



Hua Hin Municipality Climate Action Plan

2030



HUA HIN MUNICIPALITY CLIMATE ACTION PLAN 2030

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European Union

Global Covenant of Mayors for Climate and Energy

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FOREWORD

I am pleased to share the Hua Hin Climate Action Plan, a significant document that reflects our city's joint efforts to tackle the pressing challenges brought by climate change.

In recent years, we've seen the effects of a changing climate in our city. Recognizing the need to address this, we've worked together with local experts, community leaders, and dedicated citizens to create this plan. It outlines steps tailored to our city's unique characteristics, emphasizing our commitment to sustainability, preserving our environment, and ensuring the well-being of our residents.

To successfully face the complexities of climate change, we need everyone on board. The strategies in this plan require the active involvement and support of every resident, business, and organization in Hua Hin. Together, we can pave the way for a more sustainable and resilient future.

I want to express gratitude to everyone who contributed to developing this plan. Your dedication shows our shared determination to address climate change and protect the prosperity of Hua Hin.

By embracing this Climate Action Plan, we affirm our commitment to a future where Hua Hin stands as a model of environmental responsibility and forward-thinking governance. Let's work together steadily towards this shared vision.

Sincerely,



Mr. Nopporn Vuttikul

Mayor of Hua Hin Municipality

FOREWORD

It is with immense pleasure and a profound sense of collective accomplishment that I introduce the series of Climate Action Plans (CAP) for the four Thai pilot cities, a result of a collaborative initiative led by the European Commission under the Global Covenant of Mayors for Climate & Energy (GCoM) Asia Project.

Climate change is the paramount challenge of our time, and it is undeniable how human activities have accelerated the impact of extreme weather patterns and rising sea levels. The European Union, standing at the forefront of global efforts to address these urgent challenges, has committed to reducing greenhouse gas emissions by at least 55% by 2030 and achieving climate neutrality by 2050. Recognizing that global cooperation is imperative to limit global warming to 1.5°C above pre-industrial levels, we understand the necessity of raising ambitions and moving towards climate-resilient development.

Southeast Asia, home to almost 9% of the world's population, stands as one of the most vulnerable regions to the impacts of climate change. As Thailand charts its course towards a resilient and sustainable future, the EU applauds the nation's commitment to mitigating greenhouse gas emissions, adapting to the impacts of climate change, and transitioning towards a more sustainable, low-carbon economy.

The EU's stance on climate change resonates with Thailand's aspirations for a greener, more sustainable urban landscape. In support of Thailand's climate vision outlined in its National Determined Contribution (NDC), aiming for carbon neutrality by 2050 and a net-zero country by 2065, the CAP exemplifies the EU's firm dedication to supporting nations in achieving their climate goals. By fostering collaboration between the EU, Thailand, and the pilot cities of Mueang Mae Hia, Nakhon Nonthaburi, Mueang Hua Hin Town, and Mueang Suphan Buri, the CAP substantiates a shared vision for urban development that is both environmentally responsible and resilient towards future climate challenges.

Through our collaboration with the implementing partner, the Thailand Greenhouse Gas Management Organization (TGO), these four pilot cities have done great work in setting ambitious climate targets for their cities and developing policies and actions to reduce their carbon emissions and adapt to the impacts of climate change. The EU is not only confident that this collaborative effort will inspire further innovation and catalyse positive change but is also excited to witness the transformative impact it will have on the lives of residents in Mueang Mae Hia, Nakhon Nonthaburi, Mueang Hua Hin Town, and Mueang Suphan Buri. This initiative can set a precedent for cities around Thailand and the world to follow the path towards low-carbon and climate-resilient cities.

His Excellency Mr. David Daly

Ambassador of the European Union to the Kingdom of Thailand

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1.1 Background Information and Context

Cities are major sources of greenhouse gas; 70% of CO₂ in the world is emitted from cities. Effective management of climate change depends on proper city development plan, management of affected regions, joint benefits to other regions, risky groups and sites, performance measurable operation and sustainable financial support. Adaptation should be made for alleviation of impacts, as a whole. Precise development plan is necessary for resolving negative impacts of climate change and mitigation of greenhouse gas emissions.

GCoM Asia, part of the EU's global initiative to expand support, participation and training for cities in Southeast Asia, South Asia and East Asia. Reduce greenhouse gas emissions to meet local and national NDC targets through the development of a Climate Action Plan (CAP). In Thailand, the CAP will be implemented in four municipalities, namely **Nonthaburi Municipality, Muang Mae Hia Municipality, Muang Suphan Buri Municipality and Muang Hua Hin Municipality (Figure 1.1)** with intention of (1) notifying the city of the quantity of greenhouse gas within the municipality and target for mitigation of emissions, (2) finding proper measures for mitigation of greenhouse gas emissions, (3) making Climate Action Plan (CAP) and (4) presenting Policy Brief for improvement of CAP to attain the targets.

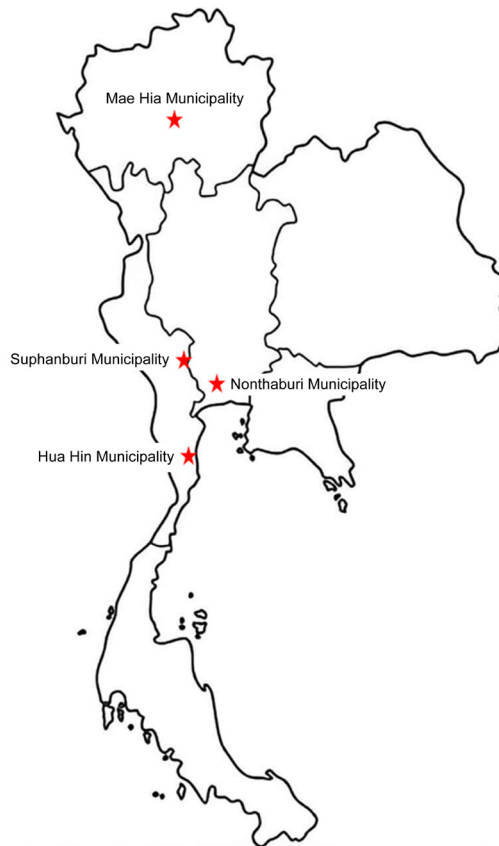


Figure 1.1: Locations of 4 Municipalities under Project

1.2 Thailand's Climate Change Operations

Thailand is facing major challenges in global climate change. Post industrial revolution economic development accelerates accumulation of greenhouse gas in atmospheric layers, which results in significant climate change, seasonal change, natural disasters, decline in natural resources, spread of diseases and germs, emerging and re-emerging viral diseases, which severely affect developing countries such as Thailand. It can be said that climate change is a great threat to sustainable national development, economic growth, elimination of poverty, better life quality, maintenance of ecosystem, natural resources, and good environments. Thailand is also facing increase of greenhouse gas emissions due to dependency on fossil fuels and rapid expansion of cities that constantly requires greater energy consumption.

To come up with solutions to climate change issues, cooperation at a global level is required. Having realized the importance of cooperation with world community, Thailand ratified the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol (KP) in 1994 and 2002 respectively, and continuously attended meetings for global cooperation on resolving climate change issues. Thailand has therefore issued the first 2008-2012 Climate Change Management National Strategy for implementation by the ministries and departments concerned, and issued the 2015-2050 Master Plan as a long-term Policy Framework for the agencies concerned, which will lead to creation of mechanisms and devices for resolving climate change issues.

a) Master Plan for Climate Change 2015- 2050

Thailand's operations on climate change. Climate change is included in the national policies and plans. Thailand will implement Master Plan in response to climate change and cooperate with NDC on management of climate change according to the UN Climate Change Convention, Master Plan In Response to Climate Change 2015-2050, which cover 3 major guidelines on 1) adaptation to climate change, 2) mitigation of greenhouse gas emissions and promotion of low-carbon city development and 3) management of climate change according to the revised master plan 2019, inclusion of climate change views in various agencies' operations without adding higher burdens, indication of joint benefits of Capacity Building for adaptation to and mitigation of greenhouse gas emissions, and determination of risks in many activities.

Now, Thailand is dealing with climate change in cooperation with NDC according to Paris Convention with the target for mitigation of minimum greenhouse gas by 30% by 2040; the target may be 40% if there are sufficient technology transfer and development and financial support. Thailand's NDC Roadmap on Mitigation 2021 - 2030 shall be implemented in support of NDC operations according to the guidelines on mitigation of greenhouse gas emissions from energy consumption, transportation, waste management and industrial processes and product utilization. There will be agencies dealing with such operations, setting forth activities, projects, targets, indicators and sources of funds for NCD operations according to guidelines and action plans for mitigation of greenhouse gas in all sectors.

b) Cooperation Target

Rapid and continuous greenhouse gas emissions create high risks in severe climate change, e.g. higher temperature, less number of cool days, higher average rainfall in rainy and dry seasons, resulting in severe floods, droughts, storms, high seawater level, affecting ecosystem, plants, animals in many regions of the world, leading to migration and spread of diseases. The world community tries to find solutions to increasing severity of climate change according to the Paris Agreement and United Nations Framework Convention on Climate Change (UNFCCC); many countries report climate change issues and set targets for solutions therefor from time to time.

Thailand's Operations, Thailand became a party to the UNFCCC in 1994 and cooperated with other countries in the mitigation of greenhouse gas in atmospheric layers and make adaptation in line with sustainable economic and social development. On 1 October 2015, Thailand submitted to the UN Secretary-General the Intended Nationally Determined Contribution (INDC), stating that the greenhouse gas will be reduced by 20-25% after the year 2020. At the Conference of the Parties: COP (COP26), Thailand by its Prime Minister, declared that Thailand shall attain carbon neutrality by 2050 and net zero greenhouse gas emission by 2065 or even earlier if it receives financial, technological and capacity building support through international cooperation as shown in Fig 1-2 and the proper processes under the convention. Under NDC, Thailand shall reduce greenhouse gas emissions by 40% by 2030 and achieve net zero greenhouse gas emission by 2050.

2nd Update NDC:

- Business As Usual (BAU): 555 million tons of carbon dioxide (MtCO₂eq) by 2030
- In 2025 (Peaking Year), the maximum greenhouse gas emission shall be 368 MtCO₂eq and the greenhouse gas shall be mitigated from BAU by 40% or 222 MtCO₂eq in 2030. Unconditional NDC: the greenhouse gas shall be mitigated from BAU to 30%
- Conditional NDC: the greenhouse gas shall be mitigated from BAU to 10%
- NDC Targets in 2030: 222 MtCO₂eq, comprising energy and transport 216 MtCO₂eq, industrial processes and product utilization 1.1 MtCO₂eq, waste management 2.6 MtCO₂eq and agriculture sector 2.6 MtCO₂eq

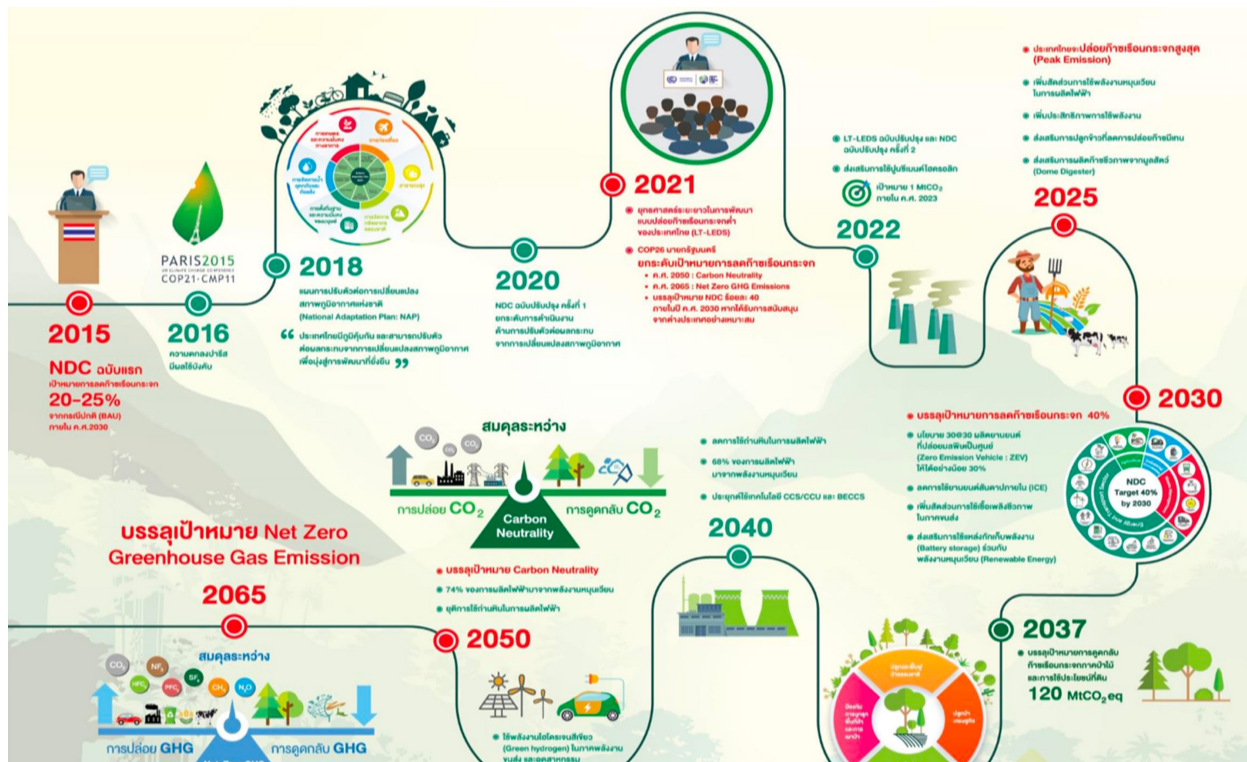


Figure 1.2: Targets for Net Zero Greenhouse Gas Emission in Thailand

c) National Plan for Adaptation to Climate Change

Thailand’s Adaptation to Climate Change 3 Phases:

- Phase 1: 2015**
 The Office of National Resources and Environmental Policy and Planning (ONEP) conducted vulnerability assessment of regions and provinces under 6 branches of the master plan for the making of The National Adaptation Plan (NAP), drawing maps of risky and vulnerable areas and creation of database on adaptation to climate change.
- Phase 2: 2016**
 ONEP applied the gaps and needs found in Phase 1 studies to determine the best practices for adaptation to climate change at local and national level and making NAP for all branches and areas in country.
- Phase 3: 2018**
 ONEP revised the NAP in line with international cooperations to ensure coverage and appropriateness to the changing situations.

For adaptation to climate change, preparation and support for related operations, the NAP sets forth the 6 best practices for: (1) Water Management, (2) Agriculture and Food Security, (3) Tourism, (4) Public Health, (5) Natural Resources Management and (6) Human Settlement and Security, and dealing with Cross Cutting Issues. See the targets and indications under Table 1.1.

