

**PROJECT TO SUPPORT THE PLANNING AND IMPLEMENTATION
OF NAMAS IN A MRV MANNER
*HO CHI MINH CITY COMPONENT***

SYNTHESIS REPORT

**PROPOSED POLICY FRAMEWORK FOR GREENHOUSE
GAS INVENTORY AND IMPLEMENTATION OF ACTION
FOR REDUCING GREENHOUSE GAS EMISSION
COMPLIANCE WITH HO CHI MINH CITY'S CONDITIONS**

Ho Chi Minh City, October 2017

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ABBREVIATIONS

SPI-NAMA	Support the planning and implementation of NAMAS in a MRV manner
JICA	Japan International Cooperation Agency
MoNRE	Ministry of Natural Resources and Environment
DoNRE	Ho Chi Minh Natural Resources and Environment
HCMC	Ho Chi Minh City
HCM PC	People's Committee of Ho Chi Minh City
GHG	Greenhouse gas
MRV	Measurement, Reporting and Verification
NAMA	Nationally Appropriate Mitigation Action
INDC	Intended Nationally Determined Contribution
NDC	Nationally Determined Contribution
UNFCCC	United Nations Framework Convention on Climate Change
IPCC	Intergovernmental Panel on Climate Change
JCM	Joint Crediting Mechanism
CCAP	Climate Change Action Plan of Ho Chi Minh City in the period 2017-2020, with a vision towards 2030
BaU	Business as Usual

INTRODUCTION

BACKGROUND

JICA is implementing the “Project to Support the Planning and Implementation of NAMAs in a MRV Manner” together with the Ministry of Natural Resources and Environment (MONRE), Vietnam. The purpose of the project is to enhance the capacity of the Government of Vietnam concerning the planning and implementation of NAMAs. Part of the project activities focus on Ho Chi Minh City (HCMC) and other cities of Vietnam.

PCKK together with two other consulting firms have been selected by JICA to implement project activities in HCMC and other cities of Vietnam. The three consulting firms have formed the Short-Term Expert Team for this purpose.

The Short-Term Expert Team shall: 1) assist the establishment and enhancement of the capacity of the cities in Vietnam to continuously quantify GHG emissions and reductions, taking HCMC as a model city; 2) develop and recommend an MRV style applicable at the city level in Vietnam; and 3) promote the planning, implementation and management of NAMAs in Vietnam through the development and dissemination of materials to assist the capacity enhancement of the cities in Vietnam.

The Contractors, Dr. Tran Thanh Tu and Dr. Phan Thu Nga, are engaged to assist HCMC prepare supporting documents for policy development to institutionalize GHG inventory and MRV in HCMC. The Contractors shall work closely with relevant local stakeholders via the coordination of DONRE-CCB, and cooperate with the Short-Term Expert Team and local consultants responsible for GHG inventory and MRV.

The consultancy service shall start on March 2017 until October 2017.

OBJECTIVE

The main objective of the consultancy service is to develop a policy framework for greenhouse gas inventory and management procedures for greenhouse gas reduction activities, to assist HCMC in preparation of legal documents related to greenhouse gas inventory and management of green house gas emission reduction activities in accordance with HCMC conditions.

CONTENT

Content 1: Background research to support GHG inventory and MRV policy development

Task 1: Understand the technical aspects of GHG inventory and MRV, and the initiatives to date. (There is no requirement of reporting for this task.)

- Consult with the Short-Term Expert Team and local consultants responsible for GHG inventory and MRV to understand the technical aspects of GHG inventory and MRV, and initiatives undertaken to date.

- The Contractors shall continue to communicate with the Short-Term Expert Team and local consultants responsible for GHG inventory and MRV in the tasks to follow to produce effective outputs.

Task 2: Review the draft of the GHG Inventory Preparation Manual and MRV Manual developed by the Short-Term Expert Team and local consultants, and provide constructive comments from the perspective of institutionalizing and sustaining GHG inventory and MRV in HCMC.

Task 3: Review and propose proper procedures to develop and submit the drafted GHG inventory and MRV regulations to the HCMC People's Committee.

Task 4: Analyze the organizations and institutions related to climate change mitigation in HCMC

- Review legal documents, i.e., both vertical legal system and city policies, related to climate change mitigation in Vietnam and HCMC; and analyze the potential of integrating mitigation measures and GHG management into development policies of HCMC.

- Review the administrative organization and climate change response network of HCMC to identify an appropriate data flow.

Task 5: Propose possible instruments, which may include incentives and penalties, to encourage stakeholders' participation in MRV implementation.

Content 2: Research on GHG emission reduction potential of HCMC

Task 6: Collect information on on-going and planned mitigation programs and projects in HCMC within priority programs and sectors of HCMC. This task will build on the study already completed by the project to date and will update latest information on projects and programs approved by HCMC People's Committee by December 2016.

Task 7: Analyze the GHG emission reduction potential of HCMC by 2025 and 2030, in order to facilitate GHG emission reduction roadmap development of HCMC towards 2030. This task will provide a concrete

reference and scientific basis for HCMC to promote and monitor MRV implementation.

Content 3: Draft synthesis report and policy documents

Task 8: Draft GHG inventory and MRV regulations for HCMC and revise according to the comments of relevant stakeholders during consultation seminars.

Task 9: Draft synthesis report (for content 1 and content 2).

