting up of the reduction target respect to a base year and a target year. The designs of the actions for implementation at the local level covers the monitoring of emissions reductions achieved by their mitigation actions and assigned the respective government agencies for Climate Governance in Melaka. Hence, cutting carbon emissions as part of the fight against climate change should be a key priority for both local and city governments around the world. Taking action in these areas is necessary to bring about a successful and prosperous low carbon transition.



The MSCAP called upon the Melaka community, the MGTC, the four key LAs, relevant government agencies, private entities and community or **Melaka Climate Governance**, to reduce GHGs emissions as much as 5,793 MT CO₂e or 45 % as of year 2030. The MSCAP prioritises GHGs emissions from energy consumption in industry, on-road transportation and commercial/institutional building for further strategic reductions action and takes stocking the existing climate action initiatives. Prior to the Plan, the workshop with 20 stakeholders and representatives from government agencies was held and has agreed to have 22 strategies of Climate Resolution for Melaka State 2020 - 2030. It is a bottom-up approach for the basis of climate action policy formulation.

MSCAPS were constructed based on the Global Protocol for Community-Scale Greenhouse Gas Inventories or GPC. The tools allow continuous monitoring and improvement purposes as per target year defined and based on the inclusive definition of the “city” that includes the actors at the community, town, municipal, and metropolitan levels to realise their potential and contribution to this global effort. The GPC aims to reduce GHGs emissions and adopt low emission development trajectories (*mitigation*) as well as adapt the impacts of climate change (*adaptation*) to build local climate resilience. Hence, I would like to thank MGTC for their commitment throughout the project period, 2016-2019, the team of expert of Universiti Teknologi Malaysia (UTM) and the UTM for the University-Industry Tier 1 Grant, under the Ministry of Education.

Thank you

Sincerely,



Dr. Irina Safitri Zen

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Executive Summary



Executive Summary

- The Melaka State Climate Action Plan (MSCAP) 2020 – 2030 is a **state- and community-wide action plan** which was based on the Greenhouse Gas (GHG) inventory data as of year 2015. It was co-developed by the team of expert from Universiti Teknologi Malaysia, the officers in Melaka *GreenTech* and the stakeholders in Melaka state which can be a basis for **Melaka Climate Governance**.
- Six main sectors were identified from the Melaka Climate Resolution 2019, Melaka Climate Action Plan Stakeholder Workshop. The six are **Public & Stakeholder Engagement, Climate Governance, Energy, Transport, Waste, Ecosystem & Biodiversity**.
- The development of detail GHG emission sources helps agencies to determine the major sources of carbon emissions, identify the strategies for mitigation and adaptation in order to reduce these emissions and improve the overall resilience of the city.
- MSCAP was developed as a guide for structured and continuous action to translate the Melaka State GHG Inventory Report. It was developed to strategize the Melaka contribution towards the Nation voluntary commitment on CO₂ reduction by identifying emissions from various sectors and activities in Melaka.
- Community- and sector-wise GHG inventory reveals the characters of carbon emitters and helps in assigning the responsibility for further climate mitigation and adaptation action.
- As of year 2030, Malaysia national target for carbon emission reduction is 45% and the **Melaka State GHG emissions reductions target** set up for **45 % or equivalent to 5,703 MT CO₂e**.
- Per capita GHG emission for Melaka State was recorded **5.09 tCO₂e** in 2015 based on 872,900 population.
- In line with the trends of energy demand, the major contributors to GHG emissions are industrial energy use with **1,590 MT CO₂e** (35.77 %), on-road transportation with **1,115 MT CO₂e** (25.09 %) and commercial / institutional buildings and facilities with **733 MT CO₂e** (16.49 %).
- Climate resolution for Melaka State (2020 – 2030) is a result of the Melaka Climate Stakeholder

Melaka Intensity Carbon Emission Target

LONG TERM

**45% reduction or
5,703 MT CO₂e by
Year 2030**

MEDIUM TERM

**30% reduction or
2,663 MT CO₂e by
Year 2025**

SHORT TERM

**20% reduction or
1,252 MT CO₂e by
Year 2030**

- **Industrial and commercial sectors** are the largest end users of electricity in Melaka, accounting for over 3/4th of the electricity consumption. The industrial demand has spiked alarmingly, with electricity consumption in industries more than doubling since 2011.
- In 2015, the total of greenhouse gas (GHG) emissions of Melaka State is up to **4,446 MT CO₂e**. It was contribution from the stationary unit (67%), mobile unit (25%), waste (6.74 %), and AFOLU (Livestock) (1.18 %).
- **Stationary units** dominated the GHG emissions with **2,979 MT CO₂e** (67%) in 2015. It consisted of residential buildings (13.76%), commercial/ institutional buildings and facilities (16.49%), manufacturing industry and construction (35.77%), agriculture, forestry and fishing activities (0.98%).
- **Mobile Units** was recognised as the second largest contributor of GHG emissions with **1,115 MT CO₂e** (25.09 %) in 2015.














Climate Resolution for Melaka State (2020 – 2030)

The Climate Resolution for Melaka State (2020 -2030) produce from the Melaka Multi-stakeholder Climate Action workshop which held in Melaka state, November 2018. It is resulted as a participatory based approach that was agreed upon by 20 stakeholders, non-governmental organisations, NGOs and government agencies. The key stakeholder involved is the data custodian for development of greenhouse gas (GHG) of Melaka State GHG emission inventory report in 2013, 2014 and 2015. The Climate resolution produces 22 actions identified and classified into six focus areas. The six are Good Climate Governance, Energy, Transport, Waste & Low Carbon Lifestyle, Ecosystem, Biodiversity & Green Area and Public & Stakeholder Engagement. The 22 actions are as follows:



1. Every Local Authority identifies its niche and strength to lead Climate Action Plan in Melaka state. For example, tourism, industry, sustainable transport.
2. Adopt Global Protocol for Community-scale for Green House Gas Inventory (GPC) at Local Authorities level with strength and comprehensive data for global recognition.
3. Strengthen and harness the Climate Change Governance of Melaka State.
4. Improve the role of Melaka Green Technology Corporation (MGTC) with local authorities through Melaka Green Technology Council.
5. Strengthen a forest and wetland functions' as a carbon sequestration.
6. Develop Integrated Public Transportation Masterplan.
7. Develop Pedestrian and Bicycle Masterplan for Melaka.



8. Promote other types of renewable energy for example solar, PV, solar thermal, biogas, municipal solid waste, MSW etc.	
9. Prioritise and upscale climate action initiative with big impact.	
10. All of the existing and new buildings must be certified as green building and 'Melaka Green Seal' as a minimum requirement.	
11. Promote energy efficiency and sustainable energy management practices through ASEAN Energy Management System (AEMAS) for sustainable energy management in industry.	
12. Enforce the Efficient Management of Electrical Energy Regulations 2008 (EMEER2008) for industry.	
13. Establish community recycling centre in collaboration with Solid Waste Corporation (SWCorp) and corporate social responsibility of private sector.	
14. Formalise and legalise carbon emission intensity (per unit of GDP) reduction target up to 20% by 2020, 30% by 2025 and 45% by 2030 (based on 2015 baseline data) by developing Melaka Climate Action Policy.	
15. Promote waste to energy at state and community level.	
16. Update sectoral GHGs reduction from time to time by using social media.	
17. Strengthen the Eco School involvement in GHG reduction by low carbon school programme.	
18. Provide reward, recognition and incentive to promote climate change initiative.	
19. Strengthen the good governance for effective climate change initiative implementation.	
20. Recognise green job through JPA.	
21. Legalise the prohibition of single use plastic, polystyrene and straw to encourage low carbon lifestyle.	
22. Implement the open data policy for Melaka State in order to allow data integration and increase efficiency and enforcement of climate change initiatives by related agencies.	

1

INTRODUCTION



1.0 INTRODUCTION

As a transboundary challenge, climate change does not stop at political and geographical boundary. The solutions are not limited by such borders but need a collaborative and immediate actions. The Melaka Climate Action Plan is a report that coupled with the previous Melaka State Greenhouse Gas (GHG) Emission Inventory Report 2013, 2014 and 2015. It is the action plan that need to reconcile all efforts from various actors contribute to GHG emissions. The plan need to set up the target year based on selected base year followed by the actions at local level.

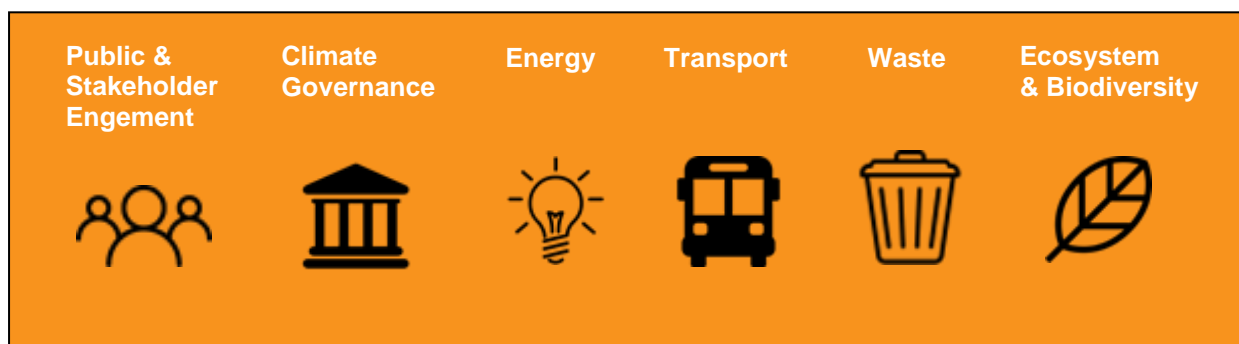
As an annual report, the Melaka state GHG Emission Inventory Report functions as a crucial mechanism to measure and monitor the carbon emission reductions from various activities in Melaka state. It has been reporting the emissions and green initiatives through the carbon Climate Registry (cCR). Besides, the reporting has been done through the leading online platform for local and subnational governments to publicly report climate and energy commitments, GHG emissions inventories, mitigation and adaptation actions and plan. Hence, the development of Melaka State Climate Action Plan (MSCAP) 2020 - 2030 is crucial as a main reference to streamline the existing effort to achieve the GHG emission reduction target.

**“BY ADOPTING
GLOBAL PROTOCOL
FOR COMMUNITY-
SCALE GREENHOUSE
GAS INVENTORIES
OR GPC, WE WILL BE
ABLE TO ACHIEVE
THE MELAKA GHG
REDUCTION TARGET
IN CLEARER
PATHWAY”**

Our efforts will concentrate on the actions that we can deliver under our responsibility as state coordinated body and the four local authorities, and therefore the solutions will strategize to the relevance stakeholder on those which we can directly control and recourse under the Melaka Climate Governance. However, we will also endeavour, where possible, to influence and facilitate other actors throughout Melaka that can help achieve our ambition and fully include all stakeholders, especially Melaka’s citizens, in developing the local authority mitigation and adaptation action plans.

This document has SIX main strategies or focus areas that will concentrate on our efforts to deliver actions under our capacity that can contribute towards our vision.

These are the focus areas:



Malaysia voluntary reduction of up to 45% in terms of emissions intensity of GDP by the year 2030 is related to the emissions intensity of GDP in 2005 levels” (from 1990 levels). Malaysia produced the National Communications (NCs), Biennial Update Reports (BURs) and reported them to United Nations Framework Convention on Climate Change (UNFCCC). The state of Melaka aspires to become a Green Technology City State by 2020. Melaka State responds proactively by producing the Melaka State Greenhouse Gas (GHG) Emission Inventory Report 2013 and 2014.

the Twelfth Malaysia Plan

Under **Environmental Sustainability**, the emphasises on Conservation and preservation was stated where **Climate change mitigation and adaptation**, was stated as one of the crucial strategic actions among the fifteen actions to shift towards green growth and enable better resource management.

To support that, the strategies include *‘strengthening policy, legislation and institutional frameworks, improving capacity and capability in enforcement and monitoring as well as raising awareness and foster shared responsibility among stakeholders to achieve ‘Shared prosperity’.*

Melaka State Climate Action Plan (MSCAP) 2020 – 2030 is in line with the **Twelfth Malaysia Plan** which emphasises on strengthening the governance to combat climate change and reduce disaster risk to shift towards green growth and enable better resource management. Hence, it is important to streamline the governance of climate mitigation and adaptation for further action to strategize reduction effort by the top emitters by assigning the responsibility to the polluters under the principle of Polluter Pays Principle, PPP, and encouraging private-public-partnership, PPP. This is at the end is to balance the environment sustainability aspect for the State.

Understanding the profile of carbon emissions helps in developing the strategies for further enhancement of the economic value. It was also stated in the mid-term review of the Eleventh Malaysia Plan declaring that, ***‘Efforts to mitigate climate change will be intensified through the reduction of greenhouse gas (GHG) emissions from the key GHG emitting sectors, mainly ENERGY, TRANSPORT and WASTE.***

Several strategic recommendations are **through the implementation of energy efficiency, adoption of several renewable energy effort, resource efficiency practices, zero waste initiative and green infrastructures**. In the context of Malaysia, all can be intensified by expanding the implementation of **sustainable consumption production (SCP) practices, Efficient Management of Electrical Energy Regulations 2008 (EMEER2008) and ASEAN Energy Management System (AEMAS)** as well as the support to selected **Goals of Sustainable Development Goals (SDGs) 2030**.

The sector identified as vulnerable are **Water, Energy, Agriculture, Public Health, Cities and Settlements** (Mid-Term Review RMK 11). Strengthening these sectors in Twelfth Malaysia Plan improves the resilience of the community against climate change impacts and natural disasters, the mitigation and adaptation.