Table 1.1: NAP Targets and Indicators

Sector	Target	Indicators
Water Management	Increase national water security and mitigate loss and damage caused by water disasters.	<ol style="list-style-type: none"> 1. Water Security Index. 2. Value of loss of lives and properties caused by water disaster.
Agriculture and food security	Maintenance of food production and security under risks and impacts from climate change	<ol style="list-style-type: none"> 1. Proportion of agricultural production loss caused by detrimental climate to Agricultural GDP. 2. Agricultural Self Reliance in time of detrimental climate.
Tourism	Expand sustainable tourism. Reduce risks of climate change.	<ol style="list-style-type: none"> 1. Percentage of confidence in tours without being affected by climate disasters. 2. Value of loss of tourism affected by natural disasters.
Public Health	Capability for efficient management of risks and reduction of impacts on health caused by detrimental climate change	<ol style="list-style-type: none"> 1. Number of illnesses and deaths caused by climate change. 2. Economic loss incurred from ill health and climate change.
Human settlement and security	People, communities and cities are capable of adapting to detrimental climate change	<ol style="list-style-type: none"> 1. Number of people who died, went missing and directly affected by natural disasters in a population of 100,000, from database of the last 5 years. 2. Total number of city plans adapted to climate change.
Natural Resources Management	Sustainable management of natural resources and biodiversity affected by climate change	<ol style="list-style-type: none"> 1. Proportion of rehabilitated natural dwelling, forests and coastal ecosystem to domestic areas. 2. Number of species nearly extinct or threatened by detrimental climate change.
Human settlement and security	People, communities and cities are capable of adapting to detrimental climate change	<ol style="list-style-type: none"> 1. Number of people who died, went missing and directly affected by natural disasters in a population of 100,000, from database of the last 5 years. 2. Total number of city plans adapted to climate change.

(Source: The Office of National Resources and Environmental Policy and Planning (ONEP))

1.3 Municipality Context & Climate Change Operations

Muang Hua Hin Municipality lies 195 km (through Samut Sakhon Province, Samut Songkhram Province and Petchaburi Province, south of Bangkok). Muang Hua Hin Municipality has an area of 86.36 square kilometers where Hua Hin Subdistrict and Nong Jok Subdistrict are located. Muang Hua Hin Municipality was established in 1937. Previously, the area was only 72 square kilometers, but it increased on 13 February 2004. It is 90 km. from Prachuap Khiri Khan Province. Its borders are shown in **Figure 1.3**.

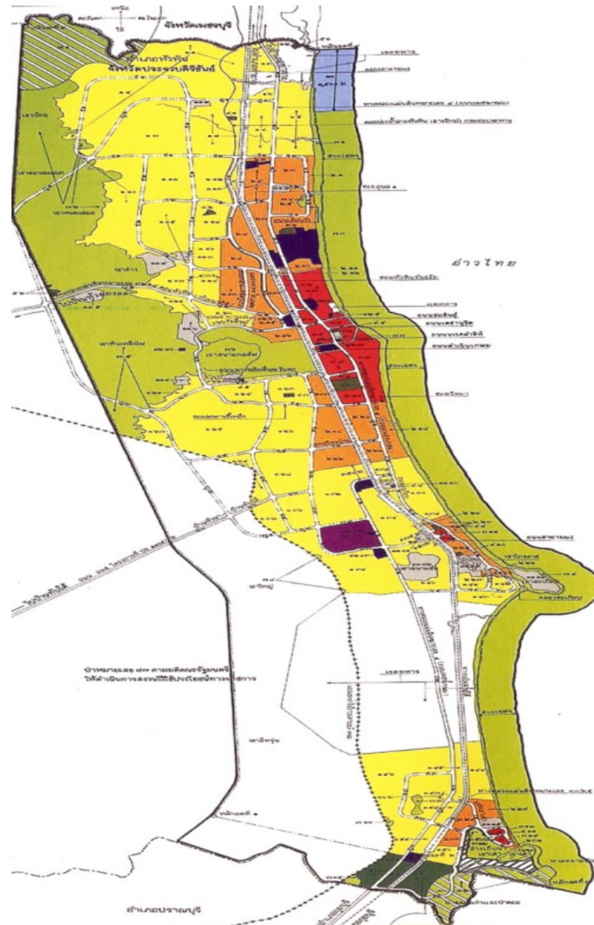


Figure 1.3: Map of Muang Hua Hin Municipality

- North:** Borders Muang Cha-am Municipality, Phetchaburi Province.
- East:** Borders Thai Gulf.
- South:** Borders Prachup Khiri Khan District, Phrachup Khiri Khan Province.
- West:** Borders Thap Tai Subdistrict and Hin Lek Fai Subdistrict, Hua Hin District

Hua Hin District lies between Tanowski Mountain and Thai Gulf; it is 60 km. wide. The western part borders Myanmar's high mountains. The eastern part is sloping land with small grove woods, adjacent to coast, suitable for agriculture and animal farming. Its natural resources are forests and quartz.

The total area is 86.36 square kilometers. According to the house registration database, the population in 2021 was 66,165, being 32,755 males and 33,410 females; the number of households is 57,230.

1.3.1 Climate

Phrachup Khiri Khan Province is under the influence of two monsoons. In rainy season, the southwest monsoon brings vapors and moistures from the seas and oceans that it rains in all areas. In the winter, from the middle of October to the middle of February, the northeast monsoon brings cold and dryness from China, so the weather is cold and it rains until December.

a) Temperature

Being close to the sea, the temperatures during daytime, nighttime and different seasons do not vary very much. The temperature is not too high in the summer. The temperature is low in some regions in the winter. The highest and lowest average temperature is 32.6°C and 23.9°C respectively. April and May are the warmest months of the year. The highest temperature was 42.0°C at Nong Plup Meteorological Station on 11 April 2016. The lowest temperature was 6.4°C at Nong Plup Meteorological Station on 26 December 1999. For the past 40 years, from 1981 to 2020, the temperature tended to rise. See **Figure 1.4**.

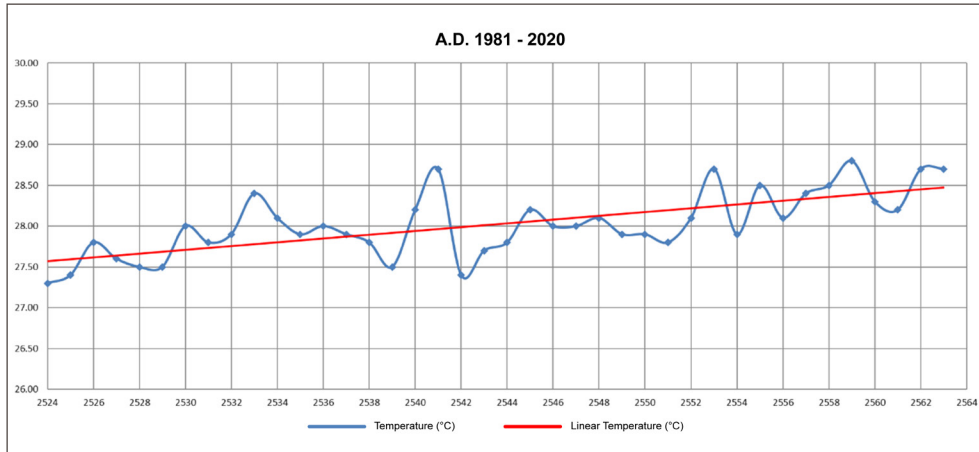


Figure 1.4: Average Temperature in Prachuap Khiri Khan Province
(Source: Hua Hin Meteorological Station)

b) Rainfall

It does not rain so often in Prachub Khiri Khan Province. The average annual rainfall is 1,117.1 mm.; it rained around 119 days. In Hua Hin District, the average annual rainfall was 945.5 mm; it rained around 105 days. In October, the heaviest rainfall occurs; at Hua Hin Meteorological Station, the heaviest rainfall in 24 hours was 429.2 mm. on 2 November 1969. For the past 40 years, from 1983 to 2020, the rainfall tended to decline. See **Figure 1.5**.

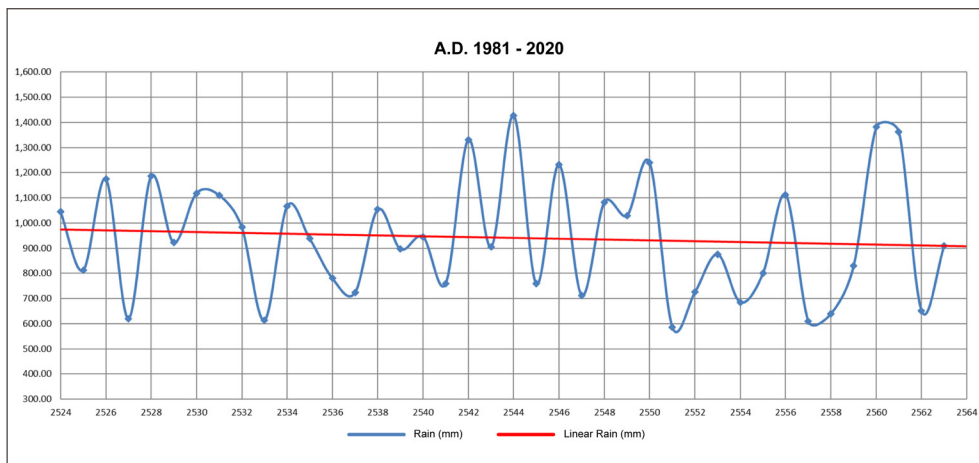


Figure 1.5: Average Annual Rainfall in Prachub Khiri Khan Province
(Source: Hua Hin Meteorological Station)

1.3.2 Guidelines on Mitigation of Local Greenhouse Gas Release

Muang Hua Hin Municipality has adopted Happy Hua Hin Strategy. Hua Hin is famous for resorts with clear seawater, clean sand and pleasant atmosphere. Many tourists visit Hua Hin throughout the year. Strategy 3 for 2023 – 2027: Improvement of public health and environments. Targets: (1) People are physically and mentally healthy and in pleasant surroundings (2) Clean and tidy city free from pollution; proper management of environments and (3) improvement of city and communities in an environmentally friendly manner. CCF Plan: One megawatt waste-energy-power plant. Investment by private firm; improvement of waste elimination sites, elimination of old waste, separation and burying of waste in used grounds; use of scrap plastic in production of oil and fuels. Mitigation of greenhouse gas emissions in some projects are in line with the National policy. See **Table 1.2**.

Table 1.2: Muang Hua Hin Municipality's Local Low-Carbon Development Plan for 2023 – 2027

Agencies in Charge	Project
Strategy 1 Improvement of Tourism, Infrastructure and Economy 1.6 Housing & Community Plan	
Bureau of Public Works	1. Increase of efficiency in use of energy in state agencies
Strategy 3 Improvement of Public Health and Environments 3.6 Housing & Community Plan	
Waste Elimination Site, Bureau of Public Works	1. Participation in Waste-to-energy Power Plant Project 2. Participation in Waste Reduction, Reuse and Recycle 3. Participation in Improvement and Rehabilitation of Old Waste Elimination Site 4. Wind Turbine Power Plant Construction 5. Waste Elimination

Chapter 2.0 Municipality Report and Estimation of Greenhouse Gas

2.1 List of Municipality’s Greenhouse Gas Emission Activities

2.1.1 List of Municipality’s Greenhouse Gas Emission Activities

The city structure is made up of housing units, government agencies, private firms, business units, production sites, public and private transport systems, forests, land utilization and waste elimination sites. Each municipality sets forth the areas under its administration.

Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC). There are 5 Main Groups. The Municipality’s targets are shown in **Table 2.1**.

Table 2.1: City’s Greenhouse Gas Emission Activities

Main Greenhouse Gas Emission Activities	Activities within Municipality
Stationary Energy	<ol style="list-style-type: none"> 1. Fuel consumption in housing units, commercial buildings, business, trades, agencies, production and construction and other unidentifiable sites. 2. Power consumption in transmission lines, housing units, commercial buildings, businesses, trades, agencies, production and construction and other unidentified sites.
Transportation	<ol style="list-style-type: none"> 1. On-road fuel consumption 2. On-rail fuel consumption 3. Waterborne fuel consumption 4. Aviation fuel consumption 5. Off-road fuel consumption
Waste Management	<ol style="list-style-type: none"> 1. Waste Disposal by Landfilling 2. Biological Waste Treatment 3. Waste Incineration 4. Wastewater Disposal
IPPU	<ol style="list-style-type: none"> 1. Industrial Processes 2. Use of Cooling Agents
AFOLU	<ol style="list-style-type: none"> 1. Ranches 2. Land Utilization and Change Thereof 3. Activities Related to Grounds and Other Sources

Data on greenhouse gas emission activities in the municipality are collected to determine the primary and secondary sources in line with present situations. The focuses are on consumption of energies in households, commerce and industries; consumption of fuels in transportation; disposal of waste and wastewater; raising of animals in city areas. The data obtained may be limited in many aspects, e.g. freedom to disclose information, collection of information and persons responsible for the information. Therefore, the emissions of greenhouse gas are determined from various types of information and sources thereof, including hypotheses, to ensure correct results. The notation keys herein comply with the GPC report and IPPC guidelines, as follows:

NO	means	Not Occurring	The activities or processes do not occur or start in the municipality.
IE	means	Include Elsewhere	The activities or processes occur or start in the municipality, but they are estimated and included in other reports.
NE	means	Not Estimated	The activities or processes occur or start in the municipality, but they are not estimated or reported.
C	means	Confidential	Report cannot be made because the information on greenhouse gas emissions is confidential.

2.1.2 Estimation of Greenhouse Gas Emissions

In this report, the estimation of greenhouse gas emissions complies with the guidelines on collection of data on greenhouse gas emissions at national level by the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. The greenhouse gas emissions and removals can be estimated by direct measurement or determination from existing data or both. See **Equation 1**.

$$\text{Quantity of Emitted Greenhouse Gas} = \text{Greenhouse Gas Emission Activities} \times \text{Greenhouse Gas Emission Value}$$

Equation 1

Reference is made to Intergovernmental Panel on Climate Change (IPCC): 2006, 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Vol.1 – Vol.5. The quantity of emitted greenhouse gas is determined from primary and secondary data collected from discussion with people related to such activities according to GHG Protocol for Community-Scale GHG Emission Inventory (GPC).

The quantities of greenhouse gas emitted from various activities are also based on local and overseas information sources as shown in **Table 2.2**.