PART 1

OVERVIEW OF GHG INVENTORY AND THE IMPLEMENTATION OF NAMAs IN THE GLOBAL AND IN VIETNAM

1.1. GLOBAL OVERVIEW

Climate change is considered as one of the major challenges for the global development in the 21st century. According to the assessment of IPCC, the main cause of global climate change is an excessive emission of GHG from activities of anthropogenic socio-economic development. To mitigate the global warming phenomenon, the United Nations Framework Convention on Climate Change (UNFCCC) was signed by 155 nations at the Earth Summit in Rio de Janeiro in 1992 with the objectives of "stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system". Since then, GHG reduction has always been a main subject to be negotiated at the Conferences of the Parties (COP) of UNFCCC.

In order to strengthen the legal basis in implementing the UNFCCC, COP3 in Kyoto, Japan in 12/1997 ratified the Kyoto Protocol to set specific targets of GHG reduction for developed countries. In order to achieve GHG emission reduction targets, three flexible market-based mechanisms were established so that the Parties to the Protocol can jointly implement common objectives including (1) Joint Implementation, (2) Clean Development Mechanism and (3) International Emission Trading. Although developing countries including Vietnam don't have the obligation of quantitative emission reduction, these countries can still contribute into global GHG reduction target through Clean Development Mechanism (CDM). In October 2012, there was more than 4900 CDM projects registered to the CDM Executive Board (EB); in which, energy projects accounted for 71.71%, waste projects accounted for 12.42%, projects of forestation and reforestation consisted of 0.71% and others accounted for 15.17% (The Steering Committee for the Implementation of the UNFCCC and KP in Vietnam, 2012).

At COP13 in Bali, Indonesia, a new approach for reducing GHG emissions in developing countries has been introduced with a name of "National Appropriately Mitigation Actions" (NAMAs). The concept of NAMA was defined in the Bali Action Plan and subsequently formalized in the Copenhagen Accord at COP15. This concept has been quite new at that time and is understood as a tool to encourage developing countries to contribute to the goal of global GHG emissions reduction and sustainable development with supports from developed countries in technology, finance and capacity building. At the same time, the Copenhagen Accord also encourages developing countries to

report on NAMAs in their National Communications and requires NAMAs should be implemented in measurable, reportable and verifiable way (MRV) (Bockel et al., 2011).

Subsequently, the Cancun Agreement adopted at COP16 proposed the establishment of an official international registration system for NAMA and solutions for the successful implementation of NAMAs. Developing countries provide information on NAMAs while developed countries provide support information for NAMAs. Supporting activities should be internationally MRV. For unsupported NAMAs, these NAMAs need to be MRV internally (Ministry of Natural Resources and Environment, 2014). The NAMA concept continues to be negotiated at the forthcoming COP of UNFCCC to provide the foundation of diversified approaches for preparation steps and implementation steps of GHG emissions reduction and sustainable development strategies.

As of April 2012, 50 developing countries have submitted NAMA proposals to the UNFCCC. These proposals cover various forms of NAMA, ranging from goals and strategies to reduce GHG emissions to policies and projects. The proposals also differ on the level of detail. Many NAMA submissions are just statements intended to be made, not concrete actions or progress or the national policy framework that NAMA can be integrated into. Among these 50 countries, there were 13 countries which didn't develop NAMAs for specific sectors but they aim at the overall goal of the countries such as GHG emission reduction goal (for ex, India and China) (Ministry of Natural Resources and Environment, 2013).

The most NAMA-nominated area was Latin America with 22 NAMA with different progress. Outstanding activities include Action Plans and Mitigation Scenarios with Developing Countries Cooperation (South- South Cooperation) to develop long-term mitigation plans and Mitigation Action Implementation Network (MAIN) implemented by the Center of Clean Air Policy (CCAP) and World Bank Institute (WBI). MAIN Program supports the design and implementation of NAMA and the Low Carbon Development Strategy in 08 Latin American countries and 07 Asian countries. After COP17, African countries begun to pay attention to NAMA. At South Africa, The Renewable Energy Program in South Africa has been implemented with support from European countries. This program will provide financial support to the replication of renewable energy in South Africa. One of the first studies to identify NAMA in the Middle East and North Africa was implemented by Center for Renewable Energy and Energy Efficiency in November 2011. This study identified some general NAMAs outline for Algeria, Greece, Jordan, Lebanon, Libya, Morocco, Syria, Tunisia and Yemen (Regional Centre for Renewable

Energies and Energy Efficiency, 2011). In Asia, in 2012, Indonesia, Vietnam and Thailand initially implemented activities for developing NAMAs. In 2013, Indonesia established “Policy framework for mitigating actions in accordance with national conditions of Indonesia” to provide policy frameworks for central and local agencies to implement GHG mitigation actions and NAMA proposals in five key areas in Indonesia.

Through the research process of implementing NAMAs in different countries, some lessons learned are as follows: (Ministry of Natural Resources and Environment, 2013)

- Political commitment and leadership of the government are important elements in a process of developing and proposing NAMAs - both for setting national priorities and increasing opportunities for NAMAs implementation.

- Co-operation among relevant ministries plays an important role in the implementation of NAMAs. Therefore, the development of an institutional system with the participation of relevant agencies has an important role in NAMAs implementation. The clear assignment of responsibilities for parties will reduce overlap and conflicts between ministries and sectors, which can accelerate the development and implementation of NAMAs;

- Participation of stakeholders in NAMA development and implementation is an important element which helps parties understand about barriers of NAMA implementation and potential negative impacts of NAMAs into the socio-economic development. Involvement of many stakeholders in the development and implementation of NAMAs also contributes to raising awareness about NAMAs;

- The harmonization of technical and political issues when building NAMAs requires flexibility in the NAMAs process: The construction of NAMAs at the national level will be based on technical calculations; however, many options and trade-offs amongst these options are largely dependent on decision-makers as other criteria need to be based on such as a level of feasibility and financial potential;

- The development of NAMAs requires a lot of time and data for capacity building to ensure accurate decision making. However, this does not mean that you have to wait until there are enough conditions to start developing NAMAs. Instead of this, you need to “learn by doing”.