THE VISION

**“TO HELP TRANSFORM
MELAKA STATE INTO A LOW
CARBON SOCIETY,
GREEN TECHNOLOGY
& SMART CITY STATE”**



**UNDER THE LEADERSHIP OF
Chief Minister ADLY BIN ZAHARI,**

**“Melaka has committed to reduce
its community-wide emissions
to below 2015 levels, or 5,703 MT carbon
dioxide
equivalent or up to 45 % reductions by 2030”.**

We, the Melaka Green Technology Corporation, MGTC and the local authorities admit that climate change is one of the greatest challenges that affect the continuing prosperity and well-being of Melaka citizens and its environment. We also recognise that local authorities by the facilitation of MGTC under Melaka Climate Governance function as leaders in the forefront to fight against climate change. Hence, we share a responsibility to work together with the national and international partners to tackle this issue to achieve ‘Shared Prosperity’. This can be done through the economic prosperity, the social re-engineering and last but not least, the environmental sustainability.

Through a well-coordinated, measured and strategic approach, We will transform our grey and green infrastructure and area move towards more sustainable future. These to protect our cultural and natural heritage and transform the Melaka state into a region that is socially and economically stable, attractive to live and work in, and physically resilient to environmental change.

THE MISSION

**“WE, THE MELAKA STATE WILL
LEAD MALAYSIA RESPONSE TO
MITIGATE AND ADAPT TO THE
EFFECTS OF CLIMATE CHANGE”**



We will work together with relevant stakeholders from the public and private sectors to share knowledge, expertise and initiative in order to create an action plan for each of the four local authority areas in Melaka State: Melaka Historical City Council, Hang Tuah Jaya Municipal Council, Alor Gajah Municipal Council and Jasin District Council, to reduce carbon emissions by 20% by the year 2020, 30% by 2025 and 45% by 2030 (based on 2015 baseline data).

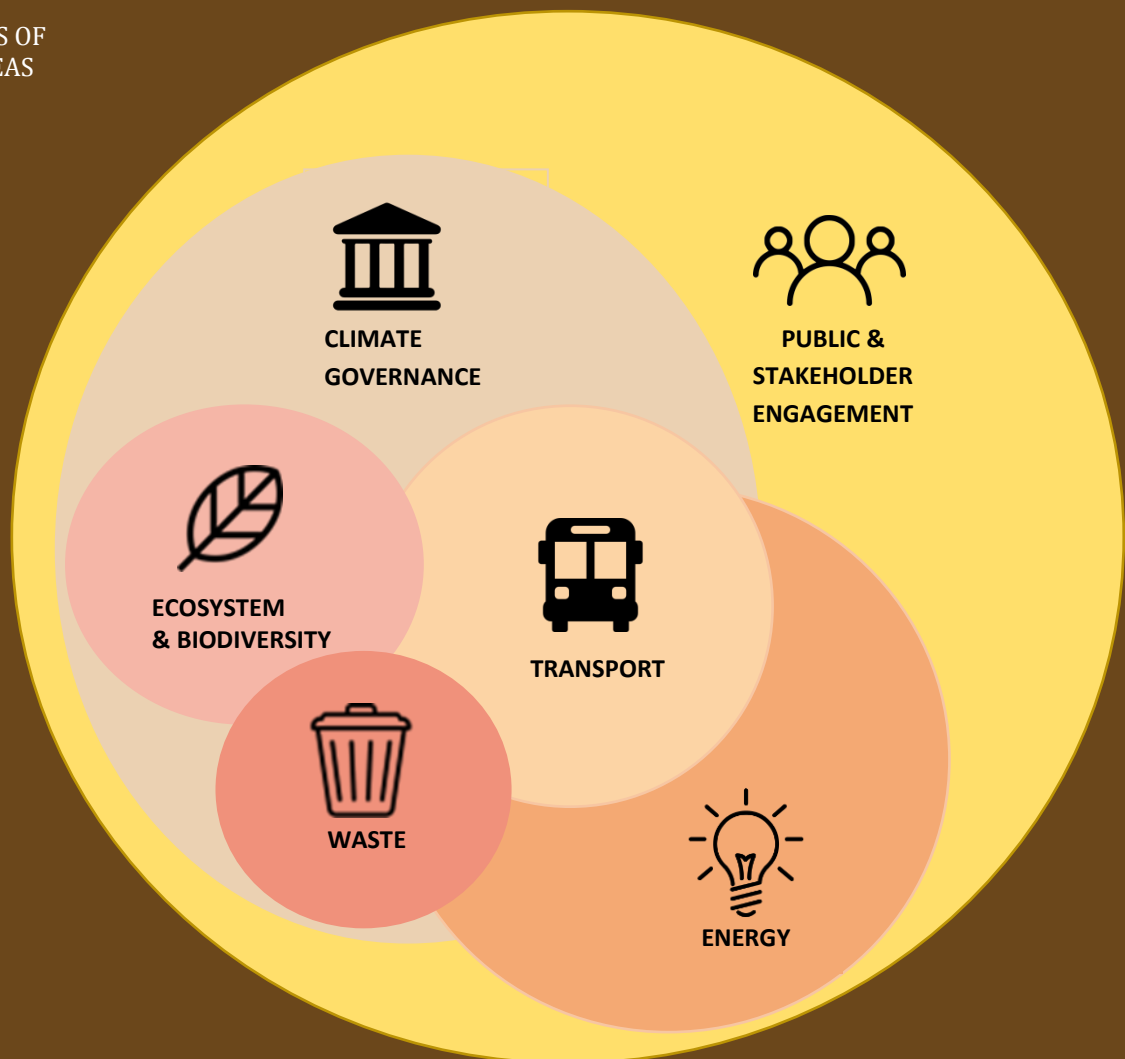
A clear mitigation strategy for the local authorities and operations is a vital first step - it helps to save money on energy, whilst allowing local governments to lead by example in reducing the risk of dangerous climate change.

FOCUS AREAS

Six focus areas were identified as the greatest potential to help the Melaka State move towards a low carbon state and adjust to the effects of climate change in a more systemic way.

Segmenting the climate change based on focus area facilitate the effort to address its own challenges and opportunities. The interrelatedness of each focus area allows the complementary objectives for comprehensive solutions that reflects the details of core actions. The relationships between the focus areas are illustrated in Figure 3 below, which highlights that Public and Stakeholder Engagement encompasses all of the focus areas.

FIGURE 3:
RELATIONS OF
FOCUS AREAS



1.1 GHG Inventory for Melaka State

The Melaka State Climate Action Plans (MSCAPs) 2020 - 2030 were developed based on the GHG Inventory 2015 data. The data was calculated in accordance with the approved principles and standards of the Global Protocol for Community-scale Greenhouse Gas Emissions (GPC) developed by ICLEI, Local Authorities for Sustainability and World Resources Institute, WRI. As an international protocol, the tool is formalised for international standard reporting for sub-national governments or local authorities across the world. This is to allow the monitoring and evaluation purposes from the operational control approach where local government must account for emissions from all facilities, operations, or sources. This includes measuring emission resulting from buildings or other operations from emissions source (e.g. recycling centre or wastewater treatment plant).

Scope

The globally accepted carbon accounting standard known as the World Resources Institute (WRI) Greenhouse Gas (GHG) Protocol defines direct and indirect emissions as follows:

- Direct GHG emissions are emissions from sources that are owned or controlled by the reporting entity.
- Indirect GHG emissions are emissions that are a consequence of the activities of the reporting entity, but occur at sources owned or controlled by another entity.

Emissions are also classified by their operational boundaries where the GHG Protocol further categorises direct and indirect emissions into three broad scopes:

- **Scope 1:** All direct GHG emissions (with the exception of direct CO₂ emissions from biogenic sources).
- **Scope 2:** Indirect GHG emissions associated with the consumption of purchased or acquired electricity, heating, cooling or steam.
- **Scope 3:** All other indirect emissions which are not covered in Scope 2, such as emissions resulting from the extraction and production of purchased materials and fuels, transport-related activities in vehicles not owned or controlled by the reporting entity (e.g. employee commuting and business travel), electricity-related activities (e.g. T&D losses), outsourced activities and waste disposal.

There are a number of types of GHG emissions sources resulting from operating municipal buildings and vehicles, outdoor lighting, and water and waste treatment plants. These types can be summarised as follows:

- **Stationary or Mobile Combustion:** Emissions resulting from on-site combustion of fuels (natural gas, diesel, gasoline, etc) to generate heat, electricity, or to power vehicles and mobile equipment.
- **Purchased Electricity:** Emissions produced by the generation of power from utilities outside of the jurisdiction.
- **Fugitive Emissions:** Emissions resulting from the unintentional release of greenhouse gases into atmosphere (e.g. leaded refrigerants, methane from waste decomposition, etc).
- **Process Emissions:** Emissions resulting from physical or chemical processing of a material (e.g. wastewater treatment or cement production).

The GHG Inventory Report in Melaka state is ongoing reporting system to cover all carbon emissions emitted from various sources of four local authorities: Melaka Historical City Council, Hang Tuah Jaya Municipal Council, Alor Gajah Municipal Council and Jasin District Council in Melaka State. Hence, the Climate Action Plans and Strategies need to be developed to set up the target year for emissions reduction as well as action to reduce the emissions from the sectors and relevant government agencies involved.

GHG emissions were measured from building energy usage, estimated fuel consumption for residential sector (i.e. kerosene and liquid petroleum gas, LPG), for industry (i.e. diesel petrol, PNG and furnace oil), estimated fuel consumption for road transportation (i.e. diesel, petrol and CNG), and solid waste sent to open dumpsite and composting. For this purpose, the online software application, Harmonised Emissions Analysis Tool (HEAT+) developed by ICLEI – Local Governments for Sustainability was used to analysis the GHG data collected. The first Melaka State

GHG Inventory Report developed based on the baseline data 2013.

The GPC allows city-to-city comparison across the globe for monitoring and continuous improvement purposes. It is based on the inclusive definition of the “city” that includes the actors at the community, town, municipal, and metropolitan levels, and realise their potential and contribution to this global effort.

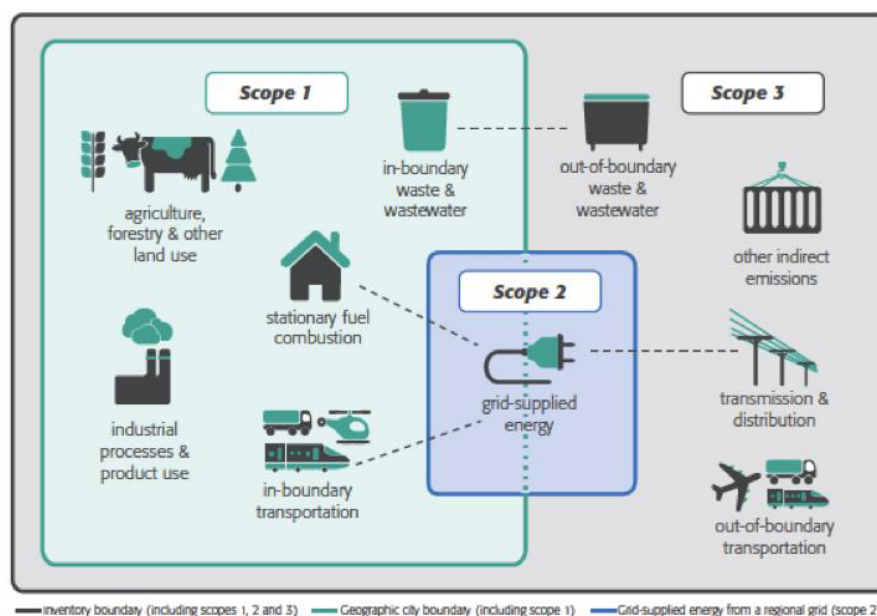


Figure 1. GPC Scope Framework : Sources and boundaries of city GHG emission

Under the framework of 3 Scopes, local governments can identify the sources of emissions to be measured and organise emissions by the degree of control. All emissions should be classified by scope in the inventory to illustrate the local government’s direct versus indirect control of its emissions. Local governments should account for report all Scope 1 and 2 emissions, at the minimum. Reporting on Scope 3 emissions considered optional. However, most local governments typically include Scope 3 emissions from waste disposed outside of its operational boundary, employee commute, and employee business travel.

1.2 About MSCAP

- The Melaka State Climate Action Plan (MSCAP) 2020 – 2030 presents a set of community-generated strategies to guide the Melaka Green Technology Corporation (MGTC), its local authorities(LAs), government agencies, non-government organisations, NGOs, local business and community group level in reducing greenhouse gas (GHG) emissions gradually, and it is consistent with the National goals for addressing Malaysia’ contributions to climate change.
- The MSCAPS 2020 – 2030 is based on climate change action initiatives; mitigation and adaptation for the strategic implementation at the State as well as local authorities’ level.
- The report is based on the Melaka state GHG inventory data in 2015. The Melaka Climate Action Plan is **co-developed** by the team of expert from Universiti Teknologi Malaysia (UTM) and Melaka Green Technology Corporation (MGTC). The project was funded by the Tier 1 Industry-Community Research Grant, Ministry of Higher Education (2017-19).
- The report follows the Principles for City Action Planning provided by UN Habitat (2015) and GHG Protocol Mitigation Goal Standard by World Resources Institute (WRI).
- The Melaka stakeholder workshop for Melaka State Climate Action Plan suggested the plan as a state-wide target reduction under the auspicious of Melaka Green Technology Council. Therefore, to legalise the target reduction, the development of policy and regulatory framework at the State level was suggested.
- The report is a proactive action to implement the

Objectives of the Project MSCAP

i. To develop the Melaka Climate Action Plan based on the Melaka State GHG inventory data 2015,

ii. To generate the Melaka Climate Resolution to support the Melaka State Climate Action 2020 - 2030,

iii. To develop strategic recommendation for the Melaka State Climate Action Plan.

Malaysia Climate Change Policy, Green Growth agenda and Sustainable Consumption Production which highly emphasize on green and cleaner technology as well as to support Goals 11, Sustainable Cities & Communities.