Table 2.2: Data on Greenhouse Gas Emissions

Activities	Documents on Greenhouse Gas Emission Values
Stationary Burning <ul style="list-style-type: none"> • Power consumption • Fuel consumption 	<ul style="list-style-type: none"> • Greenhouse gas emissions from power generation under Thailand Green House Gas Management Organization (Public Organization) Projects • 2006 IPCC Guidelines for National Greenhouse Gas Inventories
Transportation <ul style="list-style-type: none"> • Fuel Consumption 	<ul style="list-style-type: none"> • 2006 IPCC Guidelines for National Greenhouse Gas Inventories
Waste Elimination <ul style="list-style-type: none"> • Landfilling with Waste • Waste Decomposition • Waste Incineration • Wastewater Elimination 	<ul style="list-style-type: none"> • 2006 IPCC Guidelines for National Greenhouse Gas Inventories
Industrial Processes and Product Utilization	<ul style="list-style-type: none"> • 2006 IPCC Guidelines for National Greenhouse Gas Inventories
Agriculture, Forestry and Land Utilization	<ul style="list-style-type: none"> • 2006 IPCC Guidelines for National Greenhouse Gas Inventories

There are no measures for mitigation of Business as Usual (BAU) greenhouse gas emissions. The quantity of BAU greenhouse gas is used in determination of mitigation. The basic or present greenhouse gas quantities in all activities shall be determined to find the future quantity of greenhouse gas within certain periods of time. **Equation 2** shall apply.

$$\text{Future Activities in Year (n)} = \text{Activities in Year (n-1)} \times \text{Activities Annual Growth Rate}$$

Equation 2

The activities growth rate can be determined by **Equation 3**.

$$\text{Activities Annual Growth Rate (\%)} = \left(\frac{\text{Last Year Activities}}{\text{First Year Activities}} \right)^{(1/(\text{Number of Years}-1))} \times 100$$

Equation 3

The estimation of greenhouse gas emissions is made on the hypothesis that the activities in the municipality remain the same, unless otherwise there are changes in the processes emitting more greenhouse gas. Estimation of greenhouse gas emissions can be made by **Equation 4**.

$$\text{Quantity of Greenhouse Gas Emission in Year (n)} = \text{Activities in Year (n)} \times \text{Greenhouse Gas Emissions}$$

Equation 4

The greenhouse gas emissions are estimated on the basis of increase in activities in all sectors concerned and data collected by questionnaires as per details in **Table 2.3**.

Table 2.3: Estimation of Greenhouse Gas Emissions According to Sectors' Activities

Activities	Estimation
Stationary Energy	<p>Fuel Consumption Determination of increase in fuel consumption by geometrical progressive method based on the data of Energy Business Department, Energy Ministry.</p> <p>Power Consumption Determination of increase in electrical power consumption by geometrical progressive method based on the data on Thailand energy consumption in the areas being studied.</p>
Transportation	<p>Fuel Consumption Determination of increase in fuel consumption by geometrical progressive method based on the data of Energy Business Department, Energy Ministry.</p>
Waste Elimination	<p>Waste Determination of waste accumulation in municipality by geometrical progressive method.</p> <p>Wastewater Determination of wastewater based on the size of population and water consumption.</p>
IPPU	<p>Industrial Processes The municipality areas are free from industrial processes, so the greenhouse gas emissions are not estimated.</p>
AFOLU	<p>Ranches Based on data from district and provincial ranch office.</p> <p>Agriculture Based on satellite photos and interviews of people in the agencies concerned in the areas of study. There will be no changes in agriculture and land utilization in the future.</p> <p>Land Utilization and Changes Thereof Based on satellite photos and interviews of people in the agencies in the areas being studied. There will be no changes in land utilization.</p>

2.1.3 Estimation of Future Greenhouse Gas Emissions

This report covers 7 greenhouse gases, namely carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O) hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) sulfur hexafluoride (SF₆) and nitrogen fluoride (NF₃) which potentially give rise to global warming. See **Table 2.4**.

Table 2.4: Greenhouse Gases and Potential to Global Warming

Name	Potential to Global Warming (AR5)	Name	Potential to Global Warming (AR5)
Carbon dioxide	1	HFC-236fa	8,060
Methane	28	HFC-245ca	716
Nitrous oxide	265	HFC-245fa	858
Hydrofluorocarbon		HFC-365mfc	804
HFC-23	12,400	HFC-43-10mee	1,650
HFC-32	677	Perflorinated compounds (PFCs)	
HFC-41	116	Sulfur hexafluoride	23,500
HFC-125	3,170	Nitrogen trifluoride	16,100
HFC-134	1,120	PFC-14	6,630
HFC-134a	1,300	PFC-116	11,100
HFC-143	328	PFC-218	8,900
HFC-143a	4,800	PFC-318	9,540
HFC-152	16	PFC-31-10	9,200
HFC-152a	138	PFC-41-12	8,550

Name	Potential to Global Warming (AR5)	Name	Potential to Global Warming (AR5)
HFC-161	4	PFC-51-14	7,910
HFC-227ea	3,350	PFC-91-18	7,190
HFC-236cb	1,210	Trifluoromethyl sulfur pentafluoride	17,400
HFC-236ea	1,330	Perfluorocyclopropane	9,200

(Source: *Climate Change 2014: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*)

Report of greenhouse gas emissions by GPC method at 2 levels, namely Basic and Basic+, based on the studies in 2019. See **Figure 2.1**.

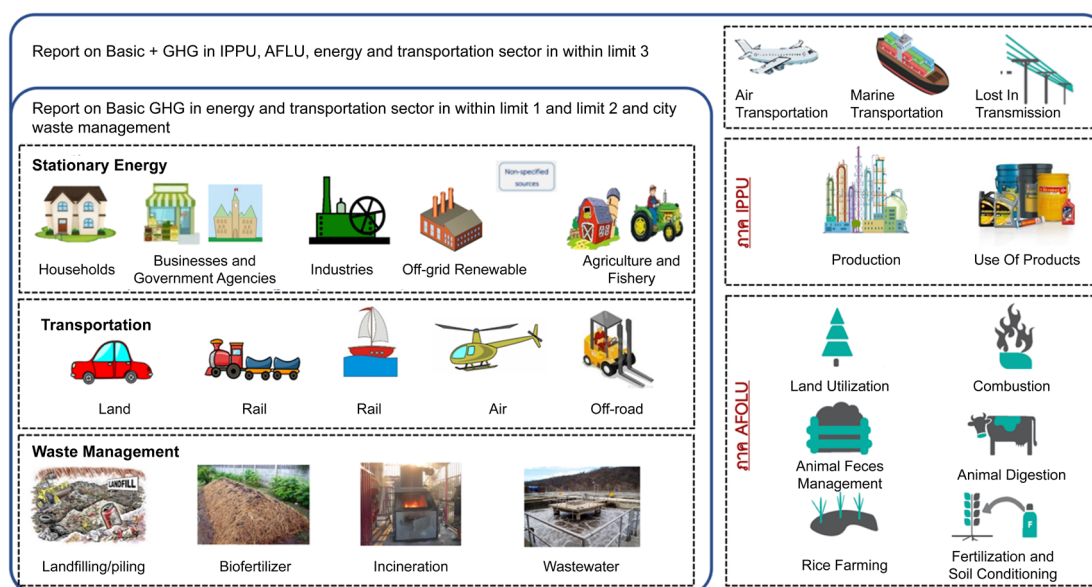


Figure 2.1: Report of Greenhouse Gas Emissions at Basic and Basic+ Level

Report of Greenhouse Gas Emissions at Basic Level

Greenhouse Gas Emissions Boundary 1: Energy, (Except Electrical Generation for Line Transmission), Transportation, Waste Elimination (Except Elimination of Waste from Other Cities)

Greenhouse Gas Emissions Boundary 2: Energy and Transportation

Greenhouse Gas Emissions Boundary 3: Elimination of City Waste Outside

Report of Greenhouse Gas Emissions at Basic+: It covers greenhouse gas emissions from IPPU at Basic level and within Boundary 1.

All greenhouse gas emissions within Boundary 1: From agriculture, forests and AFOLU.

Greenhouse gas emissions within Boundary 3: Energy (loss of energy from transmission lines and power sale, steams, and heat outside the city) and transportation.

2.2 GHG Emission Report, 2019

Carbon footprint in Muang Hua Hin Municipality based on data in 2019. Basic and Basic+ greenhouse gas emissions are 41,677 tCO₂eq and 127,547 tCO₂eq respectively as per details in **Table 2.5** and **Figure 2.2**. Basic+ greenhouse gas emissions from different sectors in Muang Hua Hin Municipality in descending order:

- Stationary Energy: 282,734 tons of carbon dioxide or 54.16% of all greenhouse gas emissions in the municipality.
- Transportation: 133,894 tons of carbon dioxide or 25.65% of all greenhouse gas emissions in the municipality.
- Waste Disposal: 102,162 tons of carbon dioxide or 19.57% of all greenhouse gas emissions in the municipality.
- AFOLU: 3,204 tons of carbon dioxide or 0.61% of all greenhouse gas emissions in the municipality.
- IPPU: IP greenhouse gas emission activities cannot be found; PU greenhouse gas emission activities cannot be estimated. Therefore, the IPPU greenhouse gas emissions in the municipality cannot be determined.

Table 2.5: Greenhouse Gas Emissions in Muang Hua Hin Municipality in 2019

Group of the activities			Total GHG emissions (tCO ₂ e)				
			Limit 1	Limit 2	Limit 3	BASIC	BASIC+
I	ภาคพลังงาน (Stationary Energy)	All Fuels Burned	11,102	271,632	0	282,734	282,734
		Fossil Fuel	0				
II	ภาคการขนส่ง (Transportation)	Total in Group	69,500	0	64,394	69,500	133,894
III	ภาคการจัดการของเสีย (Waste)	City Waste	102,077		85	102,162	102,162
		Waste from Other Cities	0				
IV	ภาคกระบวนการอุตสาหกรรมและการใช้ผลิตภัณฑ์	Total in Group	0				0
V	ภาคเกษตร ป่าไม้ และการใช้ประโยชน์ที่ดิน (AFOLU)	Total in Group	3,205				3,205
Total			185,884	271,632	64,479	454,396	521,995

Note:



Greenhouse Gas Emissions at BASIC level



+



Greenhouse Gas Emissions at BASIC+ Level



Greenhouse Gas Emissions Other than Boundary 1 in the City



No greenhouse gas emissions activities in the city

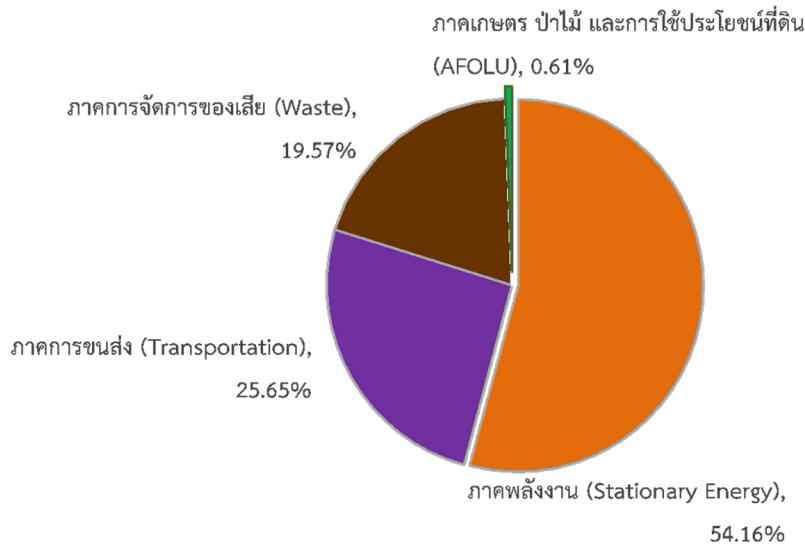


Figure 2.2: Greenhouse Gas Emissions in Muang Hua Hin Municipality in 2019

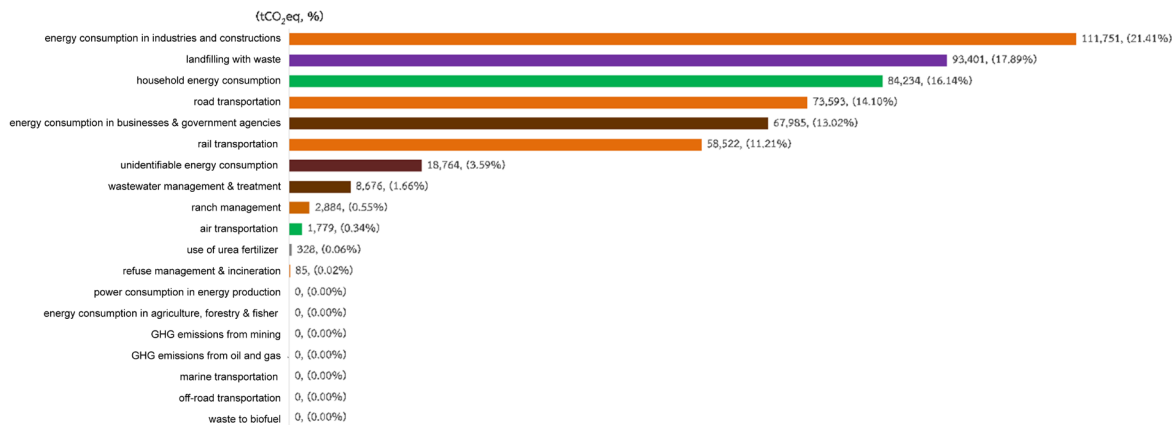


Figure 2.3: Greenhouse Gas Emissions in Muang Hua Hin Municipality Branches in 2019

Figure 2.3 shows greenhouse gas emissions from subsectors in descending order: Industries and constructions 21.41%, landfilling with waste 17.89%, household 16.14%, land transportation 14.10%, trading and government agencies 13.02%, totaling 82.56% of total greenhouse gas emissions in the municipality. The figures identify greenhouse gas emission activities so that proper measures for mitigation thereof can be adopted.

2.3 Estimation of Future Greenhouse Gas Emissions

Estimation of greenhouse gas emissions under normal circumstances in the municipality from 2019 to 2030. In the year 2030, the total greenhouse gas emissions from Business As Usual (BAU) without greenhouse gas emission mitigation based on the data on the city's growth are 379,240 tons of carbon dioxide in descending order: Energy sector 180,161 tons of carbon dioxide or 47.51%, waste elimination 137,083 tons of carbon dioxide or 36.15%, transportation 58,945 tons of carbon dioxide or 15.54% and agriculture, forestry and land utilization 3,051 tons of carbon dioxide or 0.80% as per details in Figure 2.4 and Figure 2.5.