After the Paris Agreement on Climate Change adopted at COP21 binding all parties to be responsible for GHG emission reduction, NAMAs are put into the Intended Nationally Determined Contribution (INDC) as a means to achieve the emission reduction targets set out in the INDC. It can be said that Paris Agreement through binding responsibilities of the Parties to implement

Nationally Determined Contribution (NDC) in 2020 has provided a clearer framework as well as motivating countries to implement NAMA and action programs to reduce GHGs emission, contributing into global target of GHGs emission reduction to keep the global average temperature at the end of 21st century increase no more than 2°C as compared to the pre-industrial time.

In order to successfully implement NAMA activities, countries need to have a detailed GHG inventory system and establish a GHG emission baseline curve as well as developing a monitoring system at national level and MRV procedure for NAMA activities (4).

1.2. OVERVIEW OF VIETNAM

Recognizing the importance of reducing global GHG emissions and level of impact on the development of socio-economic of the country, Vietnam has supported the United Nations Framework Convention on Climate Change and actively participated in legal agreements relating to climate change mitigation. Specifically, Vietnam signed UNFCCC in 1992 and ratified in 1994; signed Kyoto Protocol in 1998 and ratified in 2002. Vietnam also established National Steering Committee for the Implementation of the UNFCCC and the Kyoto Protocol and sent UNFCCC Secretaries the first National Communication in 2003, the second National Communication in 2010 and the first Biennial Update Report in 2014. Which reflects the latest efforts on responding to climate change and GHG inventory of Vietnam.

As the country is not belonged to the Annex I of Kyoto Protocol, Vietnam is not committed to reducing GHG emissions under the Kyoto Protocol but has a great potential for CDM participation to contribute into global GHG emissions reduction and take advantage of opportunities to develop the country in a sustainable way. According to the Intended Nationally Determined Contribution, until 06/2015, Vietnam had 254 CDM projects approved by the international Executive Board on CDM (EB). Vietnam ranked fourth in the world in terms of number of projects, with a potential GHG reduction of about 137.4 Mt CO₂ equivalents (CO₂ eq) in the credit period. Of the 254 projects, energy projects accounted for 87.6%, waste treatment accounted for 10.2%, afforestation and reforestation accounted for 0.4% and others accounted for 1.8%. The certified emission reductions (CERs) approved by EB at that time was over 12 million, ranking 11th in the world.

In addition to CDM, Vietnam is cooperating with Japan to implement the Joint Crediting Mechanism (JCM) in Vietnam. According to the Circular No.17/2015/TT-BTNMT dated 06/4/2015 of Ministry of Natural Resources and

Environment, JCM is “Mechanism within the framework of low carbon development cooperation between Vietnam and Japan to promote the investment, transfer and dissemination of low-carbon technologies, products, systems, services and facilities in different sectors towards the low-carbon development in Vietnam, supporting the implementation of international commitment of GHG emission reduction of Japan and contributing into the common goal of international response to climate change” (Circular No.17/2015/TT-BTNMT dated 06/4/2015). Until 01/2016, Vietnam conducted more than 60 pilot projects under the JCM mechanism nationwide. Two projects have been registered successfully with the Vietnam - Japan Joint Committee which is the Green Hospital Promotion Project by improving energy efficiency and environmental protection in Vietnamese national hospitals, and Eco-driving Project using electronic speedometer.

On 21 November 2012, the Prime Minister issued Decision No.1775/QĐ-TTg on approval of the Scheme on GHG emission control, managing carbon trading activities on the world market in which NAMA implementation and developing national MRV system are important contents that needs to be implemented. Institutional system of NAMA implementation in Vietnam is currently in the process of being finalized. Some activities such as capacity building, technical assistance to develop baseline scenarios and emission reduction scenarios, the formation of the MRV system and etc. are being conducted. In the first Biennial Update Report of Vietnam, some NAMAs has been implemented in Vietnam includes:

- “Facilitate implementation and readiness for mitigation actions” Project (FIRM) financed by the Danish Agency for International Development through UNEP-DTU as a partner, which was implemented by MoNRE and relevant agencies. The goal of the project is to support efforts of GHG emissions reduction, contributing to the development of low carbon economy and green growth in Vietnam. The project contributes to the removal of non-financial barriers in the country in order to develop and pilot prioritized NAMAs. In this project, 02 NAMA have been developed to be registered including (1) Supporting program for wind power development in Vietnam and (2) NAMA on biogas power generation in medium and large scale pig farms.

- General Directorate of Energy, Ministry of Industry and Trade of Vietnam also developed NAMA named “Renewable Energy Development Fund - FiT Vietnam GET Program” and sent to NAMA Facility to consider support for implementation. This project will support the promotion of public and private investment in the renewable energy sector in order to achieve the goal of renewable energy development in the Electricity Master Plan VII, contributing

into achieve target of GHG emission reduction in the National Green Growth Strategy.