- The report follows the guiding principles of City Climate Action Planning which has to be **Ambitious, Inclusive, Fair, Comprehensive and Integrated, Relevant, Actionable, Evidence-based** and **Transparent and Verifiable**.

- Six main sectors cover **Building, Energy, Transport, Waste, Water, Health** and **cross-sectional issues** including **Land Use, Business and Livelihoods, Energy Efficiency,**

Consumption, Natural Environment and Natural Hazards.

- The MSCAP approach to GHG reductions was developed by using input from stakeholder workshops, occurred on November 26-27, 2018 with three focus areas: i. Energy, Waste, Water and Building, ii. Transportation and Land Use and iii. Agriculture, Forest and Environment Sustainability.
- MSCAP is only used for the GHG state-wide reductions and not purposely designed for specific local authorities due to data limitation and lack of expertise and local capacity.

2

MELAKA STATE PROFILE



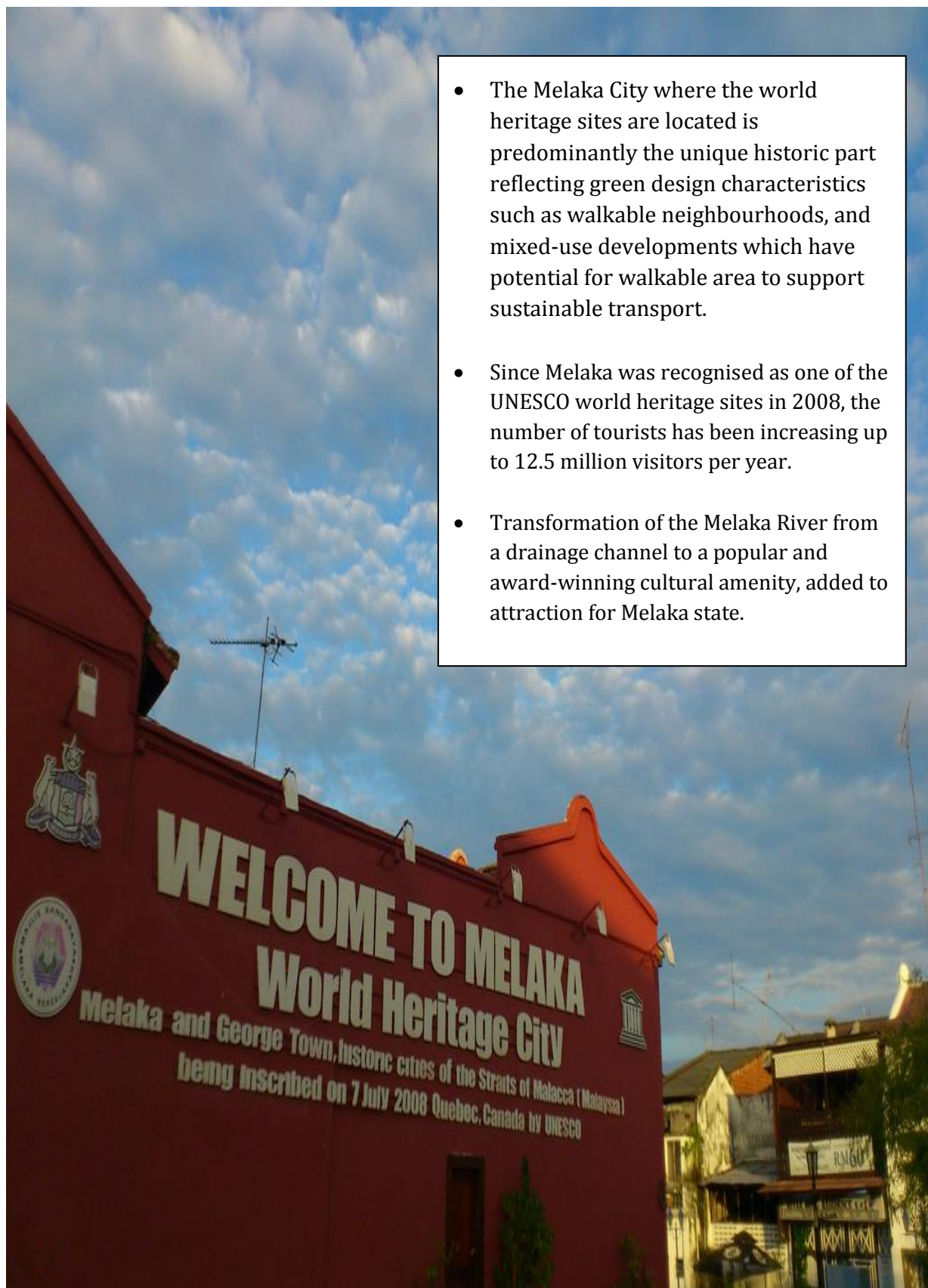
2.0 Background

- Nearly two-thirds or 2/3 of Melaka land is categorised as Environmentally Sensitive Areas (ESAs) due to its rich biodiversity.

About 61% population of Melaka are located in Central Melaka District, which occupy only 18% of total land of Melaka State.

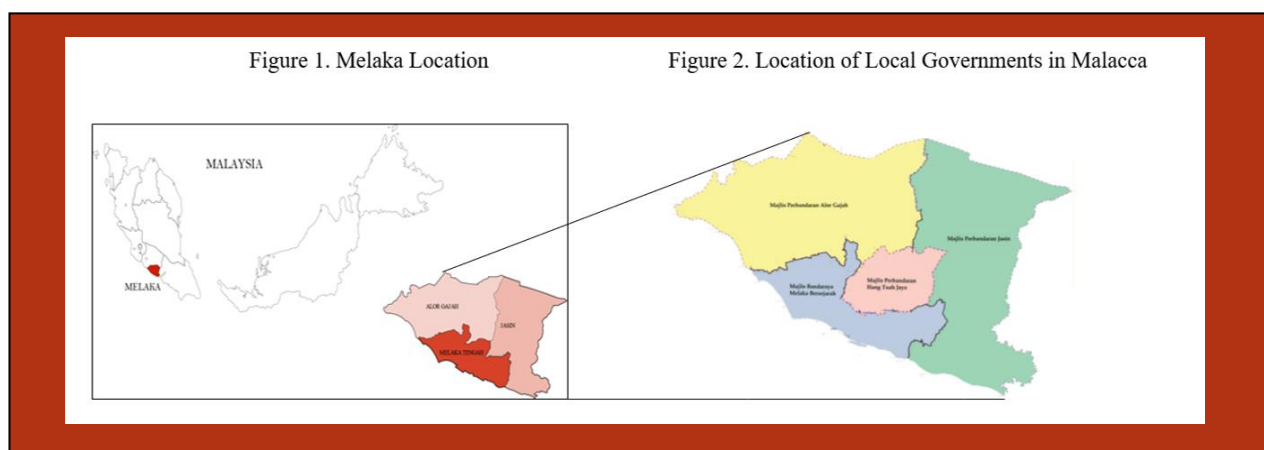
Central Melaka District is the smallest district where the historical spot tourism is situated with 12.5 million visitors each year.

- Agriculture is still prominent as a land uses and occupies almost half (47,67%) of the total 1,663.1 sq km of land in Melaka.
 - Melaka's population growth exceeded national levels, 2.7 percent compared to 1.9 percent between 2000-2010.
 - In 2015 Melaka had a population of around 873,000, with 25 percent of the population's age were below 15 years old and 7 percent were above 60 years old.
 - The ethnic composition of Melaka is Malays (66%), Chinese and Peranakan (25.9%), Indians and Chitty (6.2%) and the minority Kristang and Dutch Eurasians community.
 - In 2015, Melaka had GDP of MYR 39, 853 million with GDP per capita of MYR 45,650. The GDP growth rate was 5.8 percent in 2015.
 - The development of solar farm project supports Melaka towards Green Technology City for a large-scale production of renewable energy.
- Malaysia and Melaka have a policy framework supporting sustainable urban development.
- Service sector contributed to the largest share of economy in Melaka with the amount reached up to 36.3 percent in 2015. Two major service sectors are medical and cultural tourism which were followed by manufacturing sector (32.6%) and agriculture (8.5%).
- Number of factories registered were 435 as of 2013, 441 as of 2014 and 393 as of 2015
- About 398,300 of Melaka people were employed (2015) with unemployment rate 1 percent.



2.1 Adaptive Capacity of Melaka State

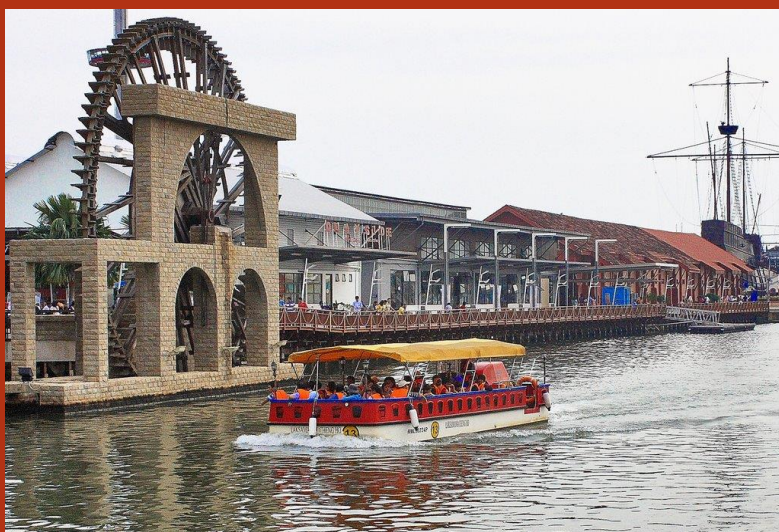
- Melaka state covers a total area of 1,663.1 sq km of land which is divided into three districts under separate jurisdictions.
- About 82 % of land used for agricultural activity is located in Alor Gajah (673.8 sq km) and Jasin District (689.2 sq km).
- From the total 873,000 population (2015), about 534,600 population or 61% were located in Central Melaka. This area consisted only 18% or 300.1 sq km from the total land of Melaka state.
- The other 82 % or 1,363.1 sq km of land were occupied with only 338,400 populations or 39% of the total population in Melaka state. This statistic revealed different strategic climate mitigation action and adaptation.
- The smallest district in Melaka state is Central Melaka which occupies approximately 18.0% of the total land area with the highest population density at almost 1,700 persons/Sq. km.
- The capital of Melaka State, Melaka City, is located in Central Melaka District. This district is the major destination of tourists in Melaka as the most historical spots are situated within it. Majlis Bandaraya Melaka Bersejarah (MBMB or Melaka Historic City Council) and Hang Tuah Jaya Municipal Council are two local councils located in Central Melaka District and functioning under the Melaka State government.
- As the spot tourism area, the Melaka City needs to be coupled with sustainable transport infrastructure for the city couple with numbers of tourist. It is to achieve Goal 11, *Make cities and human settlements inclusive, safe, resilient and sustainable*, Sustainable Development Goals, SDGs 2030. This is a chance to instil low carbon practices among the tourist as well as the local people.



Source. Global Scale Green House Gas Inventory Report for Melaka 2013

Being the Melaka UNESCO world heritage site, the Melaka City has zonation restrictions for the new development or construction for new infrastructure.

The traffic congestion in this area that can risk Melaka's competitiveness as a tourist destination.



Sea level rise affects the Melaka UNESCO world heritage site due to its location which is near Melaka river which is also one of the major tourism attractions. The river beautification project has transformed Melaka river into a Class II of water quality and received the award-winning for the transformation of the Melaka River.

3

MELAKA GREENHOUSE GAS INVENTORY



3.0 Community-Wide Greenhouse Gas Inventory

The inventory is a record of our greenhouse gas emissions in the calendar year 2015. Data quality for this year was considered to be of a reasonable standard, and undertakings and operations at the council in 2015 were considered comparable to current activities.

Greenhouse gas emissions are reported in units of carbon dioxide equivalents (CO₂e). This allows the impact of each different greenhouse gas to be expressed in terms of the amount of CO₂ that will create the same amount of warming, allowing easy comparison of the impact of different emission types. Throughout this report all greenhouse gas emissions are given in terms of carbon dioxide equivalent.

The 5.09 tCO₂e per capita GHGs emission of Melaka State for 2015 showed an increasing trend from 4.89 tCO₂e for 2013 to 5.01 tCO₂e for 2014.

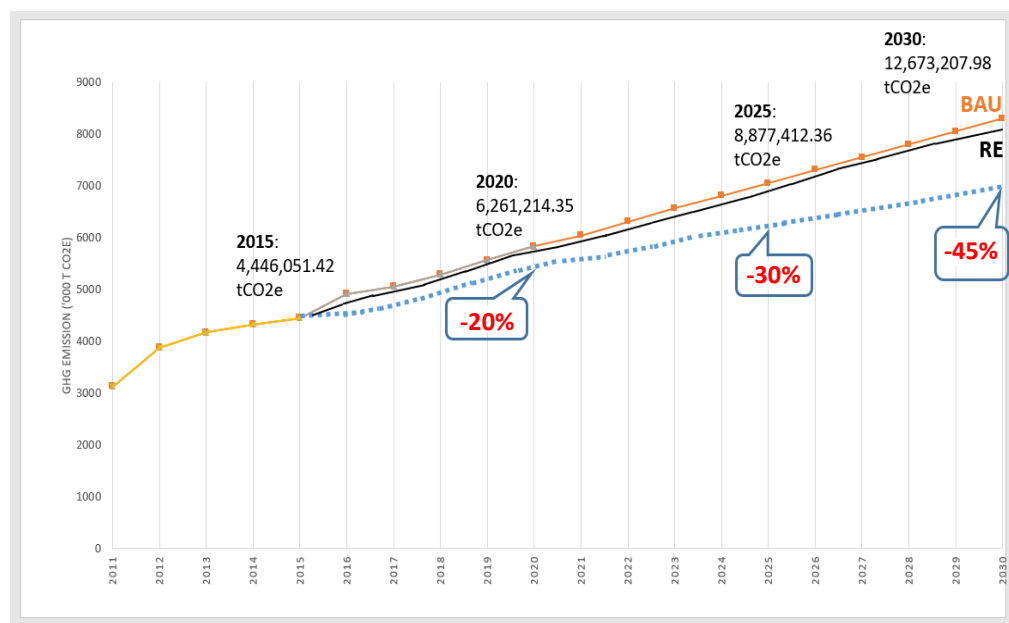


Figure 2. Greenhouse Gas Emission Forecast & Reduction Targets 2020, 2025

The total GHGs emissions for the state of Melaka was 4,446 MT CO₂e, based on the 2015 data. If there were no carbon emission reductions initiatives being taken or Business-As-Usual (BAU) projection, the GHGs emissions were estimated to increase up to 41%. This is equivalent to 6,262 MT CO₂e in 2020, and as of 91% in 2025 or equivalent to 8,877 MT CO₂e and up to 12,673,207.98 MT CO₂e in year 2030 (Figure 2).