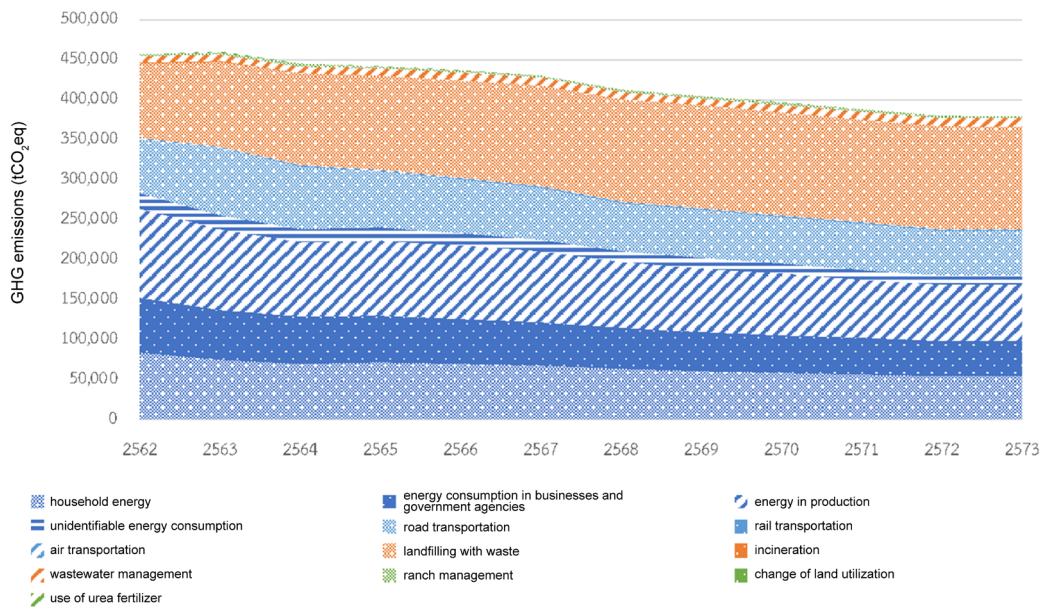


Figure 2.4: Greenhouse Gas Emissions under Normal Circumstances in Muang Hua Hin Municipality in 2030

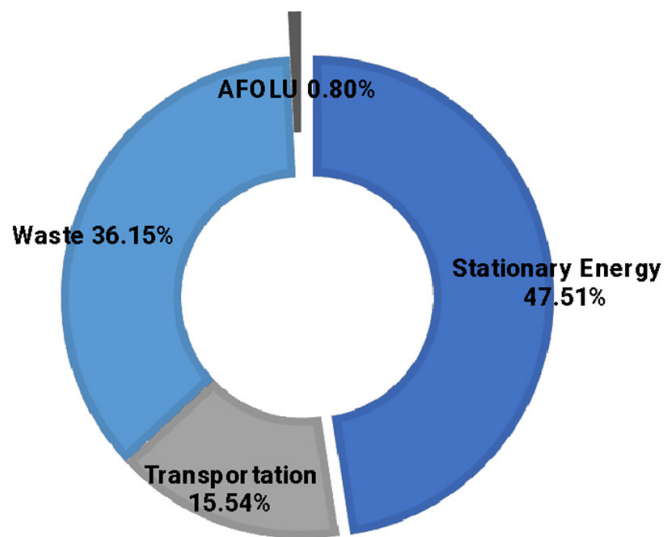


Figure 2.5: Greenhouse Gas Emissions in Muang Hua Hin Municipality in 2030

Chapter 3.0 Measures for Mitigation of Greenhouse Gas Emissions

3.1 Measures for Mitigation of Greenhouse Gas in Order of Priority

Based on local, national and international policies on mitigation of greenhouse gas emissions, the following 6 low carbon measures are proposed: Energy Efficiency (EE), Alternative Energy (AE), Transport Management (TM), Waste Management (WE), Forest and Agriculture Management (FOR & AGR) and Others (OTH).

Table 3.1: Priority Order of Low Carbon Measures

Factors to Consider		Priority Order		
		Level 1	Level 2	Level 3
Consistency with Municipality's Policies		No power to take actions	Requires cooperation and support from other agencies	Municipality can take actions
Appropriateness to area		No association	Appropriate but immediate actions cannot be taken	Appropriate to area and immediate actions can be taken
Readiness	Budget	No budget	External fund required	Fund from municipality
	Technology	No technology	Need technology transfer	Actions can be taken in this area
	Society	Not acceptable by local people	Not enough cooperation; need support from other agencies	Acceptable by local people
	Personnel	No/Insufficient personnel	Need support from other agencies	Actions can be taken by municipality personnel

Roadmap for Muang Hua Hin Municipality

The City Climate Change Operation Development Project Plan Working Group held a Meeting No. 1/2566 on the Support to Global Covenant of Mayors for Climate and Energy (GCoM) in Asia for Muang Hua Hin Municipality at Muang Hua Hin Municipality Conference Room, Prachuap Khiri Khan Province, on Wednesday 28 February 2023 from 09:30 hr. to 12:00 hr. as per details in **Appendix B-4**.

At the meeting, the draft plan for mitigation of greenhouse gas emissions in the city was presented to the persons concerned and stakeholders for exchange of views and prioritization of measures and adoption thereof. They came up with the flowchart showing municipality's short, medium and long term operations for mitigation of greenhouse gas emissions for development of low carbon city.

In year 1 to year 2, 10 medium-term measures can be implemented. In year 3 to year 5, 15 medium-term measures can be implemented—After year 5, 2 measures can be implemented. Four measures were discarded for the reason that they were not consistent with the city's operations. See **Figure 3.1**.

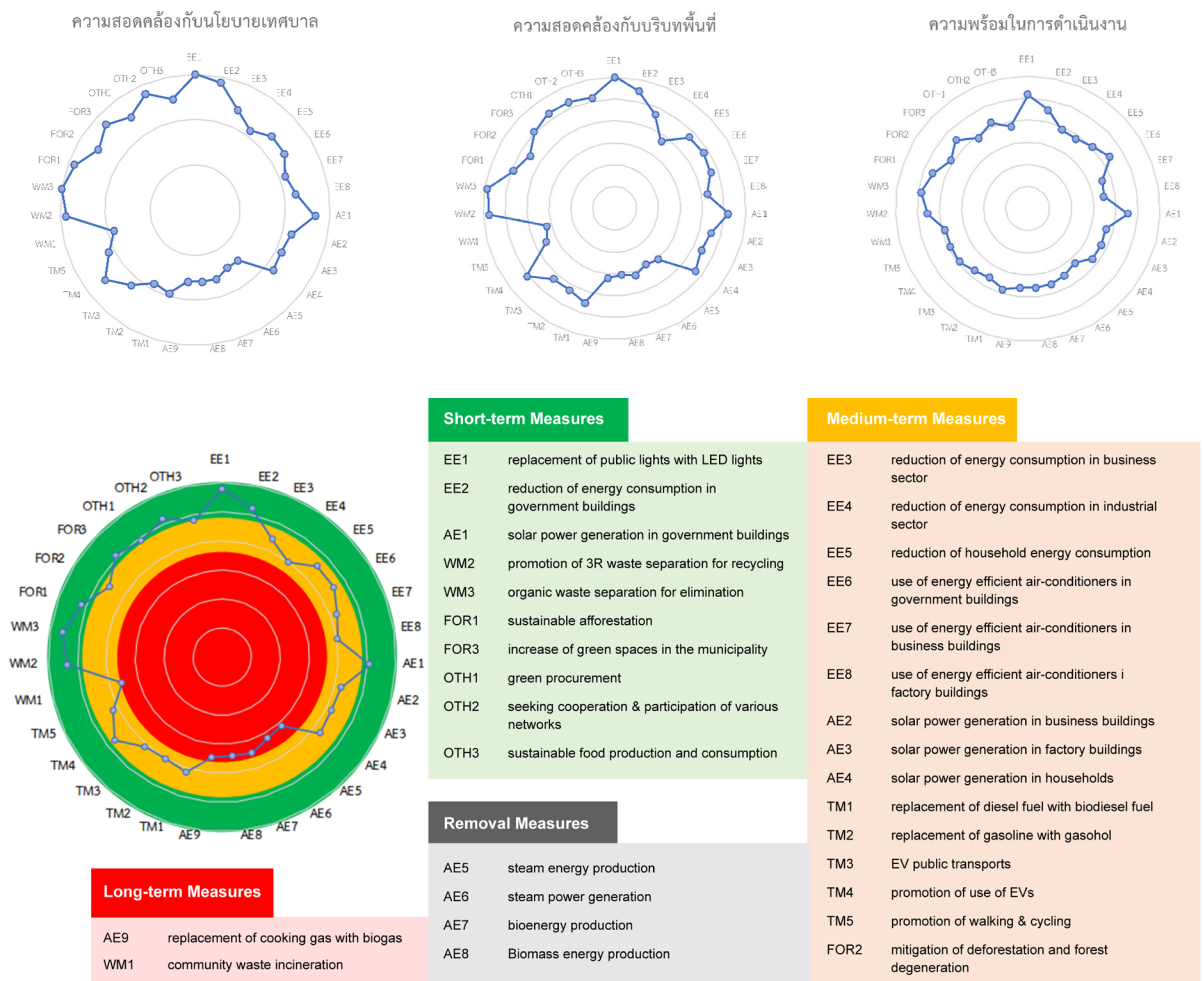
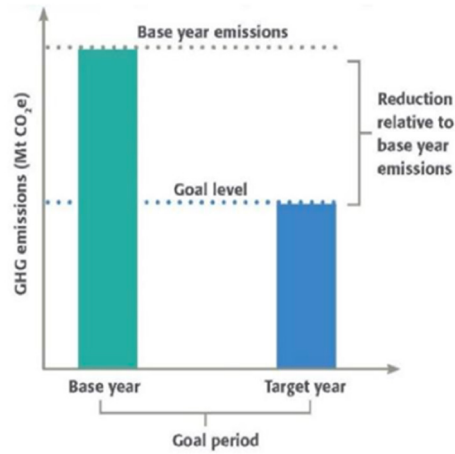


Figure 3.1: Guidelines on Mitigation of Greenhouse Gas Emissions in Muang Hua Hin Municipality

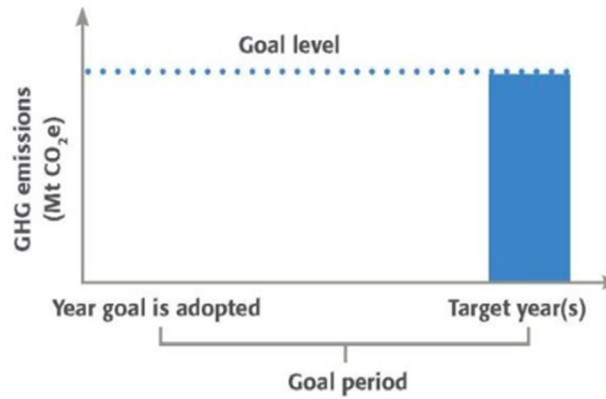
3.2 Targets for Mitigation of Greenhouse Gas Emissions

After estimation of greenhouse gas emissions from different activities in line with the municipality context, the following goals are set for the mitigation thereof.



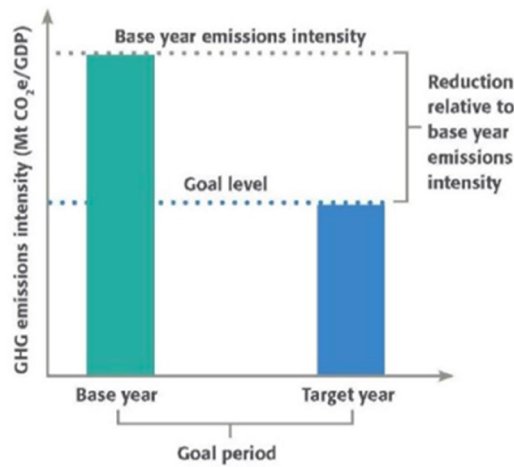
1. Base Year Emission Goal

Base year greenhouse gas emission goal



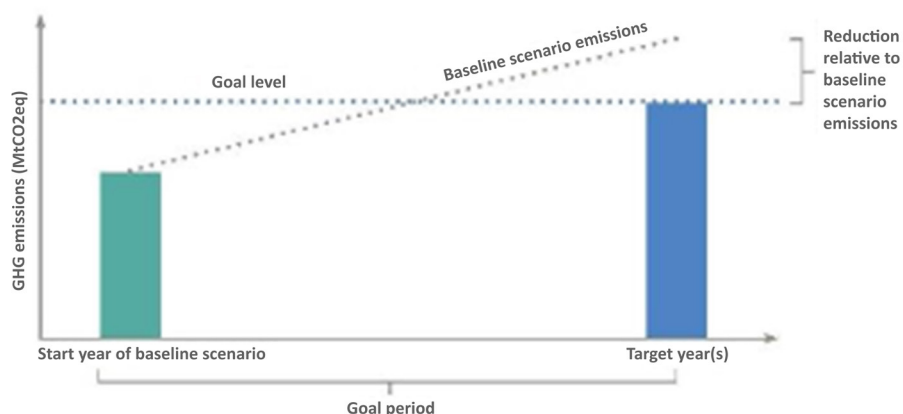
2. Fixed Level Goal

Goal fixed at a certain level, e.g. 10 tCO₂e/q within 5 years.



3. Base Year Intensity Goal

The yearly goal based on the city population or GDP



4. Baseline Scenario Goal

Goals for greenhouse gas emissions, from 2019 to 2030, as compared with the Business-as-usual (BAU)

For the project, the baseline scenario goal is set in line with the municipality's BAU. It clearly helps us see the pictures and understand such goal. The baseline scenario goal is also consistent with Thailand's declaration to the world that its NAMAs shall be reduced to 7-20% as compared with the BAU through voluntariness of energy sector (power generation, industries and waste to energy) and transportation sector by 2020 and NDC for reduction of greenhouse gas by 30-40% as compared with BAU by 2030.

The goals are set for mitigation and removal of greenhouse gas in 4 sectors, namely energy, transportation, waste management and agriculture, forestry and land utilization. The municipality shall focus on the NDC roadmap, regional operation plan for mitigation of greenhouse gas emissions or local development plan. In summary, the municipality's 4 goals for greenhouse gas emissions, from 2019 to 2030, as compared with the BAU shall be mitigated by 5 - 22% as per details in **Table 3.2**.

Table 3.2: Project's Targets for Mitigation of Greenhouse Gas Emissions in 4 Municipalities

Sector		Goal for GHG in 2030 (tCO ₂ eq)	Goal for GHG Mitigation (tCO ₂ eq)	GHG Mitigation %
Muang Hua Hin Municipality	Energy	180,161	13,534	7.51
	Transportation	58,945	361	0.61
	Waste Management	137,083	5,398	3.94
	Agriculture, Forestry and Land Utilization	3,051	201	6.77
	Total	379,240	19,499	5.18

3.3 Measures for Mitigation of Greenhouse Gas Emissions

The City Climate Change Operation Development Project Plan Working Group held a Meeting No. 2/2566 on the Support to Global Covenant of Mayors for Climate and Energy (GCoM) in Asia for Muang Hua Hin Municipality at Muang Hua Hin Municipality Conference Room, Prachuap Khiri Khan Province, on Monday, 12 June 2023 from 10:00 hr. to 12:00 hr. as per details in **Appendix B-4**. The consultant presented the effective measures for mitigation of greenhouse gas emissions in all sectors for exchange of views and planning for implementation of projects to attain the goals. In line with Muang Hua Hin Municipality's context and national development plan, Thailand Voluntary Emission Reduction Program (T-VER) and Low Emission Support Scheme (LESS) and other related methods, 13 measures are adopted:

Three measures for EE:

- HHN-EE-01 Reduction of Energy Consumption in Business and Government Buildings
- HHN-EE-02 Reduction of Energy Consumption in Industrial Sector
- HHN-EE-03 Reduction of Household Energy Consumption

Five measures for AE:

- HHN-AE-01 Solar Power Generation in Business and Government Buildings
- HHN-AE-02 Solar Power Generation In Industrial Buildings
- HHN-AE-03 Solar Power Generation in Residential Buildings
- HHN-AE-04 Replacement of Cooking Gas with Biogas in Households
- HHN-AE-05 Replacement of Public Road Lights with LED lights

Two measures for TM:

- HHN-TM-01 Replacement of Fossil Fuel with Biofuel
- HHN-TM-02 Promotion of EVs

One measures for WM:

- HHN-WM-01 Organic Waste Separation for Delivery to Waste Separation Centers

Two measures for FOR:

- HHN-FOR-01 More Green Municipal Areas
- HHN-FOR-02 More Mangrove Forests

Targets and Potential for Mitigation of Greenhouse Gas Emissions in Muang Hua Hin Municipality Are Shown in **Table 3.3** and **Figure 3.2**.