- “Smart Climate for Agriculture” implemented by the Ministry of Agriculture and Rural Development since 2012 with the financial support of FAO. The project focuses on the development of NAMA in the agricultural sector in the northern uplands and considers benefits associated with GHG mitigation actions. Through this project, biogas can replace natural gas in lowland areas with great potential for mitigating GHG emissions.

- Project of "Develop technical guidelines on NAMA and MRV in Vietnam" financed by UNDP and was implemented by the Institute of Hydrology and Meteorology Science and Climate Change in 2013. The project provided data and technical guidance to develop and implement NAMA including methods and tools for development and implementation; a list of potential mitigation actions for NAMA development in the MRV manner and experience of some countries in the world.

- “Project to Support the Planning and Implementation of NAMAs in a MRV Manner” (SPI-NAMA) financed by JICA and implemented by the cooperation between JICA and MoNRE with objectives as follows: (1) Increase capacity of MoNRE in promoting, coordinating and managing the planning and implementation of NAMA and (ii) Increase capacity of ministries and stakeholders in planning and implementation of NAMA.

Vietnam developed the Intended Nationally Determined Contribution (INDC) to submit to the UN in September 2015, which includes 02 main components: GHG emission reduction and climate change adaptation. Component of GHG emission reduction includes unconditional contributions and conditional contributions. Unconditional contributions are activities that will be performed by domestic resources while conditional contributions are activities that will be undertaken if there are new and additional financial supports, technology transfer and capacity building from international community.

After Vietnam signed Paris Agreement, INDC becomes Nationally Determined Contribution. For GHG emission reduction, Vietnam target is 8% reduction of total GHG emission as compared to the BAU in 2030 by domestic resources and may increase up to 25% reduction of total GHG emission when Vietnam receives international supports through bilateral cooperation, multilateral cooperation and implementation of new mechanisms of Paris Agreement on Climate Change. The contribution of GHG emission reduction in Vietnam will be periodically reviewed, assessed and adjusted to suit socio-economic conditions in each period of development.

The Plan for implementation of the Paris Agreement on climate change was approved at the Decision No.2053/QĐ-TTg dated 28 October 2016 of the Prime Minister to specify Vietnam's commitments with the international community to adapt to climate change, execute tasks in the Paris Agreement, which include 05 main components such as:

- Mitigation of GHGs emissions: The tasks and measures to achieve the targets listed in the NDC and take advantages of the opportunity to develop the economy in the direction of low-carbon;

- Adaptation to climate change: The tasks and measures to contribute to climate change adaptation stated in the NDC; enhance resilience to climate change;

- Implementation resources: The tasks and measures for human resource development; development and transfer of technology and financial mobilization to ensure the commitments stated in the NDC; also to utilize the opportunities presented by the Paris Agreement to develop the country;

- Transparency system (MRV system): The tasks and measures to monitor and supervise the implementation of GHG emission mitigation, adaptation to climate change and ensure adequate resources for the implementation;

- Institutions and policy: The tasks and measures to develop and revise legal documents, technical guidance; define the responsibilities of line Ministries, sectors, localities and strengthen the coordination in handling inter-regional and interdisciplinary issues.

For GHG Inventory, Vietnam carried out the national GHG inventory in 2010, which was being implemented from 2013 to 2014 within the framework of “Enhance capacity in national GHG inventory in Vietnam” (2010-2014) financed by JICA. In 2010, total GHG emission in Vietnam was 246.8 million tons CO₂ eq (including LULUCF) and 266 million tons CO₂ eq (not including LULUCF). In the period 1994-2010, total GHG emission in Vietnam (including LULUCF) increased rapidly from 103.8 million tons CO₂ eq to 246.8 million tons CO₂ eq, in which energy was the fastest increasing sector from 25.6 million tons CO₂ eq to 141 million tons CO₂ eq and is the highest emission source in 2010 (Table 1).

Table 1. GHG emission in 1994, 2000 and 2010 (unit: million tons CO₂ eq)

Sector	1994	2000	2010
Energy	25.6	52.8	141.1
IPPU	3.8	10.0	21.2
Agriculture	52.4	65.1	88.3
LULUCF	19.4	15.1	-19.2
Waste	2.6	7.9	15.4
Total	103.8	150.9	246.8

Estimated total GHG emission in 4 sectors including energy, agriculture, LULUCF and waste in 2020 is 466 million tons CO₂ eq and in 2030, this figure is predicted to increase to 760.5 million tons CO₂ eq. Energy is still the highest emission source according to the estimation.

Table 2. GHG emission in 2010 and the estimated figure in 2020 and 2030 (unit: million tons CO₂ eq)

Sector	2010	2020	2030
Energy	141.1	381.1	648.5
Agriculture	88.3	100.8	109.3
LULUCF	-19.2	-42.5	-45.3
Waste	15.4	26.6	48.0
Total	225.6	466.0	760.5

In 2015, Vietnam Government also established national system for GHG inventory at the Decision No.2359/QD-TTg dated 22/12/2015 of the Prime Minister, which creates a legal basis for GHG inventory in Vietnam and is compliant with current Vietnamese regulations relating to climate change response.

1.3. CONCLUSION

In overall, since the United Nations Framework Convention on Climate Change was signed, GHG emission reduction has always been hot topic at the Conference of Parties of the UNFCCC (COP). NAMA concept was introduced at COP13 in Bali, Indonesia as a new approach of GHG emissions reduction for developing countries besides binding obligations to reduce greenhouse gas emissions of developed countries in the Kyoto Protocol. NAMAs and MRV content has been gradually completed through later COPs.