The target for Melaka state percentage reductions as per GHG inventory data 2015 is 20 % or 1,252 MT CO₂e by year 2020, 30% or 2,663 MT CO₂e by year 2025 and 45 % or 5,703 MT CO₂e by year 2030. The target considers several factors that contribute to an increase of GHG emissions in Melaka State such as an increase in the number of industries, energy demand and

TARGET FOR 2020

We will reduce the carbon emissions from our activities by 20% by 2020, from a 2015 baseline of 4,446 MT CO₂e for 2015.

BENEFIT OF ACHIEVING THE TARGET

- Cost savings
- Compliance with legislation
- Raised awareness of climate change amongst staff, stakeholders and the public
- Positive community leadership,
- Contribute towards national targets

transport. The clear target contributed to the Malaysia national target for carbon emission reduction was set up for 45% (based on 2005) for the target year 2030.

The 8MW of solar photovoltaic (PV) solar farm built on a 7,248.43ha is a mega project of renewable energy aimed to decrease dependency to coal as an avoidance of carbon emitted. From the effort, the carbon emissions reductions estimated are from 26,000 to 80,000 tCO₂ for three consecutive years 2020, 2025 to 2030 (Table 1). It is reduced 1.5 % of carbon emissions from the total carbon emissions in 2020, 0.6% as of 2025 and 0.6 % as of 2030. Hence, more renewable energy initiatives are needed.

Table 1. Greenhouse Gas Emission Forecast & Reduction Targets in Melaka State

GHG Forecast and Reduction Targets in Melaka State				
	2015	2020	2025	2030
Reduction Targets	Baseline	20%	30%	45%
Tonnes Reduction Targets as per BAU of CO ₂ e		1,252,243.00	2,663,223.71	5,702,943.60
Tonnes Increase as per BAU CO ₂ e.		1,815,162.93	4,431,360.94	8,227,156.56
Business-As-Usual (BAU) Emissions Tonnes of CO ₂ e.	4,446,051.42	6,261,214.35	8,877,412.36	12,673,207.98
Reduction Targets from another Green City Initiatives*		-	-	-
Tonnes Reduced from BAU Resulting from 8MWatt Solar Farm Initiatives (RE)		-26,490.24	-52,980.48	-79,470.72
Tonnes Emissions Reductions (Tonnes CO₂e)	4,446,051.42	6,234,724.11	8,824,431.88	12,593,737.26

*The calculation did not take into account various green city initiatives i.e. Melaka Green Seal and other initiatives that contribute to greenhouse gas emission reduction in Melaka state.

3.1 Sector Wide GHG Emission Projection by year 2020

General projection for each sector in Melaka state (baseline 2015) shows an obvious increasing trend for commercial and residential building, and industry towards 2020. Slightly increasing trend is captured for solid waste while decreasing trend is on transportation and livestock. Furthermore, Linear trend is captured for AFOLU and transport on railway.

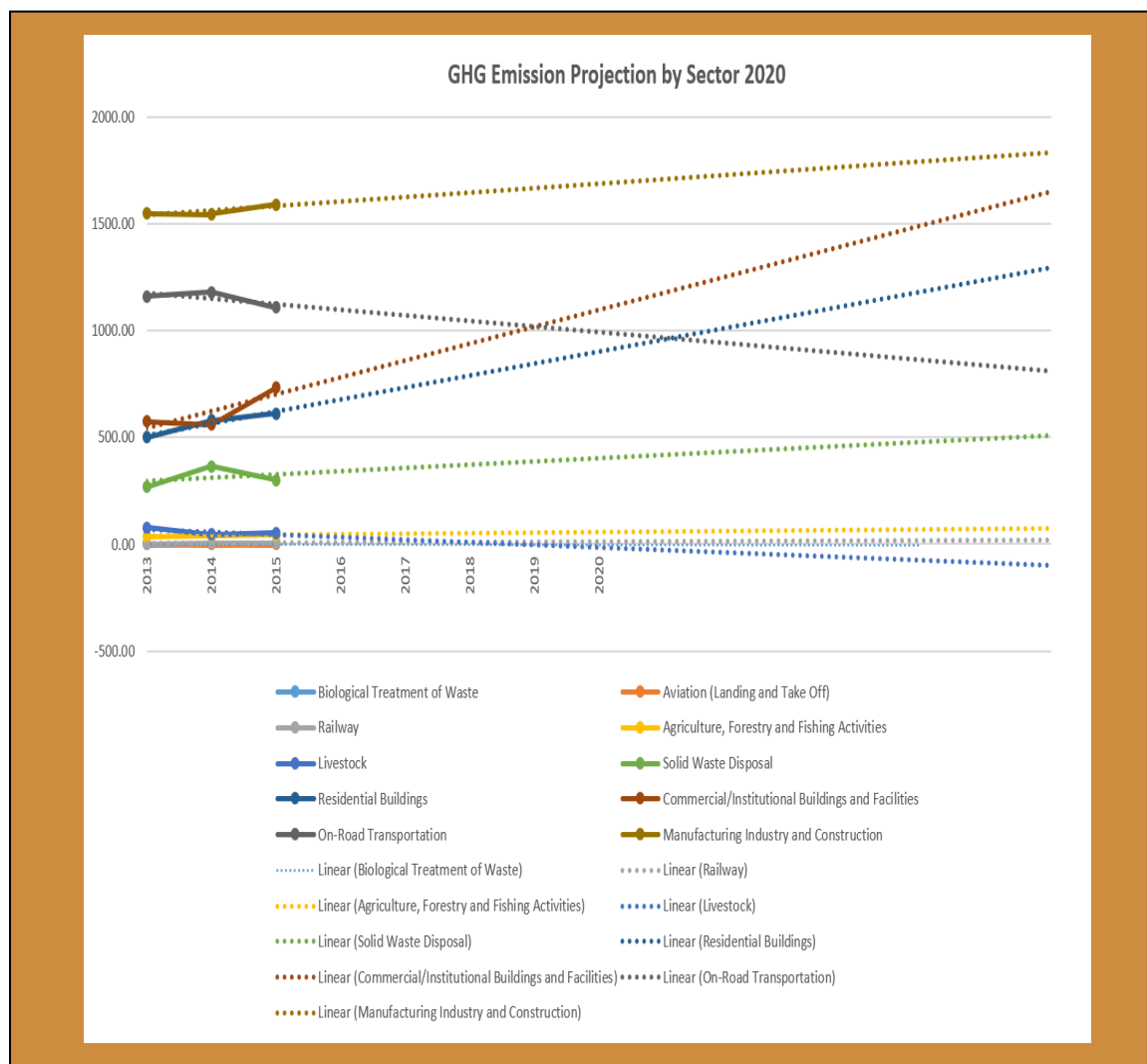


Figure 3. Greenhouse Gas Emission Projection by Sector 2020

Increasing trends for GHG emission from this sector are recorded at 1,548MT CO₂e or 37.11% (2013), 1,544MT CO₂e or 35.74% (2014) and 1,590 MT CO₂e 35.77% (2015).

Slightly decreasing trends from road transportation are 27.92 % or 1,165 MT CO₂e (2013), 27.48% or 1,187 MT CO₂e (2014) and about 25.05% or 1,115MT CO₂e (2015).

16.49% or 733 MT CO₂e. was recorded in 2015, compared to 18.78% or 575MT CO₂e (2013) and 12.95% or 559 MT CO₂e for year 2013.

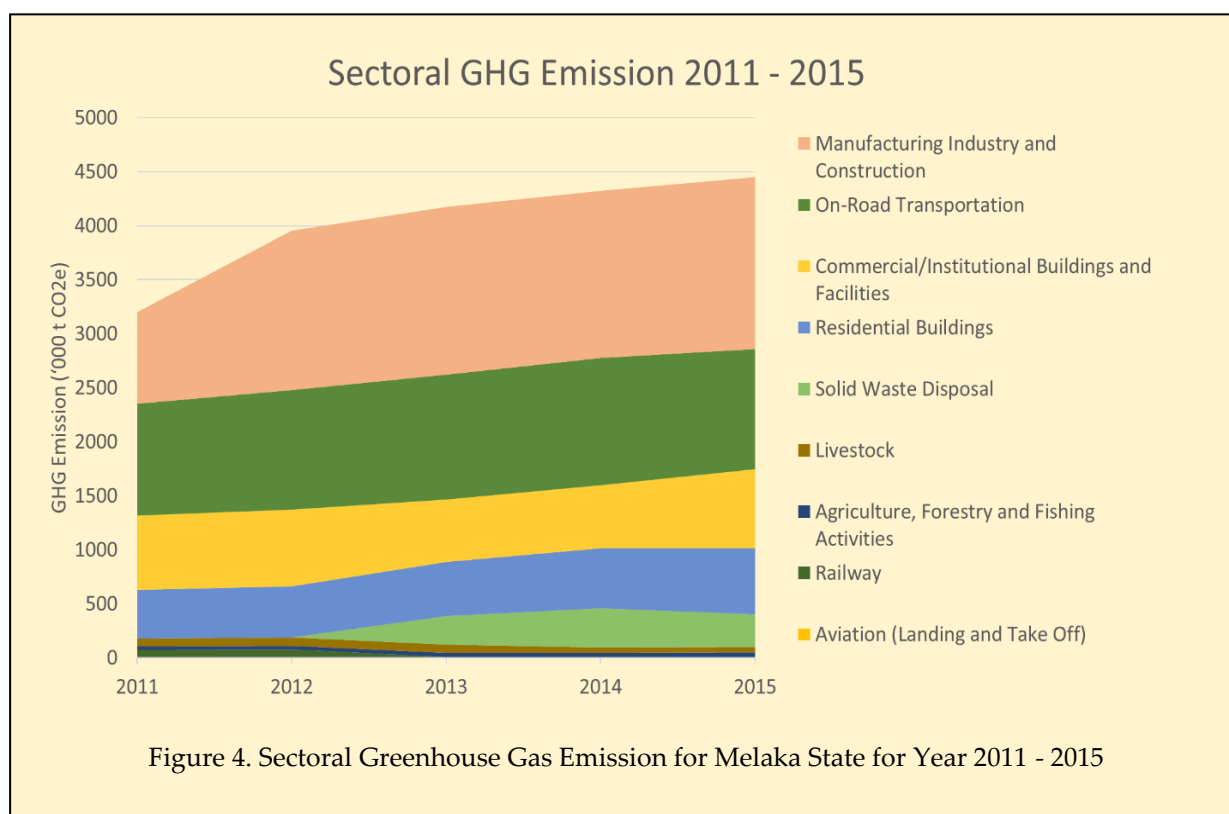


Figure 4. Sectoral Greenhouse Gas Emission 2011 - 2015

Residential building was recorded as the fourth greenhouse gas emitters for the state of Melaka, from year 2013 to 2015. Increasing trends were recorded from 11.98% or 500 MT CO₂e (2013), 13.40 or 579 MT CO₂e (2014) and 13.76% or 612 MT CO₂e (2015).

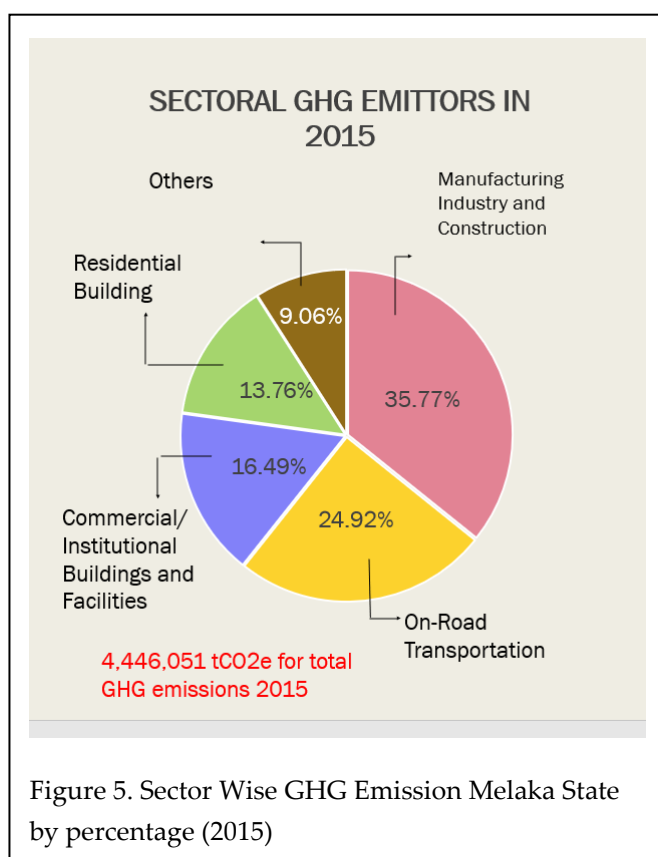
The fifth sector, **solid waste** contributed in average 7.2% from 2013 to 2015. The details were 6.44% or 268 MT CO₂e (2013), 8.42% or 364 MT CO₂e (2014) and 6.74% or 300 MT CO₂e (2015).