Table 3.3: Measures and Potential for Mitigation of Greenhouse Gas Emissions in Muang Hua Hin Municipality

No.	Code	Measures	Target for 2030	Unit	tCO ₂ eq in 2030
1	HHN-EE-01	Reduction of Energy Consumption in Business and Government Sector	7	%	2,033
2	HHN-EE-02	Reduction of Energy Consumption in Industrial Sector	7	%	648
3	HHN-EE-03	Reduction of Household Energy Consumption	7	%	3,246
4	HHN-AE-01	Solar Power Generation in Business and Government Buildings	4.41	MW	2,575
5	HHN-AE-02	Solar Power Generation in Industrial Buildings	0.56	MW	327
6	HHN-AE-03	Solar Power Generation in Residential Buildings	7	MW	4,087
7	HHN-AE-04	Replacement of Cooking Gas with Biogas in Households	7	%	376
8	HHN-AE-05	Replacement of Public Road Lights with LED Lights	1,000	lights	241
9	HHN-TM-01	Replacement of Fossil Fuel with Biofuel	7	%	210
10	HHN-TM-02	Promotion of EVs	87	vehicles	152
11	HHN-WM-01	Separation of Organic Waste for Delivery to Waste Elimination Centers	22,034	tons	5,398
12	HHN-FOR-01	More Municipal Green Areas	300	rai	201
13	HHN-FOR-02	More mangrove forests	6	rai	6

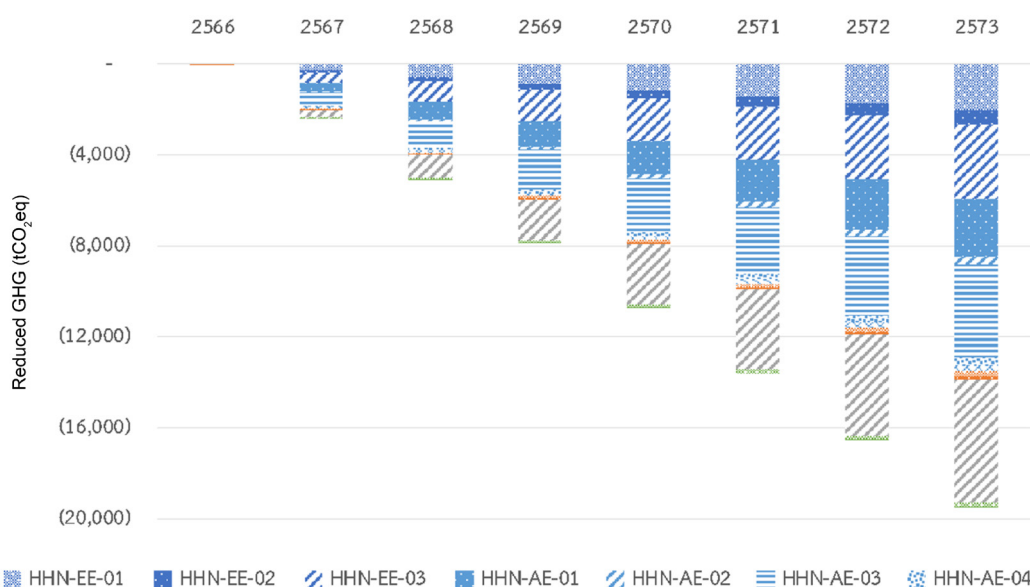


Figure 3.2: Potential for Mitigation of Annual Greenhouse Gas Emissions in Muang Hua Hin Municipality

Measures for Mitigation of Greenhouse Gas Emissions in Muang Hua Hin Municipality

HHN-EE-01 Reduction of Energy Consumption in Business and Government Sector							
Objectives	Install and improve equipment and devices in municipal, government and business buildings for higher energy efficiency.						
Targets	Reduce final energy consumption by 7%						
Activities/Projects	<ol style="list-style-type: none"> 1. Set schedule for power consumption in buildings. 2. Set schedule for electrical appliance maintenance. 3. Require that new buildings comply with CASBEE or LEED standard. 4. Use Building Energy System. 5. Disseminate information on costs and benefits of power saving. 6. Require that new buildings comply with CASBEE or LEED standard. 7. Require that houses and buildings have rainwater retention systems. 8. Renovate municipal buildings for energy saving. 						
Agencies mainly in charge	Provincial Office of Energy, Department of Alternative Energy Development and Efficiency, government and business buildings.						
Supporting agencies/Persons involved	2024						
Commencing in	2023						
tCO ₂ eq in each year	2024	2025	2026	2027	2028	2029	2030
	290	581	871	1,162	1,452	1,743	2,033
Budget (baht)	782,345						
Joint benefits	Reduction of power consumption and mitigation of greenhouse gas emissions						

HHN-EE-02 Reduction of Energy Consumption in Industrial Sector							
Objectives	Improve energy efficiency in industrial sector to mitigate greenhouse gas emissions.						
Targets	Reduce final energy by 7%						
Activities/Projects	<ol style="list-style-type: none"> 1. Hold activities for energy saving in SMEs' factories. 2. Hold activities for praising energy saving. 						
Agencies mainly in charge	Bureau of Public Works						
Supporting agencies/Persons involved	Provincial Energy Office, Department of Alternative Energy Development and Efficiency and industrial buildings						
Commencing in	2024						
tCO ₂ eq in each year	2024	2025	2026	2027	2028	2029	2030
	93	185	278	370	463	555	648
Budget (baht)	397,858						
Joint benefits	Reduction of energy consumption and mitigation of greenhouse gas emissions						

HHN-EE-03 Reduction of Household Energy Consumption							
Objectives	Improve household energy efficiency to mitigate greenhouse gas emissions.						
Targets	Reduce final energy consumption by 7%.						
Activities/Projects	<ol style="list-style-type: none"> Promote household power-saving appliances. Disseminate knowledge and understanding of air-conditioner maintenance for power saving. 						
Agencies mainly in charge	Bureau of Public Works.						
Supporting agencies/Persons involved	Provincial Energy Office and Department of Alternative Energy Development and Efficiency						
Commencing in	2024						
tCO ₂ eq in each year	2024	2025	2026	2027	2028	2029	2030
	464	928	1,391	1,855	2,319	2,783	3,246
Budget (baht)	1,260,163						
Joint benefits	Reduction of energy consumption for mitigation of greenhouse gas emissions.						

HHN-AE-01 Solar Power Generation in Business and Government Buildings							
Objectives	Use of alternative energy to mitigate greenhouse gas emissions.						
Targets	Install solar power systems with total capacity of 4.41 MW.						
Activities/Projects	<ol style="list-style-type: none"> Install solar power rooftops on carpark, municipal, government and business buildings in the areas. Promote alternative energy to mitigate global warming. Require that all new buildings to be constructed shall have solar power roofs. 						
Agencies mainly in charge	Bureau of Public Works						
Supporting agencies/Persons involved	Provincial Offices of Energy, Department of Alternative Energy Development and Efficiency, business and government buildings.						
Commencing in	2024						
tCO ₂ eq in each year	2024	2025	2026	2027	2028	2029	2030
	368	736	1,104	1,471	1,839	2,207	2,575
Budget (baht)	30,956,789						
Joint benefits	Use of clean energy to mitigate greenhouse gas emissions.						

HHN-AE-02 Solar Power Generation in Industrial Buildings							
Objectives	Use of alternative energy to mitigate greenhouse gas emissions						
Targets	Use 56 MW of solar power						
Activities/Projects	<ol style="list-style-type: none"> Solar power roofs for industrial buildings; Activities for promotion of alternative energy for mitigation of global warming; All new buildings are required to have solar power roofs. 						
Agencies mainly in charge	Bureau of Public Works						
Supporting agencies/Persons involved	Provincial Energy Office, Department of Alternative Energy Development and Efficiency and industrial buildings.						
Commencing in	2024						
tCO ₂ eq in each year	2024	2025	2026	2027	2028	2029	2030
	47	93	140	187	234	280	327
Budget (baht)	3,931,021						
Joint benefits	Consumption of clean energy and mitigation of greenhouse gas emissions						

HHN-AE-03 Household Solar Power Generation							
Objectives	Use alternative energy to mitigate greenhouse gas emissions						
Targets	Install 49 MW solar power systems.						
Activities/Projects	<ol style="list-style-type: none"> Solar power roofs for households Activities for promotion of alternative energy for mitigation of global warming; All new buildings are required to have solar power roofs. Prototype solar power energy housing development Promotion of solar power lighting in surrounding areas. 						
Agencies mainly in charge	Bureau of Public Works						
Supporting agencies/Persons involved	Provincial Energy Office, Department of Alternative Energy Development and Efficiency, housing projects and housing developments.						
Commencing in	2024						
tCO ₂ eq in each year	2024	2025	2026	2027	2028	2029	2030
	584	1,168	1,752	2,336	2,919	3,503	4,087
Budget (baht)	49,137,760						
Joint benefits	Consumption of clean energy and mitigation of greenhouse gas emissions.						

HHN-AE-04 Replacement of Cooking Gas with Biogas In Households							
Objectives	Use of alternative energy to mitigate greenhouse gas emissions.						
Targets	Reduce consumption of fossil fuel by 7%						
Activities/Projects	<ol style="list-style-type: none"> Model housing development using biogas instead of cooking gas. Cooperation with communities, business establishments, clinics, education institutions and temples in food waste separation. Management of food waste from business establishments in municipal areas. Distribution of information on food waste separation for biogas production. Hold activities for promotion of alternative energy for mitigation of global boiling. 						
Agencies mainly in charge	Bureau of Public Works						
Supporting agencies/Persons involved	Provincial Energy Office, Department of Alternative Energy Development and Efficiency, communities, business establishments, clinics, educational institutions and temples.						
Commencing in	2024						
tCO ₂ eq in each year	2024	2025	2026	2027	2028	2029	2030
	54	107	161	215	269	322	376
Budget (baht)	1,351,626						
Joint benefits	Use of clean energy to mitigate greenhouse gas emissions.						

HHN-AE-05 Replacement of Public Lights with Solar Power LED Lights								
Objectives	Reduction of power consumption and mitigation of greenhouse gas emissions.							
Targets	Replacement of 1,000 public lights with solar power LED lights.							
Activities/Projects	<ol style="list-style-type: none"> 1. Replacement of public lights with solar power LED lights. 2. Replace public lights outside municipality areas with solar power LED lights. 3. Corporate with other agencies on replacement of public road lights with LED lights. 							
Agencies mainly in charge	Bureau of Public Works							
Supporting agencies/Persons involved	Provincial Energy Office, Department of Alternative Energy Development and Efficiency, Department of Rural Roads and Provincial Electricity Authority							
Commencing in	2024							
tCO ₂ eq in each year	2023	2024	2025	2026	2027	2028	2029	2030
	31	63	94	125	167	188	219	241
Budget (baht)	2,895,618							
Joint benefits	Use of clean energy to mitigate greenhouse gas emissions.							

HHN-TM-01 Replacement of Fossil Fuel with Biogas								
Objectives	Reduce consumption of fossil fuel in transportation to mitigate greenhouse gas emissions							
Targets	Reduce consumption of fossil fuel by 7%							
Activities/Projects	<ol style="list-style-type: none"> 1. All vehicles in the Municipality shall switch over to biodiesel. 2. Measures for reduction of gasoline consumption: Before: make plan During: drive at constant speed After: properly maintain vehicle 3. Alternative energy consumption. 4. Liaise with local research institutions on establishment of service centers for adaptation of engines so that they can run on biodiesel. 							
Agencies mainly in charge	Municipality Clerk Office, Public Health and Environment Division, Education Division and Bureau of Public Works							
Supporting agencies/Persons involved	Provincial Energy Office, Department of Alternative Energy Development and Efficiency, gas stations and educational institutions in their areas.							
Commencing in	2024							
tCO ₂ eq in each year	2024	2025	2026	2027	2028	2029	2030	
	30	60	90	120	150	180	210	
Budget (baht)	1,750,000							
Joint benefits	Reduction of fossil fuel consumption and mitigation of greenhouse gas emissions.							

HHN-TM-02 Promotion of EVs								
Objectives	Reduce consumption of fossil fuel in transportation to mitigate greenhouse gas emissions.							
Targets	87 newly registered private EVs							
Activities/Projects	<ol style="list-style-type: none"> 1. Provide more parking spaces for EVs in private buildings and controlled buildings by 30% 2. Provide 20 EV charging spots in municipality areas. 3. At least 30% of all municipality vehicles shall be EVs. 							
Agencies mainly in charge	Municipality Clerk Office, Public Health and Environment Division and Bureau of Public Works							
Supporting agencies/Persons involved	Provincial Energy Office, Provincial Electricity Authority, Department of Alternative Energy Development and Efficiency and department stores in the areas.							
Commencing in	2023							
tCO ₂ eq in each year	2023	2024	2025	2026	2027	2028	2029	2030
	18	24	33	45	61	82	112	152
Budget (baht)	118,933,845							
Joint benefits	Reduce fossil fuel consumption to mitigate greenhouse gas emissions.							

HHN-WM-01 Organic Waste Separation for Delivery to Waste Elimination Centers								
Objectives	Properly manage waste to mitigate greenhouse gas emissions.							
Targets	Landfill to reduce waste by 100%.							
Activities/Projects	<ol style="list-style-type: none"> 1. Waste separation 2. Compost fertilizer production demonstration center 3. Train communities and business establishments in compost fertilizer production 4. Distribute information on source waste separation online and offline. 5. Competition of communities and business establishments in landfilling with organic waste. 6. Cooperation with communities, educational institutions, clinics and business establishments on waste separation. 							
Agencies mainly in charge	Public Health and Environment Division, Education Division and Division of Planning and Budgeting							
Supporting agencies/Persons involved	Provincial Offices of Natural Resources and Environment, Provincial Administration Organization, Environment and Pollution Control Office 8, condominiums, schools, business establishments, markets, department stores, clinics, educational institutions, temples, communities and their leaders.							
Commencing in	2024							
tCO ₂ eq in each year	2024	2025	2026	2027	2028	2029	2030	
	324	1,032	1,818	2,664	3,551	4,466	5,398	
Budget (baht)	36,244,890							
Joint benefits	Landfilling with organic waste for mitigation of greenhouse gas emissions.							