After the Paris Agreement on Climate Change adopted at COP21 binding all parties to be responsible for GHG emission reduction, developing countries including Vietnam will have responsibility of GHG emission reduction through Nationally Determined Contribution after 2020. At that time, the implementation of NAMA and MRV is an essential solution for developing countries to achieve the goals set out in their NDC that they submitted to the UNFCCC.

Since signing the UNFCCC, Vietnam has always actively participated into actions of GHG emission reduction, contributing into the common target of keeping the global average temperature increase no more than 2°C at the 21st century. Under the framework of Kyoto Protocol, Vietnam ranked fourth in the world in terms of number of CDM projects which were approved by the EB (as of June 2015). At the same time, Vietnam has applied experience in the implementation of projects under the CDM for the development of NAMA projects. Although the institution for the implementation of NAMA in Vietnam is still in the stage of completion, with technical supports from developed countries, the foundation of NAMA implementation has been gradually formed such as the national system of GHG inventory, national MRV system, MRV system at different level and etc.

After the Plan for implementation of Paris Agreement on Climate Change was established, Vietnam has a concrete plan to implement Vietnam's commitments with an international community. For GHG emission reduction, Vietnam target is 8% reduction of total GHG emission as compared to the BAU in 2030 by domestic resources and may increase up to 25% reduction of total GHG emission when Vietnam receives international supports

PART 2

OVERVIEW OF HO CHI MINH CLIMATE CHANGE ACTION

2.1. BACKGROUND OF HO CHI MINH CITY

2.1.1. Geographical location

Ho Chi Minh City (HCMC) is located in the South-Western area of the South-Eastern Region with the global positioning system coordinates of 10°10'–10°38'N and 106°22'–106°54'E. In the South of Vietnam, HCMC is located at 1730 km from Ha Noi- the capital city; its city center is 50km away from the east coast as the crow flies. With its central location in Southeast Asia, the City is an important traffic hub for road, water and air transport, connecting provinces in the region and is also an international gateway. It borders Binh Duong and Tay Ninh Province to the north, Dong Nai and Ba Ria–Vung Tau Province to the east, Long An and Tien Giang Province to the west.

HCMC is located downstream of large rivers such as Saigon, Dong Nai River and on the fringes of the Mekong Delta. Total natural area of the city is 2,095.01 km² with 17 urban districts and 5 suburban districts (HCMC Statistical Office, 2015).

2.1.2. Natural condition

2.1.2.1. Terrain

Most of Ho Chi Minh City's areas are flat, steeply sloping from the north to the south. It is barely above sea level—40%–45% of land cover in HCMC is 0–1 meter (m) in elevation, 15%–20% is 1–2 m, and very little land sits above 4m. (ADB, 2010). The city has three types of terrain (Le Sam, 2011):

- The hilly bowl-shaped terrain type with the elevation varying from 2.0m to 3.0m in Thu Duc District, District 9, District 12, Binh Tan District, Hoc Mon District, Cu Chi District and other urban districts. This is a highland terrain which is not affected by tides except for some local area located near the canal with the elevation of <+ 2m.

- Low-plain terrain type with the elevation varying from 0.8 m to 1.5 m in Districts 2, 9, 7, Tan Phu, Nha Be and Binh Chanh district as well as Sai Gon riverside. This is a type of tidal or flood plain due to the tidal effect (except for land strip inhabited with the elevation of up to + 3.0 m).

- Low-lying terrain type with dense and volatile ground in Can Gio and Nha Be district. This is the area near the sea, with the elevation varying from 0.3 to 2.0m.