The last sector, which is from **agriculture, forestry and land use** (AFOLU) contributed in average 1.3% to the total GHG emissions from 2013 to 2015. The details were as follows: about 1.84% or 76 MTCO₂e (2013), 1.06% or 46 MTCO₂e (2014) and 1.18% or 52 MTCO₂e (2015).

3.2 Sector Wise Greenhouse Gas Emission in Melaka State

Based on baseline data GHG inventory 2015, sector wise, **Manufacturing Industry & Construction** dominated the GHG emission in Melaka state. The amount of GHG emissions recorded from this sector was 1,590 MTCO₂e or 35.77%. The sources of GHG emission from industry sector came from industry energy use.

The second biggest contributing sector was **transportation** from the on-road transportation; about 25.05% or 1,115MTCO₂e. The overall transport sector covered sub sector On-Road **Commercial building/ institutional Building and Facilities** contributing as the third greenhouse gas emitter for Melaka state, 16.49% or 733 MTCO₂e. The primary fuels used by



commercial/ institutional end users such hotels, shopping centres, malls, educational institution, private and public office building in Melaka were kerosene and LPG.

Residential building was recorded as the fourth greenhouse gas emitters for the state of Melaka, 13.76% or 612 MTCO₂e (2015).

The fifth sector, **solid waste** contributed in average 6.74% or 300 MTCO₂e (2015).

The last sector, which was from **agriculture, forestry and land use** (AFOLU) contributed 1.18% or 52 MTCO₂e (2015).

From the total of 4,446MT CO₂e of Melaka state in year 2015, **stationary units** dominated 67 % of GHG in Melaka state for 2015, which were contributed from the residential building (13.76%),

commercial/ institutional buildings and facilities (15.49%), manufacturing industry and construction and agriculture (35.77%), forestry and fishing activities categorised as others (9.06%) (Figure 4). It was followed by the **mobile units** 25.09%, waste 6.74 % and Agriculture, Forestry and Land Use 1.18%.

This increment was attributed to the following community trends:

- Increase in energy consumption in commercial sector, manufacturing industry and residential sector was due to a 3.54% increase in commercial sector, 0.03% increase in manufacturing industry and 0.36% or 32,774.90 tCO₂e increase in residential building from 2014-2015.
- Increase in electricity consumption in Melaka state showed a 31% increase in commercial institution from 2014-2015.

Table 2. Greenhouse Gas, GHG Emission by Sector in Melaka State (2013 – 2015)

Sector	2013		2014		2015	
	GHG emission (t CO ₂ e)	Share (%)	GHG emission (t CO ₂ e)	Share (%)	GHG emission (t CO ₂ e)	Share (%)
Stationary Units	2,661,583.33	63.79	2,724,182.29	63.05	2,978,683.56	67.00
Residential Buildings	499,654.88	11.98	579,039.48	13.40	611,814.38	13.76
Commercial/Institutional Buildings and Facilities	574,844.16	13.78	559,524.35	12.95	733,200.15	16.49
Manufacturing Industry and Construction	1,548,411.50	37.11	1,544,352.17	35.74	1,590,261.25	35.77
Agriculture, Forestry and Fishing Activities	38,672.79	0.93	41,266.29	0.96	43,407.78	0.98
Mobile Units	1,165,108.94	27.92	1,187,307.97	27.48	1,115,471.76	25.09
On-Road Transportation	1,160,333.48	27.81	1,180,652.73	27.32	1,108,054.44	24.92
Railway	4,411.96	0.11	6,454.69	0.15	6,454.69	0.15
Aviation (Landing and Take Off)	363.49	0.01	200.55	0.00	962.63	0.02
Waste	268,829.37	6.44	363,657.40	8.42	299,547.53	6.74
Solid Waste Disposal	268,828.81	6.44	363,651.32	8.42	299,547.53	6.74
Biological Treatment of Waste	0.56	0.00	6.08	0.00	-	0.00
Agriculture, Forestry and Land Use (AFOLU)	76,811.46	1.84	45,767.61	1.06	52,348.57	1.18
Livestock	76,811.46	1.84	45,767.61	1.06	52,348.57	1.18
Total	4,172,333.10	100	4,320,915.27	100	4,446,051.42	100

3.3 Take Stock Climate Action Initiatives

To reduce GHG emission, several climate action initiatives have been in places in Melaka state. Earlier effort started with the installation of solar farm or 'Melaka Solar Valley' since 2007 as a form of climate mitigation action. Several climate initiatives described in Table 3.0 have combination of climate mitigation and adaptation initiative either as a state wide or at local authority level. Further details calculation on the contribution of each actions towards the GHG emission reduction initiative need to be further coupled with the facilitation of GHG inventory for each local authorities in Melaka state. This is to smooth the future monitoring and evaluation, M&E and strategic actions implementation at city or community level. For the purpose of this report, we evaluated the carbon avoidance and reduce from the 8MW solar farm to estimate the target of GHG reductions per tonnes CO₂ emissions.

Table 3. Take Stock of Melaka State Climate Action Initiatives

Year	Milestone	Details	Recommended Action
2014	Melaka Green Seal, MGS	No data available on carbon emission reduction from building under Melaka Green Seal or <i>Meterai Hijau Melaka</i> (MHM).	Take stock building with MHM and calculate to contribute to CO ₂ emission reduction.
2007 - 2020	Melaka World Solar Valley	About 8MW of solar capacity involving area of 7,248.43 hectare, at Alor Gajah District which will serve from 2007 – 2020.	Calculation to contribute to CO ₂ emission reduction.
2014	Hang Tuah Jaya Green City	Cover 5,152 acre of area as an example of sustainable city where buildings comply with green building standard such as the local Melaka Green Seal (MGS), Green Building Index (GBI) and the Leadership in Energy & Environmental Design (LEED). Main projects are Rehabilitation Center of Perkeso, Administration Building of Green Technology Academy, <i>Dewan Citra Kasih</i> , <i>Rumah Citra Kasih</i> and etc.	Calculation to contribute to CO ₂ emission reduction.
2014	Smart meter Pilot Project for Melaka	Installation about 800 unit of smart meter for household in Melaka to monitor and change the household behaviour towards energy consumption. The 9 million of project run by TNB were conducted through Amanah Akaun Industri Bekalan Elektrik (AAIBE) to cover Melaka and Putrajaya.	Long term commitment for Smart meter installation in the state: such as all residential and commercial houses need to install smart meter by 2030.
2014	Melaka Electric Bus	The two electric buses run in Melaka have capacity of 180 km per full charge, which take 100 minutes. The coaches consist of 33 seats including one for the disabled, as well as nine CCTVs. Its top speed reaches 76 km/h.	Clear pathway on effort to switch into electric buses.

Year	Milestone	Details	Recommended Action
2014	Hang Tuah Jaya one of the partners for the Nationwide Low Carbon Cities Framework (LCCF)	Hang Tuah Jaya Municipality is the pioneer for low carbon city initiative under the Low Carbon City Framework (LCCF), Ministry of Energy, Science, Technology Environment and Climate Change. The area covers 1,956.57 acre under the Bandar MITC, Hang Tuah Jaya will be known as 'Low Carbon City @ Hang Tuah Jaya 2014'.	Formalise the Hang Tuah Jaya Low Carbon City as a demo site to stimulate other city to adopt the LCCF as a Flagship of nationwide effort of low carbon city.
19 December 2014	Energy Efficiency Program for Private Sector	About 10 hotel buildings and industries in Melaka become a pioneer for Energy Efficiency Program under Smart Community Programme. The programme is under the memorandum of understanding (MoU) between Melaka Green Technology and Malaysia Industry Government High-Technology (MIGHT) to activate green initiative under Smart Community Programme.	Calculate CO ₂ emission reduction from the 10 Hotels as 'Energy Efficient Building'. Use the 10 Buildings as a tourism promotion advertisement as well as awareness campaign.
2013	Electrical Car Charging Station Network (EV)	About eight electrical charging stations for electric car are located in Melaka State with a capacity AC 3.7 to 22.0 kW.	Identify strategic locations for more installations of electrical charging station in Melaka State.
11 & 12 March 2015	Green Practices Courses	Enhanced climate governance for Melaka state by improving the adaptive capacity.	Good Climate Governance - Adaptation
18 May 2015	Energy Efficiency & Conservation Workshop Series 2.	The activities on capacity building contributed to climate adaptation for Melaka Climate Governance and strengthened the frontline officer at Local Authorities, LAs.	Good Climate Governance - Adaptation
2015 - 2018	'Sustainable Cities: Global Environment Facility (GEF)	Melaka as a demonstration site for 'Smart Communities' Programme under MIGHT which functioned as a reference smart community for another city in Malaysia.	Identify the reduction pathway for GHG emissions sources for further GHG inventory purpose.
2018 now	- Asia Development Bank, ADB, IMT-GT Public Private Partnership	RM200 million to Install Energy Efficient Road Lights in Melaka. Transforming 120,000 units of street lights into smart LED street lights. The Melaka Road Lighting project plans to install over 100,000 smart light-emitting diode road lamps across the state using a digital networked lighting system. The project is expected to improve lighting, lower energy costs, reduce carbon dioxide emissions and strengthen road safety.	Calculation on the contribution to Melaka state GHGs emission reduction target.

We acknowledged the current Green City initiative developed by the Green City Action Plan (GCAP) 2014 as a collaborative effort between Melaka State and Asian Development Bank (ADB) (Appendix 1). To achieve the Melaka Green Technology State by 2020, several green initiatives listed in Figure 5.0. However, the initiatives did not recognise which sector should be more emphasised and prioritised to get the quick win result. Hence, the GHG inventory and Climate Action Plan report will enhance the past GCAP report 2014.

4

MELAKA CLIMATE ACTION STRATEGY



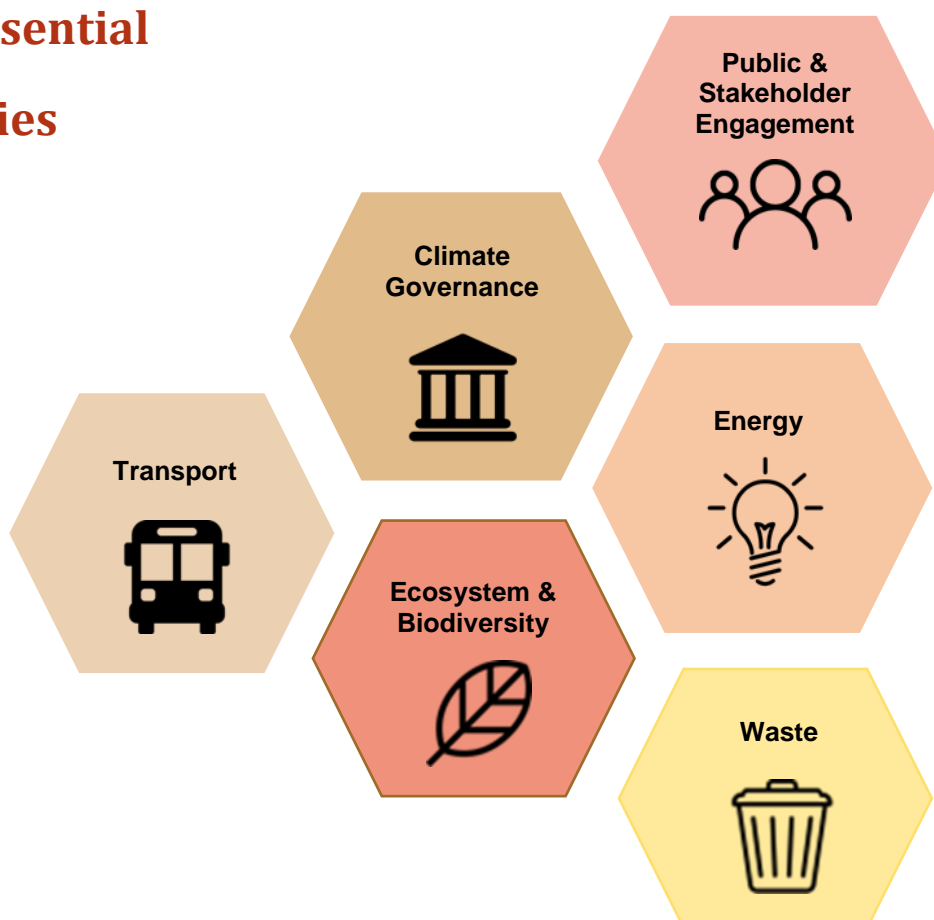
4.0 Climate Action Strategy

To achieve the GHG emissions target by 2030, Melaka State will have to cut GHG emissions by 45% or 5,7 million MT CO₂e.

The Melaka State Climate Action Plan 2020 – 2030 covers strategies that span multiple government agencies, community-based organisations (CBOs), non-government organisations (NGOs) and the four districts with the four local authorities (LAs) under Melaka State. The plan also includes state and federal actions that align with the Melaka State goals. Through a combination of the strategies listed below, a continued focus and renewed commitment to meet the ambitious goals, Melaka State can become a global leader in addressing climate change. The following are the six strategies to achieve Melaka State's GHG reduction goals extracted from the Melaka State Climate Resolution.

The three tier of period reductions are used as follows; i. 2020 for the short-term period, ii. 2025 for the medium-term period and iii. 2030 for the long-term period, the details of each action for GHG emissions are classified according to the sectors.