HHN-FOR-01 Increase of Green Areas In Municipality							
Objectives	Increase of forests in the city to retain greenhouse gas.						
Targets	Increase 300 rai of green areas in the city.						
Activities/Projects	<ol style="list-style-type: none"> 1. Campaign for deforestation in all housing developments. 2. Hold competition of model green areas in community. 3. Distribute information on tree planting and green area maintenance in communities. 4. Campaign for tree planting in municipal and private areas and notification of tree ownership. 5. Promote vegetable gardening and fruit tree planting in households. 6. Promote planting of big trees and fruit trees in public, temple and desolate areas. 						
Agencies mainly in charge	Public Health and Environments Division, Social Welfare Division and Bureau of Public Works						
Supporting agencies/Persons involved	Provincial Offices of Natural Resources and Environment, Provincial Administration Organization, Provincial Offices of Agriculture and Land Development						
Commencing in	2024						
tCO ₂ eq in each year	2024	2025	2026	2027	2028	2029	2030
	29	57	86	115	143	172	201
Budget (baht)	2,700,000						
Joint benefits	More green areas						

HHN-FOR-02 Increase of Mangrove Forests							
Objectives	Increase green areas in the city to retain greenhouse gas.						
Targets	Restore existing 12 rai of mangrove forests and provide another 6 rai of mangrove forests.						
Activities/Projects	<ol style="list-style-type: none"> 1. Restore mangrove forests. 2. Grow mangrove forests on important days. 3. People who grow mangrove forests shall own and take care of them. 4. Disseminate knowledge of mangrove forests. 						
Agencies mainly in charge	Division of Public Health and Environment, Social Welfare Division and Bureau of Public Works						
Supporting agencies/Persons involved	Provincial Offices of Natural Resources and Environment, Provincial Administration Organization, Provincial Agriculture Office and Land Development Office						
Commencing in	2024						
tCO ₂ eq in each year	2024	2025	2026	2027	2028	2029	2030
	1	2	2	3	4	5	6
Budget (baht)	41,460						
Joint benefits	More green areas						

Chapter 4.0 Assessment of Climate Change Risks

4.1 Assessment of Disaster in Municipality

Based on Muang Hua Hin Municipality’s Disaster Prevention and Mitigation Action Plan 2020, in the past 5 years, from 2014 to 2019, in the municipality, fire occurred 19 times and 13 households were struck; the damage was about 1.3 million baht; flood occurred 3 times and 52 households were struck; the damage was about 404,000 baht.

4.2 Assessment of Risks and Vulnerability to Climate Change

The City-Level Climate Risk and Vulnerability Assessment (CRVA) developed by C40 Cities Climate Leadership is used for determination of possible hazard and impacts on the city, management of climate risk, adaptation and making action plans therefor.

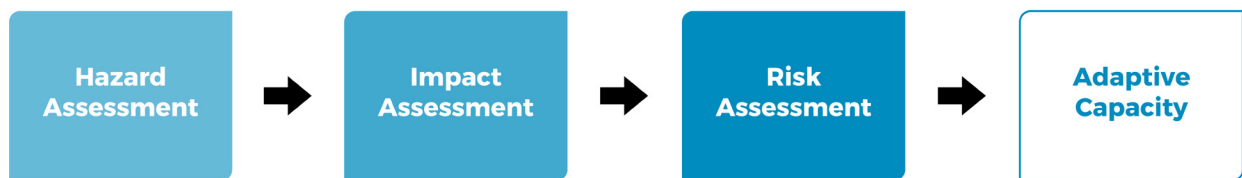


Figure 4.1: Determination of Risks in Catastrophic Weather Events at City Level

There are three stages:

1. Hazard assessment: Determine major climate hazards, probability, severity and the time of occurrence at present and in the future, which will or tend to produce impacts in 2050 and thereafter.
2. Impact assessment: Identify the impacts from climate on people, properties, services and natural surroundings.
3. Risk assessment: Determine major risks from the severity and impacts of the hazard.

On Friday, 17 March 2023, Muang Hua Hin Municipality Working Team held a meeting to assess the risks in climate change and vulnerability thereto, and plan therefor. They found that the probability of drought and increased water demand would tend to be higher in the future. See details in **Figure 4.2**.

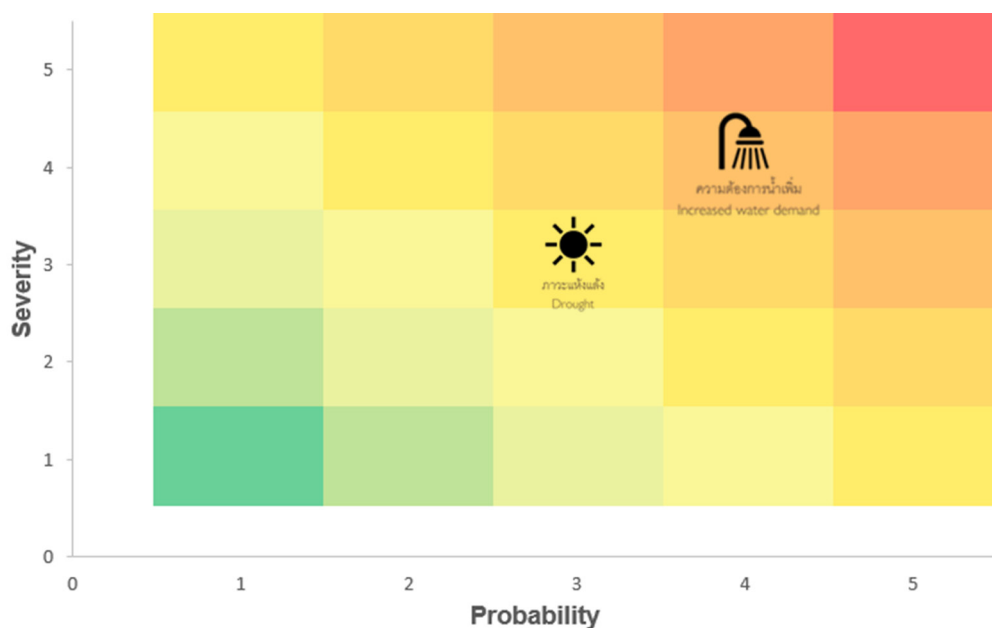




Figure 4.2: Risks & Vulnerability to Climate Change in Muang Hua Hin Municipality

- 1. Drought:** The probability of drought tends to be higher due to extreme heat and decreased green areas.
- 2. Increased Water Demand:** The probability of increased water demand tends to be higher due to city development, revived tourism and decreased average rainfall.

Table 4.1 shows that the probability of drought is high and the impacts thereof is medium; the increased water demand is medium, but it will be much higher after 30 years; water service, housing and tourism will be mostly affected; people living in poor conditions and low-income person will be mostly affected.

Quick urbanization and construction of temporary and permanent residential buildings reduce green areas in the city. Being a tourist spot, the demand for water is increasing. The municipality is increasing its capacity to find raw water from elsewhere that the impacts are not so high now.

Table 4.1: Loss and Damage Caused by Catastrophic Weather Events in Muang Hua Hin Municipality

Major disasters in Muang Hua Hin	Present disaster level		Future disaster level			Sectors mostly affected	People mostly affected	Factors affecting ability to deal with disasters +/-
	possibility	Present impacts	Expected future severity	Expected frequency	Time expected to occur			
 Drought	High	Medium	Higher	More frequent	In a short time. In 30 years.	Water supply	People living in poor conditions	physical & environmental facts: tourism
 Increased water demand	Medium	Medium	Higher	More frequent	In a short time. In 30 years.	Housing/tourism	Low-income people	capacity of local administration organization

4.3 Targets on Climate Change Adaptation

The working group's plan for climate change has set the following Adaptation Goals & Targets for climate change. See **Table 4.2**.

Table 4.2: The Adaptation Goals & Target for Climate Change in Muang Hua Hin Municipality

Adaptation Goal	Climate hazard	Sector	Vulnerable population group	Base value	Base year	Target value	Target Year
The number of complaints about water quantity and quality shall be reduced by 50% in 2027.	Drought and higher demand for water	Residential buildings	Communities in poor surroundings	2,482 cases	2022	Not more than 1,200 cases	2027

Measures for mitigation of impacts from climate change

Order/Operation	HHN-AND-01 Increase Green and Water Absorption Areas in The City
Objectives	Increase of green areas in Muang Hua Hin Municipality
Target Groups/Target Areas	Sides and islands of secondary public roads and potential private and government areas under survey.
Operation Period	Fiscal Year 2024 - 2027
Operations/Activities	<ol style="list-style-type: none"> 1. Review Bureau of Public Works's plan for improvement of green areas and landscape. 2. Survey of green areas in temples, schools, private and government land, using Google Form and taxation mapping information. 3. Record surveyed areas in report on green areas to determine the total green areas of all types, set them as the base value for development and allocate additional green areas as targeted each year. 4. Promote an increase of green areas in the city: Lease waste land on a long-term basis and turn it into a small public park with cooperation of Forest Office and landowners. 5. Promote an increase of green areas, e.g. issue municipal law on green and water absorption areas, hold competition of green area models, advertise through media or channels of municipality, e.g. VTR. 6. Collect data on increase in green areas of all types every year for planning for area increase and retention.
Indicators & Tests	Indicators: Increase of green areas of all types by at least 25 rai per year. Tests: Size of green areas found by survey.
Agencies Mainly In Charge	Bureau of Public Works, Muang Hua Hin Municipality
Budget & Source Thereof	3.8 million baht from Muang Hua Hin Municipality

Order/Operation	HHN-AND-02 Convert Abandoned Swamps into Spare Water Supply Swamps
Objectives	Spare water supply for consumption in Muang Hau Hin
Target Groups/Target Areas	Four damaged or abandoned swamps: 1. Swamps in Suk Sai Community 2. Bua Swamp 3. Khao Tao Reservoir and Noi Pond 4. Huay E Ook Reservoir or Hin Lek Fai Hill Reservoir
Operation Period	Fiscal Year 2024 – 2027
Operations/Activities	<ol style="list-style-type: none"> Survey damaged or abandoned public swamps in the areas in charge. Determine the possibility of using them as water supply based on their locations and categories. Design for use as green areas, recreation centers and reservoir. Hold a meeting of all the parties concerned to exchange views on the plan and drawings for spare water supply. Turn swamps, ponds and other water sources into spare water supply according to the plan and drawings.
Indicators & Tests	Indicators: Number of swamps and ponds being turned into spare water supply in the city and communities. Tests: Pictures of swamps, ponds and other water sources before and after operation; their water supply capacity and public benefits
Agencies Mainly In Charge	Bureau of Public Works, Muang Hua Hin Municipality
Budget & Source Thereof	Muang Hua Hin Municipality

Order/Operation	HHN-AND-03 1 One Rainwater Tank for Each Household
Objectives	Reduce complaints about water shortage
Target Groups/Target Areas	Underprivileged families in the areas with short supply of water and suffering from poor quality water.
Operation Period	Fiscal Year 2024 - 2027
Operations/Activities	<ol style="list-style-type: none"> Collect rainwater samples every time it rains from all areas for quality tests. Seek assistance in this matter from Provincial Public Health Office or educational institutions which have laboratories. Village health volunteers conduct surveys and register households affected by water supply shortages or poor water quality. Discuss guidelines on resolution of water issues and suggestion of household rainwater tanks. Inspect at least 10 household rainwater tanks in a year to ensure that they are suitable for the land and houses. Hold a public discussion for presentation of rainwater tank demand –CSR. Lend quality rainwater tanks with lids that prevent mosquitoes from breeding inside to model families –or give to them if they are poor. Follow up households using rainwater tanks to see if it has resolved water supply issues. Summarize achievements every year for expansion to other households and communities.
Indicators & Tests	Indicators: Number of families having rainwater tanks, not complaining about water shortages. Tests: The number of complaints about water shortages, based on the names and addresses of complainants in the list.
Agencies Mainly In Charge	Social Welfare Division, Muang Hua Hin Municipality
Budget & Source Thereof	Muang Hua Hin Municipality

Order/Operation	HHN-AND-04 Competition of Model Environmentally Friendly Hotels
Objectives	Campaign for water economy in private sector.
Target Groups/Target Areas	177 hotels in Muang Hua Hin Municipality
Operation Period	Fiscal Year 2024 – 2027
Operations/Activities	<ol style="list-style-type: none"> 1. Hold a meeting of representatives from Hua Hin – Cha-um Tourism Business Association to discuss conservation of environment, water economy and higher standard of model hotels. 2. Invite through the Association at least 20 hotels to enter a competition in environmentally friendly and water economy hotels in a year. 3. Train hotels in environment conservation and water economy. 4. Appoint a Decision Panel for making decisions in the competition and assessment of water economy of the hotels in competition. 5. Award the prizes to the hotels having attained the targets and exchange knowledge of successful environment conservation and water economy. 6. Summarize the lessons for the target groups for improvement and expansion of competition in the next year.
Indicators & Tests	<p>Indicators: The percentage of hotels successfully attained the targets for environment conservation and water economy.</p> <p>Tests: Names of hotels awarded the prizes for successful operations and the details thereof.</p>
Agencies Mainly In Charge	Public Health and Environment Division, Waterworks Division, Hua Hin – Cha-um Tourism Association, Provincial Waterworks Authority and Muang Hua Hin Waterworks Office
Budget & Source Thereof	Muang Hua Hin Municipality

Order/Operation	HHN-AND-05 Environmentally and Climate Friendly Educational Institutions
Objectives	Train teachers, teaching staff and students in water supply economy, mitigation of greenhouse gas emissions and adaptation to climate change.
Target Groups/Target Areas	Seven schools affiliated to Muang Hua Hin Municipality and one Nonformal Education School.
Operation Period	Fiscal Year 2024 – 2027
Operations/Activities	<ol style="list-style-type: none"> 1. Train teachers, teaching staff and students in greenhouse gas emissions, climate change and climate disasters. Collect data on carbon footprint from schools. 2. All schools collect data on carbon footprints. 3. Hold a meeting of directors of schools for presentation of data on greenhouse gas emissions collected from their schools, adopt measures and set targets for mitigation of greenhouse gas emissions and coping with drought and water shortages caused by carbon footprint. 4. Take climate observational tours to Hua Hin Weather Station and low-carbon schools, e.g. Thung Song Municipality. 5. Encourage schools to hold activities for learning about global warming and adaptation to climate change, e.g. hold a school competition. 6. Hold an event for dissemination of knowledge of mitigation of global warming and adaptation to climate change. 7. Hold a meeting of school directors for expansion of operations.
Indicators & Tests	<p>Indicators: Number of schools affiliated to the municipality and nonformal educational schools teaching global warming and adaptation to climate change.</p> <p>Tests: Presentation of schools' achievements each year.</p>
Agencies Mainly In Charge	Public Health and Environment Division, Education Division, Muang Hua Hin Municipality, Thailand Greenhouse Gas Management Organization and Provincial Office of Natural Resources and Environment
Budget & Source Thereof	Muang Hua Hin Municipality

Chapter 5.0 Action Plan for Climate Change

5.1 Actions for Mitigation of Greenhouse Gas Emissions

Muang Hua Hin Municipality's Measures for Mitigation of Greenhouse Gas Emission by 2030 in descending order of success: Use of alternative energy was the most successful one; it reduced carbon dioxide by 7,606 tons or 39%; increase in energy efficiency, waste management, transportation and green city. Two plans for mitigation of greenhouse gas emissions were implemented at the same time to attain the targets: The action plans were under the control of the municipality and implemented by households, industrial buildings, business and government buildings and public transportation in the municipality. See **Table 5.1**.