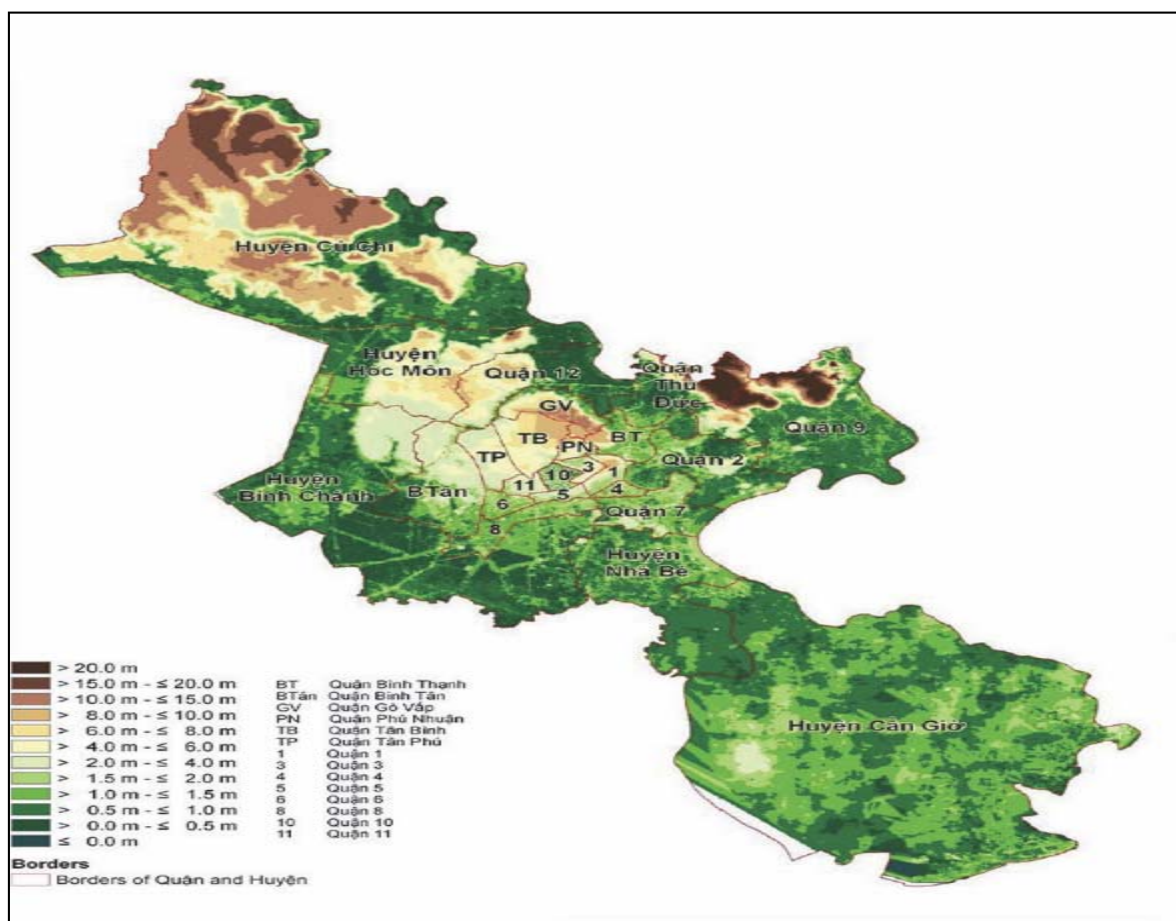


Figure 1. Terrain map of Ho Chi Minh City

HCMC is built mostly on low-lying and flat terrain. The City has a low-lying area with the height of less than 2m and sea level occupying 61% of the natural area, located in the estuary with many large regulating works in the upstream, thus, the risk of flooding in the City is relatively large.

2.1.2.2. Meteorology - Hydrology

HCMC is located in the tropical savanna climate with the subequatorial climate zone. The average sunshine duration is 6.13 hours/day with vast amount of radiant. The annual average temperature is about 28.4°C. The average annual rainfall measured at Tan Son Hoa station was 2,042.2 mm/ year, with rainfall concentrated mainly from April to November, accounting for 90% of total annual rainfall. (HCMC Statistics Office, 2015).

HCMC has an intricate network of rivers and canals with a total length of up to 5,075 km. Due to its relatively flat terrain and surrounded by 3 main river systems including Dong Nai River, Sai Gon River and Vam Co River, the hydrographic regime of rivers and canals is not only strongly influenced by the East Sea tide, but also significantly affected by the operation of upstream

reservoirs such as Tri An, Dau Tieng, etc. Characteristics of the 3 main rivers flowing through Ho Chi Minh City are as follows:

- The main flow of Dong Nai River is North East- Southwest with many large branches in the middle section. The amount of water in the lower part of the river is increased by the tributaries such as Be River, Saigon River and Vam Co River. The total length of the mainstream from the upstream to the river mouth reaches to 628 km. The river depth is not deep compared with other rivers, the average depth is 12- 15 m, the average flow is 500 m³/s. The Dong Nai River flows through HCMC with the length of 87 km (from Dong Nai bridge to Soai Rap river mouth), the width significantly varies from 500-800 m at the Dong Nai bridge to Cat Lai, 800-1,500 m at the middle section (from Cat Lai to Vam Co river intersection) and 2,000-3,000 m at the lower section (Vam Co river intersection to the river mouth), with a depth of 8-15 m. From Nha Be cape, Dong Nai River radiates into many branches creating large river mouths and dense rivers.

- The section of Saigon River passing through HCMC is about 80 km in length (from Phu My Hung ward of Chi Cu District to Phu My Ward of District 7), with an average width of 100-200 m at the above section (from Phu My Hung of Chi Cu district to Thu Dau Mot City of Binh Duong Province), and 200-300 m at the lower section (the river mouth is 400-500m in width), with an average depth of 8-15 m. Vessels weighing less than 1 thousand tons can go to Sai Gon-Ben Nghe Port by Long Tau River route.

- Vam Co River is the common name of two large rivers including Vam Co Dong and Vam Co Tay after the confluence with the total length of 36 km. The river has a basin area of 6,300 km² and a length of 283 km. Vam Co Dong has an independent water source within the Southeast region, so it is considered to belong to the Dong Nai river system. The river has a very steep river bed with significant tidal effect. Vam Co Dong River has many tributaries connected to the canal system in the Southwest of the City.

The river system of the City is affected by the semi-diurnal regime (under the tide regime of the Eastern Sea). Every day, river level rises and drops twice; accordingly, the tide penetrated deeply into the canal system of the City, which causes a great influence on water drainage of the inner city (Le Sam, 2011).

2.1.3. Socioeconomic

2.1.3.1. Economy

Gross domestic product (GDP) of HCM in 2015 was estimated at 957,358 billion VND, increased 1.5 times compared to the whole country. GDP per capita was estimated at 5,538 USD. The services sector accounted for 59.4%

of GDP, increased by 11.1%; the industry and construction sector accounted for 39.6% of GDP, increased by 8.1%; the agriculture accounted for 1.0% of GDP, increased by 5.8% (Ho Chi Minh People's Committee, 2016). HCMC has a dynamic economy leading the economic growth rate, with the annual GDP growth of over 10% from 2005 to now.