Nine Essential Strategies



Building sector has the sector with the largest mitigation potential

Energy consumption in both new and existing building can be reduced significantly by **applying existing technologies, design, equipment, management systems and alternative solutions.**

Several cost-effective technology practices to reduce GHGs emissions in the building:

- i. passive solar design,**
- ii. high efficiency lighting and appliances,**
- iii. highly efficient ventilation and cooling systems,**
- iv. solar water heaters, insulation materials and techniques,**
- v. high-reflectivity building materials and multiple glazing.**

About 70 percent or more of largest savings in energy use occur in new buildings, through designing and operating buildings as complete systems. These potential solutions are important especially for government buildings with a large scale of energy consumption.

“WE NEED TO WELL EQUIP PUBLIC WITH THE RIGHT INFORMATION TO MAKE INFORMED DECISIONS AND ASSIST AND EMPOWER THEM TO PLAY THEIR ROLE IN MELAKA’S TRANSITION TO A LOW-CARBON SOCIETY, GREEN TECHNOLOGY AND SMART CITY”.



4.1 Public & Stakeholder Engagement

Engaging Melaka in Supporting Melaka’s Climate Action Goals

No single strategy will achieve Melaka’s climate goal. Success will require all of Melaka’s stakeholders, community and local authorities (LAs) to play active role in reducing GHG emissions through various strategies and actions. From the stakeholder workshop, these are core strategic actions to help strengthen the effort for continuous public engagement (Table 4).

Table 4. Recommended Action for Continuous Public Engagement

3 Actions for ‘Continuous Public Engagement’	Short Term 2020	Medium Term 2025	Long Term 2030
1. Update sectoral GHG reduction from time to time by using social media. (Resolution No. 16)			
2. Strengthen the Eco-School involvement from time to time by using social media (Resolution No. 17)			
3. Prioritise and upscale climate action initiative with big impact. (Resolution No. 9)			



POSSIBLE ACTION AREAS

Roll out regional public climate awareness programme through various channel of media.

Encourage citizens to become 'prosumers' of their own energy, i.e. smart meter installation.

Work with existing local authority networks to engage citizens in the climate change challenge.

Involve citizens in more workshops and focus groups on the topic of climate change.

Actively refer to citizens' involvement when creating and implementing action plans and local development plans.

Link with publications such as citizens newsletters.

Make use of social media to engage citizens, businesses and community groups.

Promote the advantages of becoming low carbon or carbon neutral to business.

Promote green tourism and business, e.g. cycling tours, food co-ops and local markets.

Source: Modified from South Dublin City



**“THE NEEDS FOR GOOD CLIMATE GOVERNANCE IS CRUCIAL
ROLE IN MELAKA’S TRANSITION TO A LOW-CARBON SOCIETY,
GREEN TECHNOLOGY AND SMART CITY”.**



4.2 Climate Governance

Melaka Climate Resolution identified the needs to practice good climate governance for Melaka community-wide GHG emissions that grew gradually. It is based on three tier implementation action: Short Term by 2020, Medium Term 2025 and Long Term by 2030. From the Climate resolution of Melaka State, there are five core actions recognised under this strategy. The eight are:

Table 5. Eight Core Actions to Practice Good Climate Governance

8 Actions for Good Climate Governance	Short Term 2020	Medium Term 2025	Long Term 2030
1. Every Local Authorities identify their niche and strength to lead Climate Action Plan in Melaka state. For example, tourism, industry, sustainable transport (Resolution No. 1).			
2. Adopt Global Protocol for Community (GPC)-scale for Green House Gas Inventory at Local Authorities level with strength and comprehensive data for global recognition (Resolution No. 2).			
3. Strengthen and harness the Climate Change Governance of Melaka State (Resolution No. 3).			
4. Improve the role of Melaka Green Technology Corporation, (MGTC) with local authorities through Melaka Green Technology Council (Resolution No. 4).			
5. Formalise and legalise carbon emission intensity (per unit of GDP) reduction target by up to 20% by 2020, 30% by 2025 and 45% by 2030 (based on 2015 baseline data) by developing Melaka Climate Action Policy. (Resolution No. 14)			
6. Provide reward, recognition and incentive to promote climate change initiative (Resolution No. 18).			
7. Recognise green job by <i>Jabatan Perkhidmatan Awam</i> (JPA) (Resolution No. 20)			
8. Implement the open data policy for Melaka State in order to allow data integration and increase efficiency (Resolution No. 22).			

Strategy 1 is in line with the Midterm Review of the Eleventh Malaysia Plan which emphasises on ***strengthening the governance to combat climate change and reducing disaster risk to shift towards green growth and enable better resource management.***

The effort to promote Melaka Good Climate governance needs to be supported by the right governance structure to realise the nature of the existing organisation in Melaka state. The proposal of Melaka Climate Governance was developed based on the existing active involvement of various organisations, government agencies and local authorities which are depicted in Figure 6.

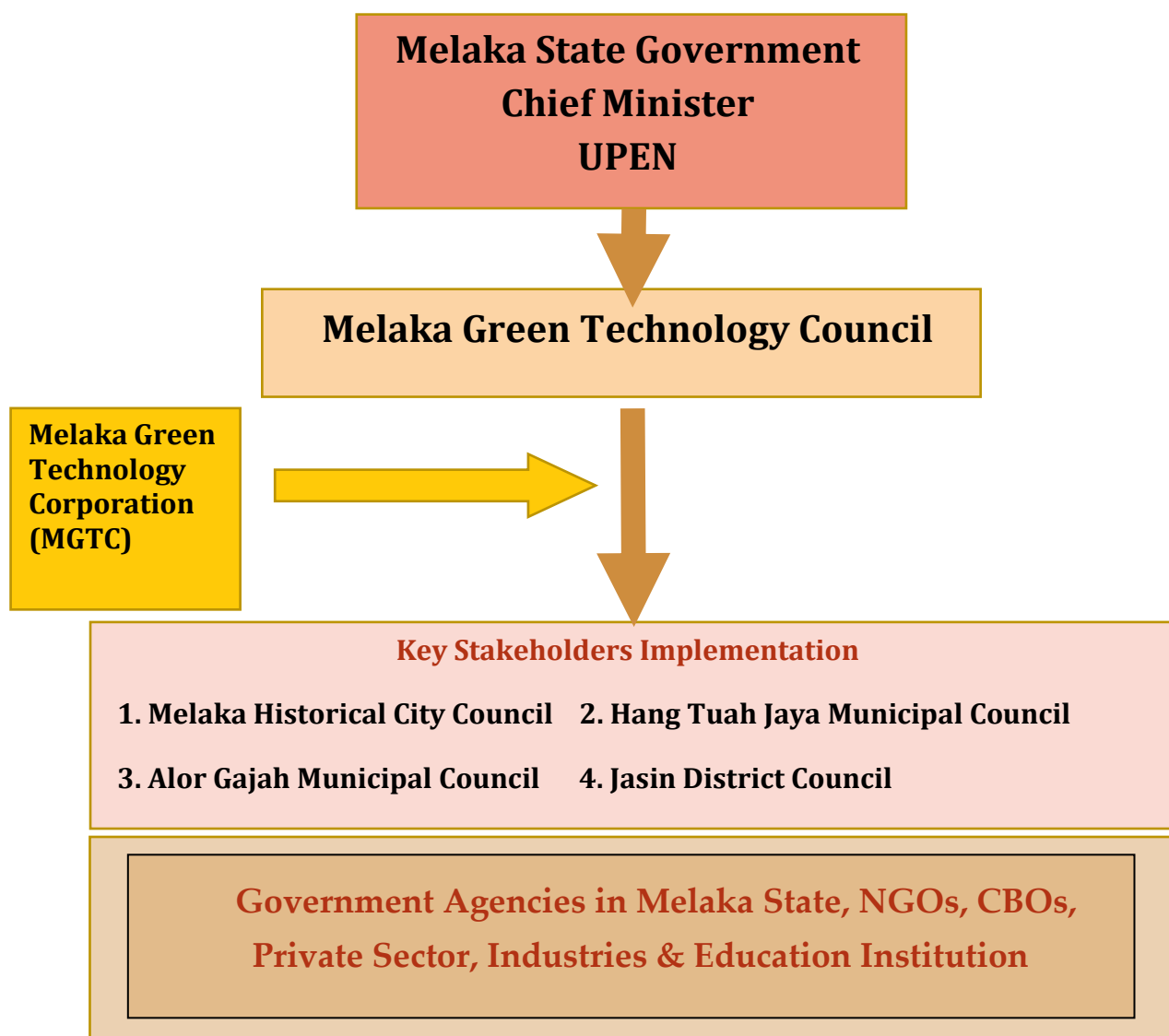


Figure 6. Proposed Melaka Good Climate Governance

“ENERGY USE ACCOUNTS FOR THE VAST MAJORITY OF GREENHOUSE GAS EMISSIONS IN MELAKA STATE AND, AS SUCH, IS CENTRAL TO LOW CARBON SOCIETY, GREEN TECHNOLOGY STATE AND SMART CITY”.



4.3 Energy



Figure 6. Melaka Solar Valley

By 2020, the Melaka Solar Valley is predicted to reduce 26,490.24 t CO₂e by 2020, 52,980.48 t CO₂e by 2025, and 79,470.72 t CO₂e by 2030. It will contribute reduction up to only 1.5 percent from the total greenhouse gas emitted 1,815,162.93 t CO₂e by 2020.

Energy use accounts for the vast majority of greenhouse gas emissions in Melaka state, as such, is central to this strategy.

The energy used in Melaka State buildings is the largest source of GHG emissions which is account for 66 percent of a total GHG emissions (Table 3). The Melaka goals need to be achieved by trajectory for longer-term reductions with large reductions in the building sector. The details of energy efficiency initiatives are written in Energy Efficiency Guideline, MS1525 and Uniform Building by Law (UBBL).

Energy contributes to climate change in two ways; first, by the type of energy supplied, be it coal, gas, oil or electricity, andsecond, through the end-use of energy for cooling the buildings, fuelling transport or powering lighting and

equipment. Fossil fuels are fuels which are non-renewable.

In order to move Melaka state from high dependency on fossil fuels to local renewable energy sources, more solar energy and or other types of renewable energy are developed and installed. This will depend on the uptake of renewable energy both nationally and locally. In particular electricity generation everything must be less carbon intensive. Maintaining these will gain low-carbon energy, in addition to find new opportunities to rapidly reduce the GHG emissions factor that will ensure our carbon intensity continue to decrease.

Table 6. The Three Core Actions to Improve Energy-Efficiency & Renewable Energy

3 Actions for 'Energy-Efficiency & Renewable Energy'	Short Term 2020	Medium Term 2025	Long Term 2030
1. Promote other types of renewable energy such as solar, PV, solar thermal, biogas, etc. (Resolution No. 8).			
2. All new buildings must be certified as green buildings and ' Melaka Green Seal ' as a minimum requirement. (Resolution No. 10)			
3. The existing and new building need to promote energy efficiency and sustainable energy management practices through ASEAN Energy Management System (AEMAS). (Resolution No. 11)			
4. Implementation of Efficient Management of Electrical Energy Regulations 2008 (EMEER2008) through sustainable energy management in industry. (Resolution No. 12)			

Electricity production will be less centralised, with localised commercial and residential energy production centres providing low-carbon energy to the surrounding areas.

Increasing Energy Efficiency at Home — Energy efficient homes not only lower the carbon footprint, but also save money, create a more comfortable living environment, and can increase the value of the home. Sign up for the Melaka Green Seal, MGS or contact *Melaka GreenTech* for



Source: SEDA Website

PROSUMERS - Many citizens are able to generate their own renewable energy using small-scale installations such as roof solar panels, and sell any leftover energy back to the grid. Smart, energy efficient buildings will be adapted to their inhabitants' needs, reducing energy use and fuel poverty.

renewable energy options. Renewable energy is now more affordable and accessible than ever.

**Table 7. Targeted Emissions Reduction and Recommended Actions
for Energy Sector in Commercial Building**


















Recommended Actions for 'Commercial Building'	Target Year of Reduction 2020	Target Year of Reduction 2025	Target Year of Reduction 2030	Organisation in Charge
Percentage of Reduction (%)	20	30	45	MGTC & TNB
Amount of GHG Emission Reduction (MTCO₂e)	146.6	219.9	329.85	MGTC & TNB
i. Update building energy codes. (Community-Wide & LAs operation)				MGTC, LAs, TNB & private sector.
ii. Increase building operation tracking and update on building operations. (Community-Wide & LAs operation)				EPU, MGTCouncil, MGTC, LAs & TNB. MGTC & LAs
iii. Provide access to finance energy efficiency, upgrades and renewable energy. (Community-Wide & LAs operation)				EPU, MGTCouncil, MGTC
iv. Propose Climate policies (Community-Wide & LAs operation)				
i. Feed In tariff (FIT) and smart metering for commercial building. (Community-Wide & LAs operation)				EPU, MGTCouncil, MGTC, LAs & TNB.
i. Attractive tax incentive for FIT and smart metering for commercial building. (Community-Wide & LAs operation)				MGTC, TNB LAs.

Table 8. Emissions Reduction Target and Recommended Actions for Residential Sector.

Recommended Actions for 'Residential Building'	Target Year of Reduction 2020	Target Year of Reduction 2025	Target Year of Reduction 2030	Organisation in Charge
Percentage of Reduction (%)	20	30	45	MGTC & TNB
Amount of GHG Emission Reduction (MTCO₂e)	122.4	183.6	275.4	MGTC & TNB
i. Encourage smart meter installation for household. (Community-Wide & LAs operation)				MGTC, relevant LAs, SPAD & private sector.
ii. Promote household reduction tax incentive linked to household with energy efficiency and renewable energy initiative. (Community-Wide & LAs operation)				EPU, MGT Council, MGTC, LAs & TNB.
iii. Promote implementation of Energy Efficient products by using Malaysia Energy Star product. (Community-Wide & LAs operation)				MGTC & LAs
i. About 50% smart meter installation for residential areas in Melaka State.				EPU, MGT Council, MGTC
ii. Introduce attractive local tax package for household and organisation using Malaysia Energy Star rating product.				
iii. Continuous promotion for residential energy efficiency package.				
i. Complete smart meter installation for all residential area in Melaka State. (Community-Wide & LAs operation)				MGTC, TNB LAs.