The City Climate Change Operation Development Project Plan Working Group held a Meeting No. 3/2566 on the Support to Global Covenant of Mayors for Climate and Energy (GCoM) in Asia for Muang Hua Hin Municipality at Muang Hua Hin Municipality Conference Room, Prachup Khiri Khan Province, on Wednesday 23 August 2023 from 09:00 hr. to 12:00 hr. as per details in **Appendix B-4**.

At the meeting, the consultant presented the measures for mitigation of greenhouse gas emissions and action plan for adaptation to climate change to the persons concerned and stakeholders for exchange of views and prioritization of measures and plan and adoption and implementation thereof. The details are shown in **Table 5.2**.

Table 5.1: Action Plans for Mitigation of Greenhouse Gas Emissions in Muang Hua Hin Municipality

Code	Measures	Short-term plan				Medium-term Plan		Long-term Plan			Operation by Municipality
		2022	2023	2024	2025	2026	2027	2028	2029	2030	
HHN-EE-01	Reduction of energy consumption in business and government buildings	→									Promotion and creation of awareness
HHN-EE-02	Reduction of energy consumption in industrial sector	→									
HHN-EE-03	Reduction of household energy consumption	→									
HHN-AE-01	Solar power generation in business and government buildings	→									
HHN-AE-02	Solar power generation in factory buildings	→									
HHN-AE-03	Solar power generation in households	→									
HHN-AE-04	Replacement of cooking gas with biogas in households	→									Operation control
HHN-AE-05	Replacement of public road lights with solar power LED lights	→									
HHN-TM-01	Replacement of fossil fuel with biofuel	→									Promotion and creation of awareness
HHN-TM-02	Promotion of EVs	→									
HHN-WM-01	Campaign for organic waste separation for waste elimination center	→									Operation control
HHN-FOR-01	Increase of green areas in the municipality	→									
HHN-FOR-02	Increase of mangrove forests	→									

Table 5.2: Action Plan for Mitigation of Greenhouse Gas Emissions in Muang Hua Hin Municipality

No.	Measures	Objectives	Targets	Target Year							Indicators	Agencies in charge	
				2023	2024	2025	2026	2027	2028	2029			2030
Target 1: Reduction of Energy Consumption in All Sectors in the City													
1	Reduction of energy consumption in business and government buildings	Increase of energy efficiency in buildings	Reduction of energy consumption by 7%	-	1%	2%	3%	4%	5%	6%	7%	Percentage of energy consumption reduction	Bureau of Public Works
2	Reduction of energy consumption in factory buildings			-	1%	2%	3%	4%	5%	6%	7%		
3	Reduction of household energy consumption			-	1%	2%	3%	4%	5%	6%	7%		
Target 2: Provision of Alternative Energy in the Areas													
4	Solar power generation in business and government buildings	Use more clean energy	Increase clean energy consumption by 10.5%	-	0.6 MW	0.6 MW	0.6 MW	0.6 MW	0.6 MW	0.6 MW	0.6 MW	Total power generation capacity	Bureau of Public Works
5	Solar power generation in factory buildings			-	0.08 MW	0.08 MW	0.08 MW	0.08 MW	0.08 MW	0.08 MW	0.08 MW		
6	Solar power generation in householders			-	1 MW	1 MW	1 MW	1 MW	1 MW	1 MW	1 MW		
7	Replacement of cooking gas with biogas in households	Reduction of fossil fuel consumption	Reduction of energy consumption by 7%	-	1%	2%	3%	4%	5%	6%	7%	Quantity of biogas produced	Public Health & Environment Division, Education Division and Strategy and Budget Division
8	Replacement of public road lights with solar power LED lights	Use more clean energy	Replacement of 1,000 lights	130 lights	130 lights	130 lights	130 lights	130 lights	130 lights	130 lights	130 lights	Number of lights replaced	Bureau of Public Works

No.	Measures	Objectives	Targets	Target Year							Indicators	Agencies in charge	
				2023	2024	2025	2026	2027	2028	2029			2030
Target 3: Promotion of Low-carbon Transportation													
9	Replacement of fossil fuel with biofuel	Reduction of fossil fuel consumption	Reduction of energy consumption by 7%	-	1%	2%	3%	4%	5%	6%	7%	ร้อยละการใช้พลังงานที่ลดลง	Public Health & Environment Division, Bureau of Public Works and Education Division
10	Promotion of EVs	Use clean energy	87 newly registered EVs	3 EVs	4 EVs	5 EVs	7 EVs	9 EVs	12 EVs	17 EVs	23 EVs	Number of newly registered EVs	Public Health & Environment Division and Bureau of Public Works
Target 4: Source Waste Management													
11	Organic waste separation for waste elimination center	Eliminate organic waste by landfilling	Elimination of 100 % of organic waste by landfilling	-	30%	40%	50%	60%	70%	80%	100%	Amount of organic waste for landfilling	Public Health & Environment Division, Education Division and Strategy and Budget Division
Target 5: Increase Carbon Sequestration in the City													
12	Increase green areas in the municipality	Increase carbon sequestration sites in the city	Increase green areas by 300 rai	-	43 rai	86 rai	129 rai	171 rai	214 rai	257 rai	300 rai	Size of green areas in the city	Public Health & Environment Division, Social Welfare Division and Bureau of Public Works
13	Increase mangrove forests		Increase mangrove forests by 6 rai	-	1 rai	2 rai	3 rai	3 rai	4 rai	5 rai	6 rai	Size of mangrove forests	

5.2 Actions for Climate Change Adaptation

From brainstorming session, it was decided that there will be one targets for the adaptation to climate change in Muang Hua Hin Municipality:

- **Target 1 to be achieved by 2027:** There will be no complaints about water quantity and quality by 2027 through 5 operations, namely installation of household wastewater treatment systems, competition of beautiful clear canals for mitigation of disasters, survey for allocation of free spaces and green areas as required by law, increase of water absorbable green areas in communities flooded in 2021 and environmentally friendly communities.

The operation plans for adaptation to climate change in Muang Hua Hin Municipality for 2024 – 2027 are shown in **Table 5.3**.

Table 5.3: Action Plans for Managing with the Impacts from Climate Change in Muang Hua Hin Municipality, 2023 - 2027

No.	Projects	Objectives	Project achievement targets	Target year					Indicators	Expected results	Agencies in charge
				2023	2024	2025	2026	2027			
Target: There will be no complaints about water quantity and quality by 2027											
1	Increase green and water absorption areas in the city.	Mitigation of drought by natural means.	Hua Hing Municipality will not be affected by drought.	5,247 rai	5,272 rai	5,297 rai	5,322 rai	5,347 rai	All types of green areas in the city shall increase by at least 25 rai per year as compared with those in 2023.	Increase in all types of green areas in the city.	Bureau of Public Works
2	Turn abandoned swamps to water supply swamps.	Increase water supply	No complaints about water supply.		1 site	2 sites	3 sites	4 sites	There will be at least one more water supply site in the city.	Spare water supply for dry season or in emergency.	Public Health & Environment Division and Bureau of Public Works
3	One rainwater tank for each family.			10 families	20 families	30 families	40 families	Families with rainwater tanks will not complain about water shortages.	Communities with no water supply shall have access to water sources that they will spend less money in buying water.	Bureau of Public Works and Waterworks Division	
4	Competition of water economy hotels.	Promotion of water economy among hotels.	In each year, 20 hotels enter the competition and at least 10 or 50% of them can economize water as targeted.		20%	30%	40%	50%	Percentage of hotels having achieved water economy target in the competition.	People staying in hotels will not consumer more water.	Social Welfare Division and Public Health and Environment Division
5	Environmentally and climate friendly educational institutions.	Students, teachers and teaching personnel understand and realize the importance of water resource conservation and mitigation of effects of climate change.	At least 7 municipal schools and one non-formal education school have become models for low-carbon and disaster averting educational institutions.		4 schools	5 schools	6 schools	8 schools	Number of educational institutions teaching global warming and how to deal with climate change.	Students, teachers and teaching personnel know how to deal with climate change.	Education Division

5.3 Limitation of Action Plan

Based on the measures for mitigation of greenhouse gas emissions, the operations meet the following obstacles:

Policies/Organizations

- Lack of policies for integration of agencies and ministerial, provincial and local level.
- No local agencies in charge of local operation plans.

Low-carbon city development planning

- It is difficult to implement low-carbon operation plans at municipal level due to lack of guidelines on operations.
- The local low-carbon operation plans, phase 5, do not cover energy sector, use of alternative energy and transportation.
- Lack of staff, facilities and resources for operations according to the plans.
- Limitation in education and training in climate change to students, business operators, workers and the general public.

Institutional Structure

- Issues of follow-up of operations and collection of data.
- Insufficient knowledge of and slow response to change in technologies, innovations and operations for dealing with climate change.

From measures to operations:

Reduction of fossil fuel consumption, management of waste and increase of green areas for carbon sequestration shall make the city more habitable and improve the quality of life. It is essential that the municipality become a low-carbon society and mitigate greenhouse gas emissions as follows:

- **Governance:** Many greenhouse gas emission activities take place outside the municipality. It is therefore necessary to cooperate with government agencies and stakeholders at local, regional, national and international level. Mitigation of greenhouse gas emissions requires support from policies, organizations and agencies at all levels. According to the action plans for mitigation of greenhouse gas emissions, the municipality held activities, such as use of solar power in residential, business and government buildings, use of EVs and setting up of EV charging stations.
- **Investment in low-carbon infrastructure:** The most challenging operations are use of alternative energy for transportation and buildings and management of waste after the spread of COVID-19. The government sector and local agencies have prioritized investments in low-carbon businesses to improve the image of the city for high economy, e.g. building public parks, promotion of EVs and provision of bicycle or scooter hiring service.
- **MRV:** The knowledge and ability of stakeholders, government sector, local agencies and private firms in measurement, report and verification of data (MRV) at international standard. The data are for use inside and outside the project and for verification. The objective of MRV is to ensure that the data truly reflect the reduced quantity of the emitted greenhouse gas.
- **Activities:** Public awareness and participation in the activities for mitigation of greenhouse gas emissions.
- **Sources of funds for various sectors:** Issuance of green bonds by fund market and offer of green loans by commercial banks.

Chapter 6.0 Follow Up and Assessment of Operations

6.1 Institutional and Management Structure

To ensure smooth operations for mitigation of greenhouse gas emissions, the action plans, the implementation thereof and potential of the persons involved should be studied in detail. The municipality should set up agencies directly in charge of the following operations for mitigation of greenhouse gas emissions and follow up thereof in liaison with the Public Health and Environment Division and other government organizations:

- plan for operations for low-carbon municipality development;
- allocate the budget therefor
- constantly follow up the operations at all levels.

The agencies should be made up of work groups at the level of office, Municipality Clerk Office, Bureau of Public Works, Education Division, Finance Division, Sanitary Works Division, Social Welfare Division, Medical Division, Strategy and Budget Division and Waterworks Division, comprising experts from outside for implementation of policies on management of climate change of local administration organizations. The Provincial Office of Natural Resources and Environment, Department of Climate Change and Environment and Thailand Greenhouse Gas Management Organization (Public Organization) are also involved in the operations to ensure that the climate operation plans are in line with national policies.

The municipality has adopted guidelines on their work groups' operations according to many plans for dealing with climate change, but the institutional analysis showed that such plans are not implemented efficiently for the following reasons:

1. The agencies under Public Health and Environment Division cannot operate in liaison with one another efficiently.
2. The agencies within the network fail to assign their duties and responsibilities continuously among themselves.
3. Staff have limited knowledge and skills that they can only operate passively. The Climate Change Strategy Work Group's structure and capacity should be improved urgently.

The municipality should strengthen its working groups and assess their operations in response to climate change as per details in **Figure 6.1**.

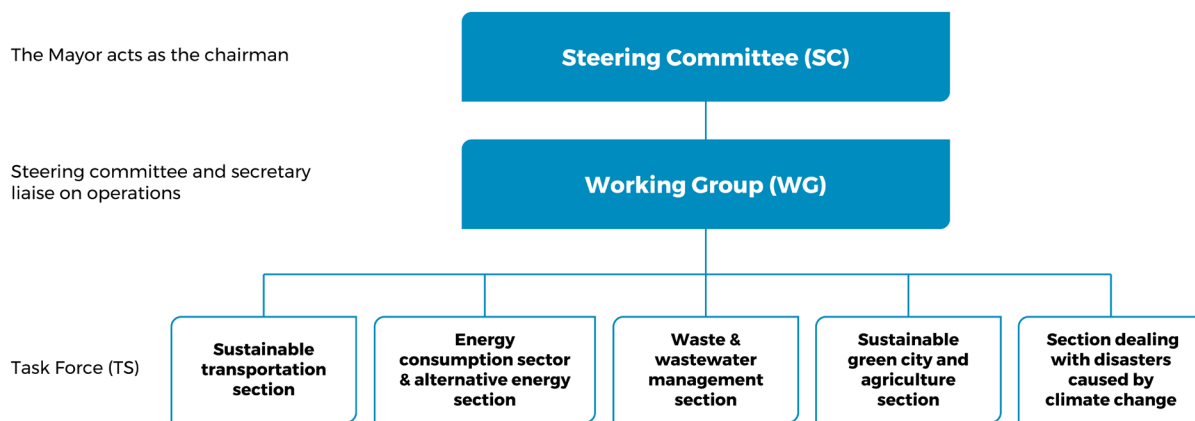


Figure 6.1: Institutional Structure of Work Groups for Operations in Response to Climate Change at Municipal Level

Steering Committee (SC)

- Adoption of guidelines on operations, follows-up of operations in response to climate change and improvement of policies.
- Overseeing MRV.

Working Group (WG)

- Discussion of techniques for operations in response to climate change and development of potential of Task Force.
- Setting guidelines, overseeing and follow-up of integration and cooperation of the Task Force's 5 sectors.

Task Force (TF) of 5 sections: Sustainable transportation section, energy consumption and alternative energy consumption section, Waste and Wastewater Management Section and Sustainable Green City and Agriculture Section.

- Operations according to plans for dealing with climate change. Each Section shall perform duties, engage in activities and propose new activities for mitigation of greenhouse gas emissions and adaptation to climate change and other related activities.
- Shall collect data on activities for mitigation of greenhouse gas emissions and adaptation to climate change for MRV.
- Shall distribute information on its sections in cooperation with the public, private and academic agencies, NGOs and other people concerned.

Secretary -- Climate Change Strategy Subdivision (CCS): Public Health and Environment Division, as coordinator for operation:

- It is set up within Public Health and Environment Division for liaison with all agencies on operations and report thereof.
- Proposal of operations for dealing with climate change, training local administration organizations in climate change, management of internal and external affairs.
- Acting as the center of communications between local administration organizations and other agencies.