The growth of each sector in 2016 is as follows (Ho Chi Minh People's Committee, 2016):

Agriculture: the City has promoted agri-extension, transfer of genetic improvement and application of technology, consultation and support to improve vegetable cultivation techniques in accordance with VietGAP process, especially to promote mechanization in orchid production; develop high quality of seedlings, breeds, ornamental fish, flowers, plants, dairy cows, etc. Thus, the value of agricultural, forestry and fishery production in 2016 was estimated at 19.544 billion VND, increased by 5.7% over the same period. The agricultural economy continues to be shifted towards modern, effective urban agriculture; to focus on the development of cultivated plants and animals with highly economic value suitable with the conditions of the City. By the end of 2016, the proportion of each agricultural sector was as follows: cultivation accounted for 24.3%; livestock accounted for 40.4%; fishery accounted for 27.3%; agricultural services accounted for 7.5%. The forest coverage rate was 16.51%, and the total rate of forest and trees coverage in the City reached 40.07%.

Industry: Industrial development index was estimated to increase by 7.68% over the same period. The 4 major industries (mechanical engineering, electronics, chemicals- rubber- plastic and food processing) actively in expanding the market, investing in equipment innovation, improving quality and competitive capability of the product.

Trade and services: The total of retail and services revenue reached about 713,978 billion VND, increased by 8.1% compared with 10.5% in 2015. Total export turnover of enterprises in the City was estimated at 30.64 billion USD, increased by 5.97% over the same period. Excluding the value of crude oil, the turnover was estimated at 28.2 billion USD, increased by 10.1%. Import turnover of goods in the area was estimated at 37.7 billion USD, increased by 11.9% over the same period. Imports increased mainly in equipment, materials for production such as computers, electronic products and components, medicine, plastic materials, iron and steel. Total turnover of tourism (travel, accommodation and restaurant) was estimated at 106 trillion VND, increased by 12.05%.

2.1.3.2. Society

According to Ho Chi Minh City Statistics Office (2015), the total population of the city in 2014 was 8,087,900 people with an average population density of 3860 people/ km². The natural population growth rate is 2.07%. From that, HCMC is a young and dynamic city with 70% of the population under the age of 35. The population distribution of the city is uneven, with a large gap of density of people between districts, for example, Can Gio District (106 people / km²) and populous districts like District 3, 4, 5, 10, 11 (over 40,000 people/ km²).

Education: In 2015, there were 939 schools in HCMC, of which 189 national standardized schools at all educational levels. In 2014-2015, the rate of secondary graduation was 99.64%; the rate of high school graduation was 97.39%; the rate of secondary graduation for the complementary system was 91.71%; the rate of high school graduation for the complementary system was 63.89%.

Healthcare: The healthcare sector of HCMC achieved and exceeded all the targets set out from the “Human Resource Training Program for the City’s Health Sector in 2011-2015” to ensure the medical examination and treatment for serving the people; it was estimated that there were 15 doctors/ 10 thousand people, 33.7 nurses/ 10 thousand people. Accordingly, the quality of the healthcare sector has been increased with the percentage of communes having health stations and doctors was 100%; the mortality rate of children under 5 year-old was less than 1%; malnutrition rate of children under 5 year-old was less than 5%.

Vocational training and job creation: HCMC has 433 vocational training institutions; enrollment and training of about 402,172 students; the percentage of trained workers reached 72.39%. In 2015, HCMC created jobs for about 295,274 workers; the number of new jobs created was 123,769 that reduced the unemployment rate to 4.5%.

2.1.4. Socio-economic development planning and urban development of the City

According to the Master Plan for Socio-Economic Development of Ho Chi Minh City until 2020 with a vision to 2025, the main viewpoint on the City's development is expressed as follows: “The city actively grasps the opportunities, overcoming challenges, maintaining socio-political stability, restructuring the economy, renewing the model and raising the quality of growth and building a synchronous system to create a breakthrough in the infrastructure system; developing a fast and sustainable city with higher quality and speed than the national average, linking socio-economic development with national defense and security; closely linking the socio-economic development of the city with the region; building a healthy cultural environment; developing production

associated with scientific-technological and human resources, focusing on the development of sectors and fields of the City with advantages; constantly improving the material and spiritual life of the people.”

From the above development point of view, the socio-economic development objectives of HCMC are as follows:

Economic development

- The average economic growth rate shall be from 10% to 10.5% per year in the 2011-2015 periods, from 9.5% to 10% per year in the 2016-2020 periods and from 8.5% to 9% per year in the 2021-2025 periods.

- GDP per capita at actual price in 2015 reached 4,856- 4,967 USD, from 8,430- 8,822 USD by 2020 and 13,340- 14,285 USD by 2025. The average GDP per capita in 2011-2020 is expected to be 1.5 times higher than the national average.

Sociocultural development

- The population of HCMC was 8.2 million in 2015 and will reach 9.2 million by 2020 and 10 million by 2025 (excluding visitors and temporary residents under 6 months).

- Employment creation: in 2015, there were 120,000 new jobs created. By 2020, 125,000 new jobs will be created each year, and by the year 2025, 130,000 new jobs will be created.

- Reduction of poor households, increase of average households: In the end of 2013, the rate of poor households was basically reduced to less than 2% (under the criterion of average income of 12 million VND/ person/ year or less). In 2016, the City's poverty standard is at over 26 million VND/ person/ year, the number of poor households is equivalent to 7-8% of the City's total households. By 2020, HCMC is expected to have no poor households according to the above standards and basically no nearly-poor households with standard income of 16 million VND/ person/ year.

- To raise the quality of medical services: The number of doctors per 10,000 people in 2015 is 15 doctors, 20 doctors by 2020, and 20-25 doctors by 2025.