Sector wise, **Industry** dominated the GHG emission in Melaka state since 2013 to 2015. The amount of emission the sector contributed was of 1,548MT CO₂e or 37.11% (2013), 1,544MT CO₂e or 35.74% (2014) and 1,590 MTCO₂e 35.77% (2015).

Table 9. Targeted Emission Reduction and Recommended Actions for Manufacturing, Industry & Construction Sector

Recommended Actions for 'Manufacturing, Industry & Construction Sector'	Target Year of Reduction 2020	Target Year of Reduction 2025	Target Year of Reduction 2030	Organisation in Charge
Percentage of Reduction (%)	20	30	45	MGTC & TNB
Amount of GHG Emission Reduction (MTCO₂e)	318	477	715.5	MGTC & TNB
i. Establish industrial energy efficiency programme such as ISO 50001, Energy Management Systems and/or relevant national standards. (Community-wide)				EPU, MGT Council, MGTC, relevant LAs, SPAD & private sector.
ii. Integrate energy efficient measurement in the daily management of the company by triggering long-term investment for other types of renewable energy such as solar, PV, solar thermal, biogas and etc. (Community-Wide & LAs operation)				EPU, MGT Council, MGTC, LAs, SPAD & private sector.
i. Implement the Efficient Management of Electrical Energy Regulations 2008 (EMEER2008). (Community-Wide & LAs operation)				MGTC, TNB & private sector.
iv. Promote the use of green technology through financial mechanism and tax allowance such as Green Income Tax Exemption, Green Investment Tax allowance, Green Tehnology Fund Scheme, My hijau, Feed in tariff,				MGTC, MIDA, private sector

**“HIGH VOLUME OF TRAFFIC IN MELAKA CITY CENTER
AS ONE OF WORLD HERITAGE SITES URGE THE NEEDS
FOR A SMART LOW CARBON TRANSPORT”.**



4.4 Transport



The total contribution of GHG emissions showed slightly decreasing trend from 27.92 % or 1,165 MTCO_{2e} (2013) to 27.48% or 1,187 MTCO_{2e} (2014). Transportation or Mobile Unit covers sub sector On-Road Transportation, railway and aviation (Landing and Take Off). Policies and strategies that create walkable communities such as Greenway Master Plan, Bike Plan etc.

**Transportation
contributed
1,115,471.76 (t CO_{2e})
or 25.09 percent from
the total 4,446M
tCO_{2e} for Melaka
State in 2015.**

Melaka City Centre where world heritage zone is located received millions of visitors each year consisting only 18% or 300.1 sq km from the total land of Melaka state. It had high population density which was 534,600 population or 61% of the total 873,000 population of Melaka state (2015). Hence, sustainable transport strategy needed to be introduced to reduce single-occupancy motorised vehicle travel as the least efficient mode of transportation, and promoted cycle and walk pathway in this area.

In the context of Melaka, the connectivity improvement and the measurement of land use, as well as community development and transportation to reduce the vehicle mile travelled is needed by encouraging higher-density, transit-oriented development by using various mode of sustainable transports. This is especially recommended by encouraging more users for electrical buses, improving pedestrian- and bicycle-friendly infrastructures especially at Melaka City Centre where the heritage area and restricted zonation need to cope with the soaring numbers of tourists; promoting urban greening; and offering trip reduction programmes.

Table 10. Three Core Actions for Sustainable Transport

3 Core Actions for ‘Sustainable Transport’	Short Term 2020	Medium Term 2025	Long Term 2030
1. Integrated Public Transport Masterplan (Resolution 6).			
2. Develop Melaka Pedestrian and Bicycle Master Plan (Resolution 7)			



Melaka needs a comprehensive, Integrated and Strategic Transportation Masterplan and a comprehensive pedestrian and bicycle masterplan which will provide a tremendous opportunity to strengthen previous commitments and integrate new strategies to meet the Melaka Climate 2030 goal.







Mass transit infrastructure, supporting sustainable growth and urban infill, and encouraging shifts in travel behaviour will be essential in the updated transportation plan.



Land use policies set the stage for higher density, mixed-use, transit-oriented development. Hence, the integrated sustainable public transport masterplan for Melaka state is needed.

Table 11. Targeted GHG Emission Reduction and Actions for Sustainable Transport

Recommended Actions for 'Promote Waste Minimisation'	Target Year of Reduction 2020	Target Year of Reduction 2025	Target Year of Reduction 2030	Organisation in Charge
Percentage of Reduction (%)	20	30	45	MGTC, JPJ & APAD
Amount of GHG Emission Reduction (MTCO₂e)	60	90	135	MGTC, JPJ & APAD
i. Introduce Smart Low Carbon Lifestyle Card (SLCLCard). (Community-wide)				EPU, MGT Council, MGTC, relevant LAs, SPAD & private sector.
ii. Promote Bike Sharing with attractive incentive package to support Green Mobility Program. (Community-Wide)				EPU, MGT Council, MGTC, LAs, APAD & private sector.
ii. Integrate Low Carbon Transport initiative in Smart Low Carbon Lifestyle Card (SLCLCard) to encourage public transport.				EPU, MGT Council, MGTC, relevant LAs, APAD & private sector.
iii. Promote Smart Low Carbon Lifestyle Card (SLCLCard) to relevant stakeholder and private entities. (Community-Wide)				EPU, MGT Council, MGTC, relevant LAs, APAD, SWCorp & private sector.

“THE APPROACH IN CONSERVING AND SUSTAINING THE ECOSYSTEM, BIODIVERSITY AND GREEN AREA HAVE TO LOOK AT THE PROPORTION OF THE LAND USE IN EACH LOCAL AUTHORITY FOR MORE IMPACTFUL AND STRATEGIC ACTION IN THE FUTURE”.



4.5 Ecosystem, Biodiversity & Green

Ecosystem and biodiversity provide ‘services’ which influence climate change. Plants play a significant role in removing carbon dioxide from atmosphere and storing it through photosynthesis. Tree canopy cover can absorb and reduce air pollutants, regulate local temperatures and catch rainfall. Hence, strengthening the forest and wetland has crucial

Nearly two-thirds or 2/3 of Melaka land is categorized as Environmentally Sensitive Areas, ESAs due to its rich biodiversity.

function to mitigate carbon by using carbon sequestration approach. Working closely with Forestry department as well as calculation for carbon sequestration are advisable to strengthen the forest and wetland area.

Under the agriculture, forestry and land use (AFOLU) category, livestock contributed about 52,348.57 tCO₂e or 1.18 % GHGs emitted of the total of 4,446 MTCO₂e for Melaka State in 2015. Cattle was a major contributor to these emissions. Livestock management for major animal types i.e. dairy cows, cattle, poultry, sheep and swine. The digestive process or enteric fermentation by which carbohydrates are broken down into microorganism into

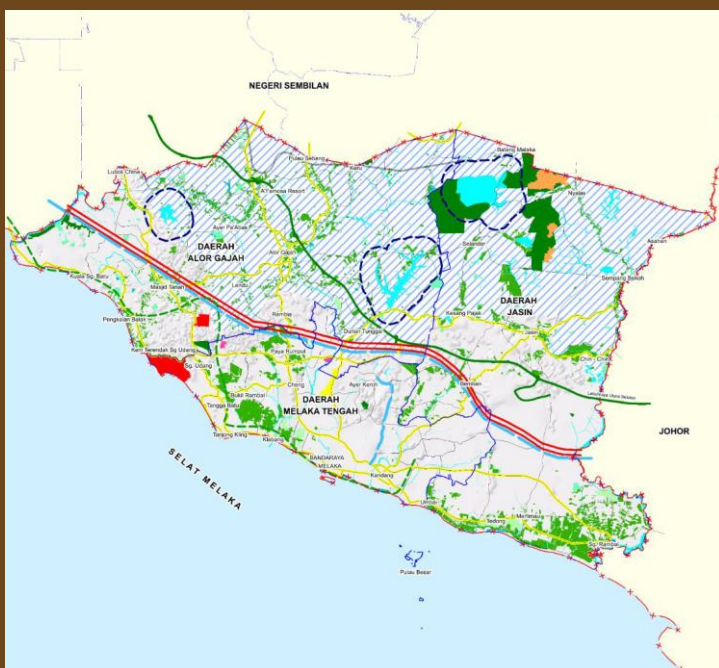
simple molecules for absorption into the bloodstream of an animal. Methane gas (GH₄) is produced as a by-product of enteric fermentation where ruminants’ animals are the major source

About 82 % of land used for agricultural activity is located in Alor Gajah (673.8 sq km) and Jasin District (689.2 sq km). The other 82 % or 1,363.1 sq km of land, where Alor Gajah and Jasin district are located, are occupied with only 338,400 population or 39% of the total population in Melaka state.

Table 12. Actions for Ecosystem & Biodiversity

Action for 'Ecosystem & Biodiversity'	Short Term 2020	Medium Term 2025	Long Term 2030
1. Strengthen forest and wetland function as carbon sequestration.	➔		

Wetlands act as significant carbon sinks, store large volumes of water and slow down its flow. Mangroves in Peninsular Malaysia are found largely sheltered along the west coast that borders the Straits of Malacca which made up mud coasts.



Figure

According to Melaka State structure plan, 2035, several high impact green technology policies need to:

- i. utilise the framework of ESA as development guideline including the aspects of the ESA (Phase 1,2,3) and ESA management criteria,
- ii. provide sufficient buffer zone between ESA (Phase 1 & 2),
- iii. preserve and gazette threatened habitat,
- iv. maintain permanent forest reserve (5,137.62 hectare/ 3.09%) and based on permanent reserved forest classification excision should not be allowed,
- v. retain and proclaim water catchment category 1 (dam catchment area).

Melaka has a unique species of turtle called "hawksbill turtle " known as the most beautiful turtle in the world. This marine turtle species or *Eretmochelys imbricate*, has main nesting area in the State of Melaka. Conservation initiative to maintain turtle population perform through the establishment of turtle sanctuaries and hatcheries in the Melaka Conservatory Turtle Center. The population of Hawksbill turtle is stable with a total annual nesting of 389 in 1991 to 389 nests in 2012 (Ministry of Natural Resources and Environment 2014).

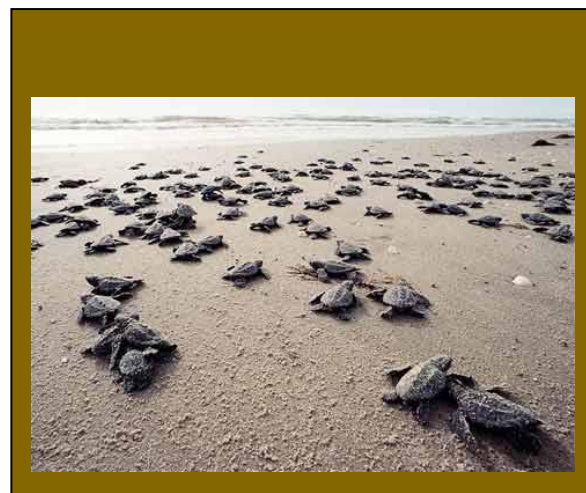





Table 13. Targeted GHG Emission Reduction and Recommended Actions to Ecosystem & Biodiversity

Recommended Actions for ‘Ecosystem & Biodiversity’	Target Yearof Reduction 2020	Target Year of Reduction 2025	Target Year of Reduction 2030	Organisation in Charge
Percentage of Reduction (%)	20	30	45	MGTC, PLANMalaysia & Forest Dept, LAs
Amount of GHG Emission Reduction (MTCO ₂ e) 52,348.57	10,5	15,7	24	MGTC, PLANMalaysia & Forest Dept, LAs
i. Explore the use of ecosystem services assessments to inform future policies and decisions. (Community-Wide)				MGTC, Forestry Dept, PLANMalaysia, LAs, MNS & private sector.
ii. Introduce tax reductions incentive to facilitate, develop and implement green infrastructure strategies to promote adaptation and mitigation. (Community-Wide)				EPU, MGT Council, MGTC, LAs, SW Corp & private sector.
iii. Promote the development of carbon sequestration systems in land use/ planning. (LAs operation)				
i. Promote community garden with waste composting at district and community level. (Community-Wide & LAs operation)				MGTC, Local Authorities, SW Corp.

<p>ii. Implement the Biodiversity Conservation and Research programme at the Melaka coastal and wetland area with a strategic public-private partnership and community wide. (Community- & State-Wide)</p>				<p>MGTC, Forestry Dept, PLANMalaysia, LAs & MNS</p> <p>MGTC, School & SW Corp.</p>
<p>i. Build resilience in natural ecosystems by retaining and rehabilitating key biodiversity elements as part of local biodiversity action plans. (Community-Wide, LAs operation and State-Wide)</p> <p>ii. Promote green agricultural process and engage with farmers through education/ training program. (Community-Wide)</p>				<p>MGTC, Local Authorities, SW Corp & Private Sector.</p> <p>MGTC, Local Authorities, SW Corp & Private Sector.</p>

“THE STRATEGY TO INSTILL WASTE MINIMISATION BEHAVIOUR CLOSELY RELATED WITH LOW CARBON LIFESTYLE TO SUPPORT SUSTAINABLE CONSUMPTION AND PRODUCTION BY PROMOTING BEHAVIORUAL ECONOMICS, THE RIGHT INITIATIVES AS WELL AS THE RIGHT SYSTEM TO SUSTAIN DESIRED BEHAVIOURAL STATE IN THE LONG RUN”.