Network members and other agencies:

- Network members and persons concerned shall be invited to cooperate with local administration organizations, namely public, private and academic agencies, NGOs and other people concerned on operations for dealing with climate change for higher efficiency.

The municipality should improve the 5-year local development plans for dealing with climate changes so that they have clear KPI, e.g. urgent assessment of project achievements, constant review and improvement of operation plans for climate change, introducing more activities for creation of networks and potential. The municipality should also make plans for improvement of working groups and implement strategies for climate change to build cooperation networks inside and outside the municipality.

6.2 M&E and MRV

The municipality should adopt simple guidelines on mitigation of greenhouse gas emissions at all levels.

- Standard platform with strategies for mitigation of greenhouse gas emissions through integration of design and planning for the municipality and stakeholders.
- The low-carbon operation plans' targets for mitigation of greenhouse gas emissions must be in line with those of the provincial and national plans.
- Templates for the municipality's follow-up of operations, MRV and measurement of greenhouse gas.

Institutional structure and management

MRV shall be conducted to ensure attainment of target tCO₂e for operations of mitigation of greenhouse gas emissions.

The following are the reports on the 5 sections' operations for dealing with climate change at 2 levels:

1. The Task Force submits its project operation reports via the Secretary to the Work Group for M&E and MRV.
2. The Work Group submits reports via the Secretary to the Steering Committee for discussion at committee level in the first stage of follow-up and assessments of the operations.

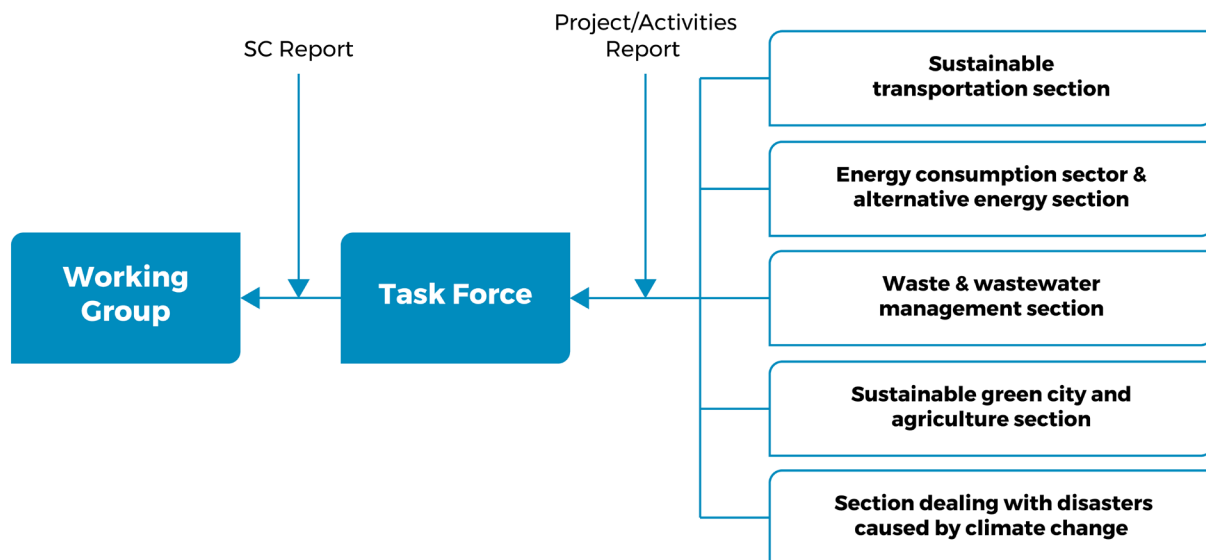


Figure 6.2: Report on Results of Weather Conditions Action Plan Implementation

Reports on operations for dealing with climate change in 4 sectors for mitigation of greenhouse gas emissions: Transportation, energy, waste and wastewater management, green city and sustainable agriculture.

M&E and MRV report on operations according to Bangkok's Master Plan for Climate Change, 2021 – 2030, 2022:

1. (1) M&E: Under green city project, 60% of trees have been planted. The Task Force shall complete the operations for green city and sustainable agriculture and assess the achievements for submission of reports to the Working Group in due course.
2. (2) MRV: The M, R and V section shall submit reports on the operations for tree planting for mitigation of greenhouse gas emissions, the annual targets and indicators.

6.3 Community Participation in Low-Carbon City Development

Switching over to low-carbon city and adaptation to climate change require funds, innovations, shift of paradigm and decisions of government, public and business sector. Attainment of targets for mitigation of greenhouse gas emissions require cooperation and participation by the public sector, e.g. increase energy efficiency in business and residential buildings, solar power roofs and transportation by EVs. Now, many private firms try to reduce risks in climate change to cut down costs and increase operation efficiency for returns on long-term investments. Through new innovations, many companies can introduce new products and services for mitigation of greenhouse gas emissions and adaptation to climate change in the market. It promotes business operation in a more socially responsible manner. The municipality should communicate with the communities about the following activities and operations:

1. Investment in low-carbon business to reduce costs through exemption of taxes, fees and license charges in proportion to reduced greenhouse gas.
2. Participation of families, businesses, shops and the public in the project for mitigation of greenhouse gas emissions. Publication and report on activities, operations and progress of the projects on the municipality's website and social media.
3. Teaching climate change and holding activities in schools and educational institutions.
4. Presentation of successful mitigation of greenhouse gas emissions to business operators and the public to invite them to participate in the low-carbon project operations.
5. Invitation of people from private firms to join membership of the Work Group and Task Force and attend meetings to express their views.
6. Public Private Partnership: Private firms invest in state's low-carbon projects.

6.4 Capacity Strengthening

- The Steering Committee shall be capable of operations according to the municipality's plans, following up low-carbon operations and activities.
- The Working Groups shall be capable of measuring, collecting and recording data on greenhouse gas emissions for MRV.
- Shall encourage municipal staff at all levels to learn, understand and participate in the low-carbon projects.
- Shall encourage the staff to undergo training in climate change.

6.5 Policy Suggestions

Hua Hin Municipality is about 195 km. south of Bangkok. The journey can be made through Samut Sakhon Province, Samut Songkhram Province and Phetchaburi Province. Its administrative area of 86.36 km² covers Hua Hin Subdistrict and Nong Kae Subdistrict. Based on the house registration database of July 2021, its population is 66,165, being 32,755 males and 33,410 females; and 57,230 families. Its slogan is "Hua Hin, the City of Happiness". Its 4-year Development Strategy (2023 – 2027): Strategy 3 Promotion and Development of Public Health and Environment with the following objectives: (1) physical and mental well beings and pleasant environment (2) clean and tidy city, free from pollution, well managed environment and (3) environmentally friendly city and community development.

Hua Hin Municipality carbon footprints in 2019: BASIC41,677 tCO₂eq and BASIC+ 127,547 tCO₂eq. The following are greenhouse gas emissions from different activities in descending order: 21.41% energy consumption in industries and constructions, 17.89% landfilling with waste, 16.14% household energy consumption, 14.10% road transportation and 13.02% energy consumption in businesses and government agencies. Prediction of greenhouse gas emissions in Hua Hin Municipality from 2019 to 2027: In 2027, the Business As Usual (BAU) greenhouse gas emissions without any mitigation measures will be at 379,240 tCO₂eq in the following proportions in descending order: 47.51% energy, 36.15% waste management, 15.54% transportation and 0.80% agriculture, forests and land utilization.

Based on Muang Hua Hin Municipality Action Plan for Prevention and Mitigation of Public Disasters 2020, in the past 5 years, from 2014 to 2019, the city was mostly hit by fire, flood, drought and additional demand for water. It is predicted that the risk of drought will be high, and its impacts will be moderate, and as a result, the demand for water will be much higher in the next 30 years with households and tourism being affected; low-income people who live in poor surroundings will be most vulnerable and heavily affected.

Based on such data, (1) 5 Climate Change Action Plans and 13 Measures are adopted with the objective of reduction of total greenhouse gas emissions to 19,499 tCO₂eq or 5.18% in the year 2030 and (2) 1 Adaptation to Climate Change Operation Plan and 5 Projects will be adopted and implemented with the objective of reducing the number of complaints about the water quality and quantity by at least 50%.

Being a major tourist attraction, Muang Hua Hin Municipality is heavily congested that a lot of greenhouse gases are emitted from power consumption on business premises and residential buildings, community refuse management and transportation. The municipality and TGO jointly assessed the city greenhouse gas emissions and planned for the mitigation thereof. Having acquired the knowledge and understanding of greenhouse gases, the municipal staff have adopted the guidelines and plans for mitigation of greenhouse gas emissions from local government buildings and higher efficiency in energy consumption and community refuse management. To ensure reduction of greenhouse gases in 2027, the municipality should seek cooperation from communities, business owners and tourists on reduction of power consumption and community waste and traveling without using private vehicles.

Policy Suggestions to the State and Agencies Concerned

1. Low-carbon City Planning and Development

- The Climate Change Division, Ministry of Natural Resources and Environment, TGO, universities and every municipality should jointly adopt Low-carbon City Development Strategies and Action Plans for Mitigation of Greenhouse Gas Emissions in all municipal's annual local development plans.
- The municipality should integrate the low-carbon action plans in the local development plans for obtaining the budgets for energy consumption reduction, use of alternative energy, turning community waste to energy and environmentally-friendly transportation at municipal level.
- The municipality should allocate resources, staff and facilities for implementation of low-carbon action plans.

2. Policies/Organization

- Integrate greenhouse gas emission mitigation policies at national, ministerial, provincial, municipal and local level.
- Set up municipal agencies and working groups directly in charge of local action plans.
- Seek cooperations from communities, business operators, factories and other stakeholders in the area.

3. Cooperation with Private and Public Sector

- The municipality should cooperate with industries, businesses and the public on energy consumption, community waste management, transportation and increase of green areas in the city for mitigation of greenhouse gas emissions.

4. Staff Training

- Climate Change Inventory Mitigation Adaptation, Ministry of Natural Resources and Environment, TGO and universities should offer training in adaptation to climate change to local government agencies, business operators, students and the public.
- The municipality should train their staff and stakeholders in the areas in the guidelines and measures for mitigation of greenhouse gas emissions and adaptation to climate change.

APPENDICES

Appendix A: Appointment of Climate Change Municipal Working Group



Appendix A-4

Order for the Appointment of Muang Hua Hin Municipal Climate Change Working Group

Appendix B: Climate Change Municipal Working Group Meeting



Appendix B-4

Meeting of Muang Hua Hin Municipal Climate Change Working Group

Appendix C: Assessment of City Carbon Footprint and Greenhouse Gas



Appendix C-4

Assessment of Carbon Footprint and Prediction of Greenhouse Gas in Muang Hua Hin Municipality

APPENDICES

Appendix D: Measures for City Greenhouse Gas Mitigation



Appendix D-4

Measures for Mitigation of Greenhouse Gas Emissions in Muang Hua Hin Municipality

APPENDICES

Appendix E: Greenhouse Gas Emissions Coefficient

Table E-1: Coefficient of Greenhouse Gas Emissions from Fuel Energy Use

Fuel Type	Unit	Coefficient (kg CO ₂ e/unit)	
		Stationary Combustion	Mobile Combustion
Liquefied Petroleum Gas (LPG)	Litres	1.6842	1.7273
Diesel (Diesel)	Litres	2.7147	2.7403
Gasoline (Gasoline)	Litres	2.1954	2.2373
Fuel Oil	Litres	3.0957	3.1071
Gasohol 91 , 95	Litres	1.9758	2.0192
Natural Gas (NG)	Scf	0.0573	0.0607
Gasohol E85	Litres	0.3293	0.383
Gasohol E20	Litres	1.7563	1.801
Electricity	kWh	0.4999	
Jet Fuel (Domestic)	Flight	-	2 , 715
Jet Fuel (International)	Flight	-	7 , 995

Table E-2: Coefficient of Greenhouse Gas Emissions from Waste Management

Factors	Value	Unit
III.1 SWDS		
DOCF	0.77	-
Managed, landfill	1	-
Managed, semi-aerobic	0.5	-
Un-managed, deep, OD (high > 5 m)	0.8	-
Un-managed, shallow, OD (high < 5 m)	0.4	-
Uncate-gorised	0.6	-
LF	0.1	-
OD	0	-
Fraction of CH ₄ generated in LF gas (F)	0.5	-
Convert C-CH ₄	1.33	-
III.2 Biological Treatment of Solid Waste		
Composting		
CH ₄ Emission Factors (on a dry weight basis)	10	g CH ₄ /kg waste treated g N ₂ O/kg waste treated
CH ₄ Emission Factors (on a wet weight basis)	4	
N ₂ O Emission Factors (on a dry weight basis)	0.6	
N ₂ O Emission Factors (on a wet weight basis)	0.3	
Anaerobic digestion at biogas facilities		
CH ₄ Emission Factors (on a dry weight basis)	2	g CH ₄ /kg waste treated
CH ₄ Emission Factors (on a wet weight basis)	1	

APPENDICES

Table E-3: Coefficient of Greenhouse Gas Emissions from Waste Management by Incineration

Waste Type	IPCC Default		
	dm (%)	FCC (%)	FFC (%)
Food Scraps	40	38	0
Paper	90	46	1
Plastic	100	75	100
Glass	100	0	0
Metal	100	0	0
Rubber/Leather	84	67	20
Cloth	80	50	20
Wood/Leaves	40	70	0
Stone/Tile	0	49	0
Other	90	3	100

Table E-4: Greenhouse Gas Emissions Factor Values Separated by Type Of Wastewater Treatment

Types of Wastewater Treatment	Methane Conversion Factor (kg CH ₄ /kg COD)	Emission Factor (kg CO ₂ eq/kg COD)	Note
In the case of wastewater not being treated			
Releasing wastewater into sea, river, and swamp directly	0.025	0.625	Gas quantity not included Greenhouse formed by Organic substances within water sources
In the case of wastewater being treated			
aeration treatment plant	0	0	
aeration treatment plant	0.075	1.875	Type without Supervise and work beyond capacity.
Non-aerated sludge removal system	0.2	5	Gas quantity not included Greenhouse traps collected from treatment systems
Reactor without air	0.2	5	Gas quantity not included Greenhouse traps collected from treatment systems
Shallow treatment pond without aeration	0.05	1.25	Depth not more than 2 meters
Deep treatment pond without aeration	0.2	5	Depth more than 2 meters

APPENDICES

Table E-5: Factor of Greenhouse Gas Emissions in The Livestock Sector

Animal Type	GHG Emissions (kg CO ₂ e/Head)	
	Enteric Fermentation	Manure Management
Dairy Cattle	1,579.48	541.51
Other Cattle	1,195.60	71.12
Buffalo	1,677.48	59.36
Sheep	140	5.6
Goat	140	6.16
Camel	1,288	71.68
Horse	504	61.32
Pigs	28	84.77
Deer	560	6.16
Chicken	0	0.64
Duck	0	0.64
Goose	0	0.64
Quail	0	0.64

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