4.6 Waste

The waste sector contributes relatively small percentage to greenhouse gases. Globally it is estimated between 3-5% and in Melaka itself it is 6.74%. Due to that, it is often overlooked in climate change mitigation and adaptation discussion. For that purpose, two pronged approaches are introduced to accelerate climate actions; community-wide and local authorities (Las) operations.

Waste sector which consists of municipal solid waste(MSW) comprising degradable waste such as paper, textiles, food waste, yard or garden waste, partially degradable materials such as wood, disposable napkins, sludge, and non-degradable materials such as leather, plastic, rubbers, metals, glass, ash from fuel burning like coal, briquettes or woods, dust and electronic waste. Hence, moving to a more sustainable model of waste prevention and material use has strong potential to transform Melaka state waste sector from a minor cause of climate change to a major solution in preventing the creation of greenhouse gases in the first place.

Melaka has a population of about 872,900 people and solid waste generation per capita is about 0.75 kg/ per day. Estimated about 1,200 tonnes of waste per day are received in the existing dumpsite in Krubong, Melaka. The highest amount of waste is received from Central Melaka district which hosts the Melaka Historical City Council (MBMB) (675 tonnes/ day) and Hang Tuah Jaya Municipal Council (MBHTJ) (157 tonnes/day). The rest, are from Alor Gajah Municipal Council (134 tonnes/ day) and Jasin District Council (MPJ) (67 tonnes/ day). The total waste dumped at the Krubong landfill works out to around 438,000 tonnes/ year.

About 299,547.53 tCO₂e of waste generated which consist of 6.74 percent from the total of 4,446M tCO₂e for Melaka State in 2015.

In terms of waste composition, more than or 54.3% consist of organic food and garden waste or wet waste. Only 30 % of them are plastic and paper waste or recyclable items and the rest is 15.7 % or miscellaneous. Nationwide, 22% was set up as recycling rate for Malaysia. Solid Waste Corporation (SWCorp) in Melaka has begun the institutional and community composting programme. Since 2013, about 14.17 tonnes of organic waste from nearly 5 community and institutional participants has been undertaken by SWCorp. Recycling programme is promoted through drivers and recycling bank programmes in school, institution and communities.



Composting Initiative by SWCorp









Table 14. Recommended Action to Promote Waste Minimisation

3 Actions to 'Promote Waste Minimization'	Short Term 2020	Medium Term 2025	Long Term 2030
1. Establish community recycling centre in collaboration with Solid Waste Corporation (SWCorp) and corporate social responsibility of private sector (Resolution No. 13).			
2. Promote waste to energy at state and community level (Resolution No. 15)			
3. Legalise the prohibition of single use plastic, polystyrene and straw to encourage low carbon lifestyle (Resolution 12).			

The fifth sector, **solid waste** contributed in average 7.2% from 2013 to 2015. The details are: 6.44% or 268 MTCO_{2e} (2013), 8.42% or 364 MTCO_{2e} (2014) and 6.74% or 300 MTCO_{2e} (2015).

Table 15. Targeted GHG Emission Reduction and Recommended Actions to Promote Waste Reduction & Low Carbon Lifestyle.

Recommended Actions to 'Promote Waste Minimisation'	Target Year of Reduction 2020	Target Year of Reduction 2025	Target Year of Reduction 2030	Organisation in Charge
Percentage of Reduction (%)	20	30	45	MGTC & SWCorp
Amount of GHG Emission Reduction (MTCO_{2e})	60	90	135	MGTC & SWCorp
i. Establish community recycling centre to prevent waste goes to landfill. (Community-Wide)				MGTC, relevant LAs, SW Corp & private sector.

<p>ii. Offer tax reductions incentive to encourage more separation at source. (Community-Wide)</p>			EPU, MGT Council, MGTC, LAs, SW Corp & private sector.
<p>iii. Offer tax reductions incentive for organisations/ government agencies practising the Green Government Procurement. (LAs operations)</p>			EPU, MGT Council, MGTC, LAs, SW Corp & private sector.
<p>iv. Introduce tax reductions incentive for premise and household involves in Melaka Biodiesel Program. (Community-Wide)</p>			EPU, MGT Council, MGTC, LAs, SW Corp & private sector.
<p>i. Promote community garden as a waste to energy strategy at state and community level. (Community-Wide & LAs operation)</p>			MGTC, Local Authorities, SW Corp.
<p>ii. Introduce and promote waste to energy at state and community level. (Community- & State-Wide)</p>			MGTC, each LAs, SW Corp.
<p>iii. Strengthen the Eco School involvement in GHGs reduction by low carbon school program. (Community-Wide)</p>			MGTC, School & SW Corp.
<p>i. Introduce tax reductions incentives for community garden and waste to energy initiative at community level. (Community-Wide)</p>			MGTC, Local Authorities, SW Corp & Private Sector.
<p>ii. Offer technical and financial assistance to sustain waste to energy effort. (Community-Wide)</p>			MGTC, Local Authorities, SW Corp & Private Sector.

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7. Badan Kawal Selia Air
8. Jabatan Penerbangan Awam
9. Jabatan Perhutanan Negeri Melaka
10. Jabatan Pertanian Melaka
11. Jabatan Perkhidmatan Veterinar Negeri Melaka
12. Jabatan Alam Sekitar Negeri Melaka (JAS)
13. Mara Liner Sdn Bhd
14. Panorama Melaka Sdn Bhd
15. Majlis Bandaraya Melaka Bersejarah (MBMB)
16. Majlis Perbandaran Hang Tuah Jaya (MPHTJ)
17. Majlis Perbandaran Alor Gajah (MPAG)
18. Majlis Perbandaran Jasin (MPJ)
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23. Jabatan Kerja Raya Melaka
24. Indah Water Konsortium Sdn Bhd
25. Plan Malaysia @Melaka
26. Jabatan Pengangkutan Jalan Negeri Melaka (JPJ)
27. Syarikat Air Melaka Berhad
28. Jabatan Pengairan dan Saliran
29. Suruhanjaya Pengangkutan Awam Darat (SPAD) Melaka
30. Pejabat Kawasan Suruhanjaya Tenaga @ Negeri Sembilan & Melaka
31. Perbadanan Pegurusan Sisa Pepejal dan Pembersihan Awam (SWCorp)
32. Universiti Teknikal Malaysia Melaka
33. 100 Resilient Cities Office, Melaka
34. Malaysian Nature Society (MNS)
35. International Islamic University Malaysia (IIUM)

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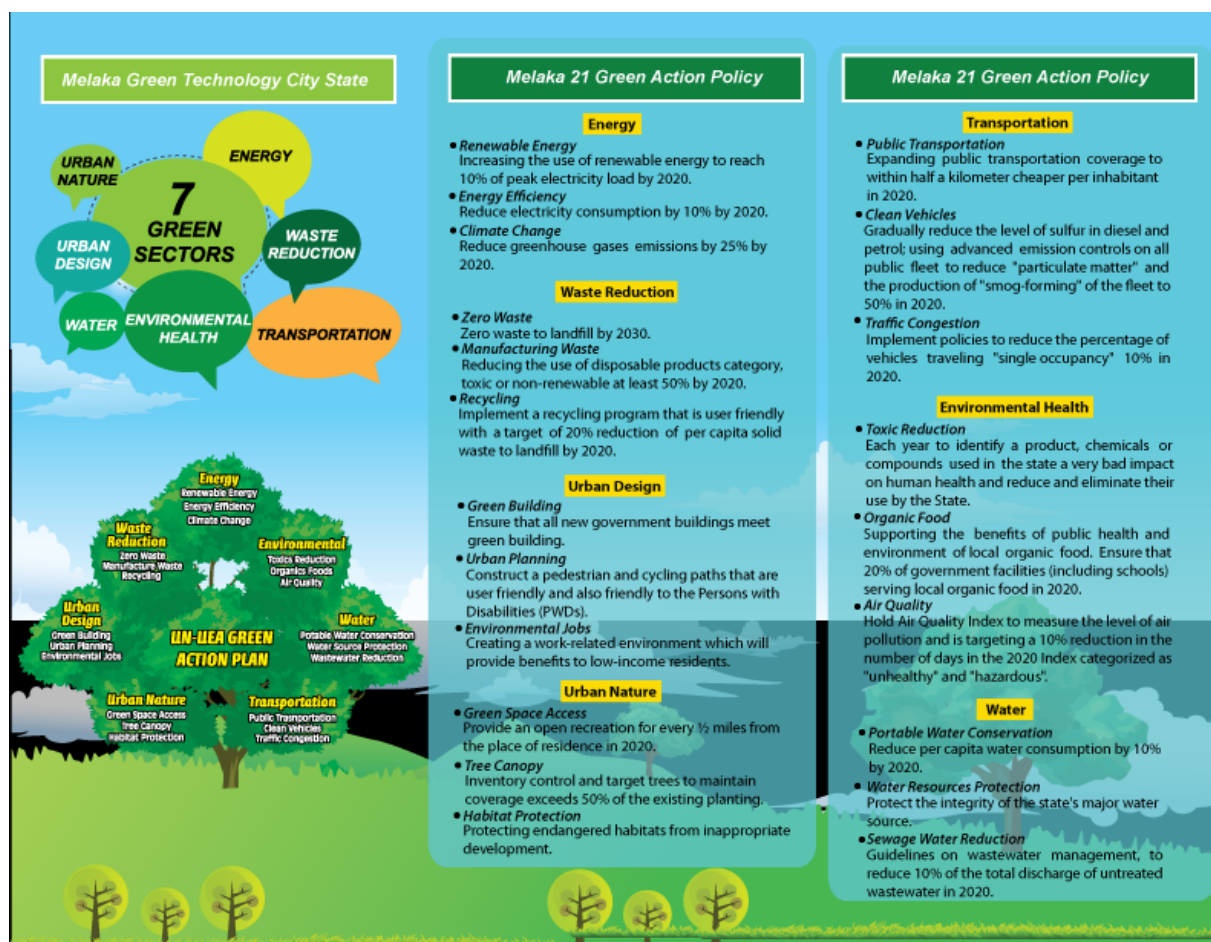
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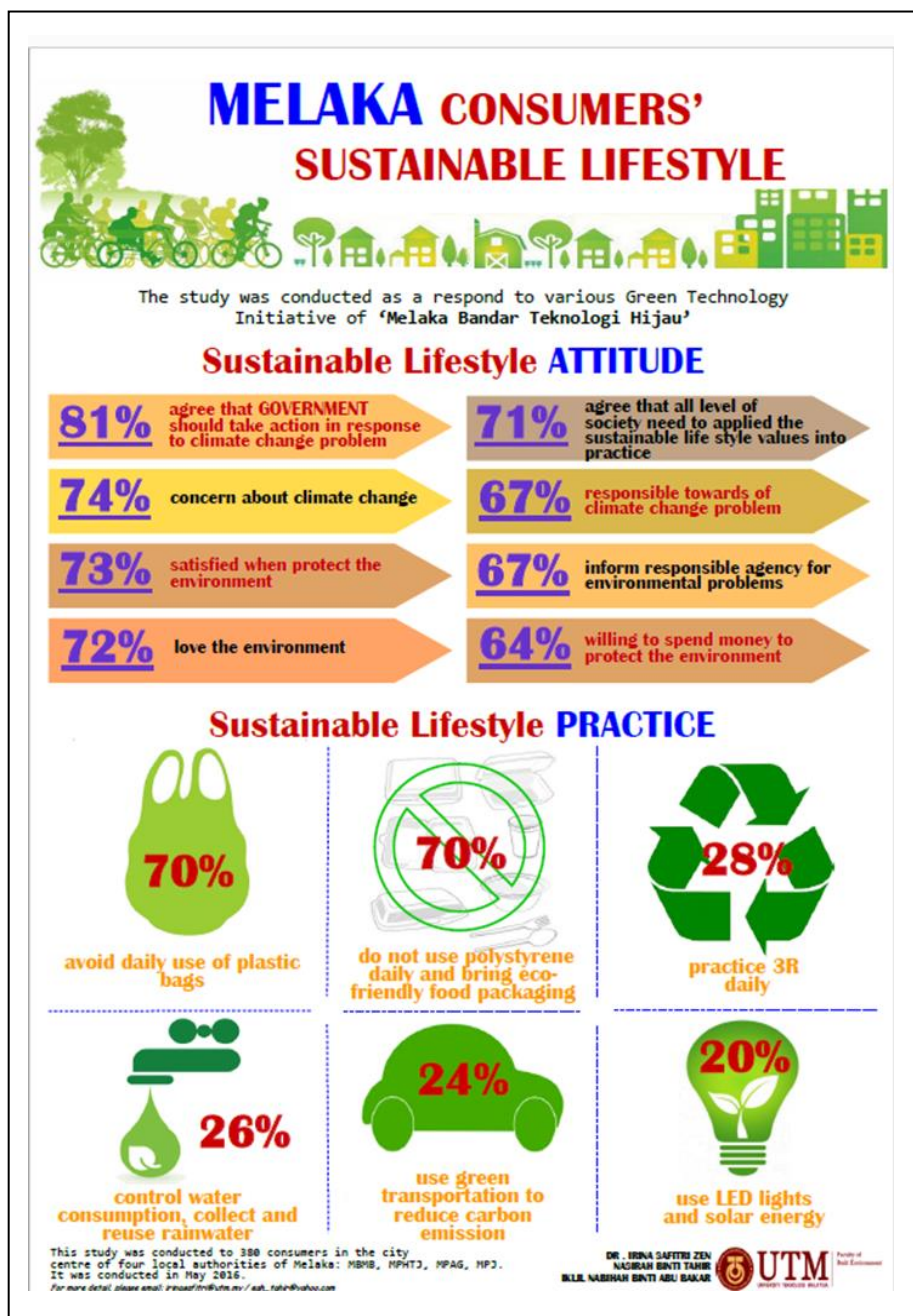
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Appendix 1.



Initiatives under the Melaka Green City Action Policy

Appendix 2



Melaka Consumers' Sustainable Lifestyle



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