- To develop HCMC to be a highly-qualified cultural, educational, training and medical center on a par with developed countries in Southeast Asia.

Urban development

According to the Adjusted master plan for Ho Chi Minh City development by 2025, the City develop in a centralized and multi-polar model, the central area is the inner city with a radius of 15 km and 4 developing poles, specifically:

- To develop the city in the direction of multi-center with the integrated center in the old inner city and the city-level centers in 4 directions;

- To develop the city in 2 main directions: the East and the South to the sea, and 2 additional directions: the Northwest and the West, the Southwest;

- No development of urban areas in the strict conservation areas and ecological restoration areas in Can Gio mangrove nature reserve in Can Gio Biosphere Reserve, special-use forests and protection forests in Binh Chanh and Cu Chi District;

- To develop urban centers in association with the objectives of ensuring national defense and security.

The main indicators of urban development of HCMC are as follows:

- In the existing urban area: urban construction land is 31.6 m²/ person; residential land is 13.1 m²/ person; land of trees: 2.4 m²/ person; land for public works: 2.9 m²/ person;

- In the new urban development: urban construction land is 104 m²/ person; residential land is 38.4 m²/ person; land of trees is 7.1 m²/ person; land for public works is 4.6 m²/ person;

- Urban areas in the suburban districts: urban construction land is 110 m²/ person; residential land is 50 m²/ person; land of trees is 12 m²/ person; land for public works is 5 m²/ person.

2.2. INSTITUTION FOR CLIMATE CHANGE RESPONSE IN HO CHI MINH CITY

2.2.1. The administrative structure of the city

The position, property and function of the People's Committee at province level, district level, ward level and equivalent level are stipulated in Article 123 of the 1992 Constitution of the Socialist Republic of Vietnam and Article 2 of the Law on Organization of People's Councils and People's Committees: "The People's Committee, which is elected by the People's Council, is the executive office of the People's Council, the State administrative organ in the locality. It is responsible for the implementation of the Constitution, the laws, the written decisions of the State organs of higher levels and the resolutions of the People's Council of the same level"

In local level, therefore, the position and function of the People's Committee are shown in the following two points:

- The People's Committee is the executive body of the local bodies of state powers.

- As administrative agency in the locality, the People's Committee is the body performing the state administrative management function, implementing the resolutions of the People's Council of the same level and the written decisions of the State organs of higher levels.

The People's Committee has only one function which is administrative management as it is the primarily activity, covering the entire operation of the People's Committee. On the basis of ensuring the uniformity of laws, the People's Committees have the right to promulgate mechanisms and policies suited to the reality of their respective localities and create favorable conditions to encourage economic sectors to be developed and attract foreign investment. Departments, Boards are specialized agencies under the People's Committees of the provinces or special cities which belong to Central Government. These agencies advise and assist the provincial People's Committees in performing the function of state management in the fields of culture, social affairs, education, sport, economy and etc. The organizational structure of the departments includes Department Office, Inspection Office, professional divisions and non-business units belong to the department. Departments and Boards have powers and duties as follows:

- Submit to the provincial level People's Committee for promulgating decisions and directives to manage in all areas under the jurisdiction of the department or board in accordance with the law and the decentralization of the Ministry. Departments and Boards take responsibility for the content of submitted documents.

- Organize, guide, examine and take responsibility for organizing the implementation of legal documents in the locality including national strategies, master plans and plannings of socio-economic development in provincial area and issues relating to the development and implementation of master plans, plannings and use of resources for provincial socio-economic development.

2.2.2. Administrative organizational structure in Greenhouse gas management

Legal basis

- Decision No.4842/QD-UBND dated October 21st, 2009 of Ho Chi Minh City People's Committee on the establishment of the Steering Committee for the implementation of the Action Plan to respond to climate change;

- Decision No.2816/QD-UBND dated May 31st, 2012 of Ho Chi Minh City People's Committee on the establishment of the Ho Chi Minh City Climate Change Bureau;

- Decision No.38/2012/ QD-UBND dated August 21st, 2012 of Ho Chi Minh City People's Committee of the City on the promulgation of the Regulation on organization and operation of the Department of Natural Resources and Environment.

Accordingly, the state management apparatus in the field of climate change is organized into three groups as follows:

- **City level:** The City People's Committee is the highest governing body with the support of the Climate change Steering Board, including leaders of relevant departments in the City.

- **Level of Department, District People's Committees:** The HCMC Department of Natural Resources and Environment is the standing body of the Climate change Steering Board with its subordinate unit- the Ho Chi Minh City Change Climate Bureau is the focal point in coordinating with other Departments and District People's Committees to advise the City People's Committee on climate change management.

- **Relevant stakeholders:** Institutes, businesses and communities take essential roles in the organizational structure of climate change management to ensure successful implementation of projects.

In overall, Ho Chi Minh City accomplished a large amount of work in strengthening the human resource in climate change response such as (1) establish the Climate Change Steering Board in 2009 with the Chairman is also Chairman of the People's Committee of HCMC and all leaders of relevant departments; (2) establish a Working Group for this steering board in 2010 including officials in relevant departments to help the Steering Board in implementing the Climate Change Action Plan and solving related issues during the implementation; (3) establishing climate change working groups in departments in 2010 to coordinate in doing tasks relating to climate change response; (4) establish the Climate Change Bureau in 2012 to support the

Climate Change Steering Board and do the tasks of internal and international cooperation and (5) establish climate change working groups in 24 districts in HCMC (Figure 2).

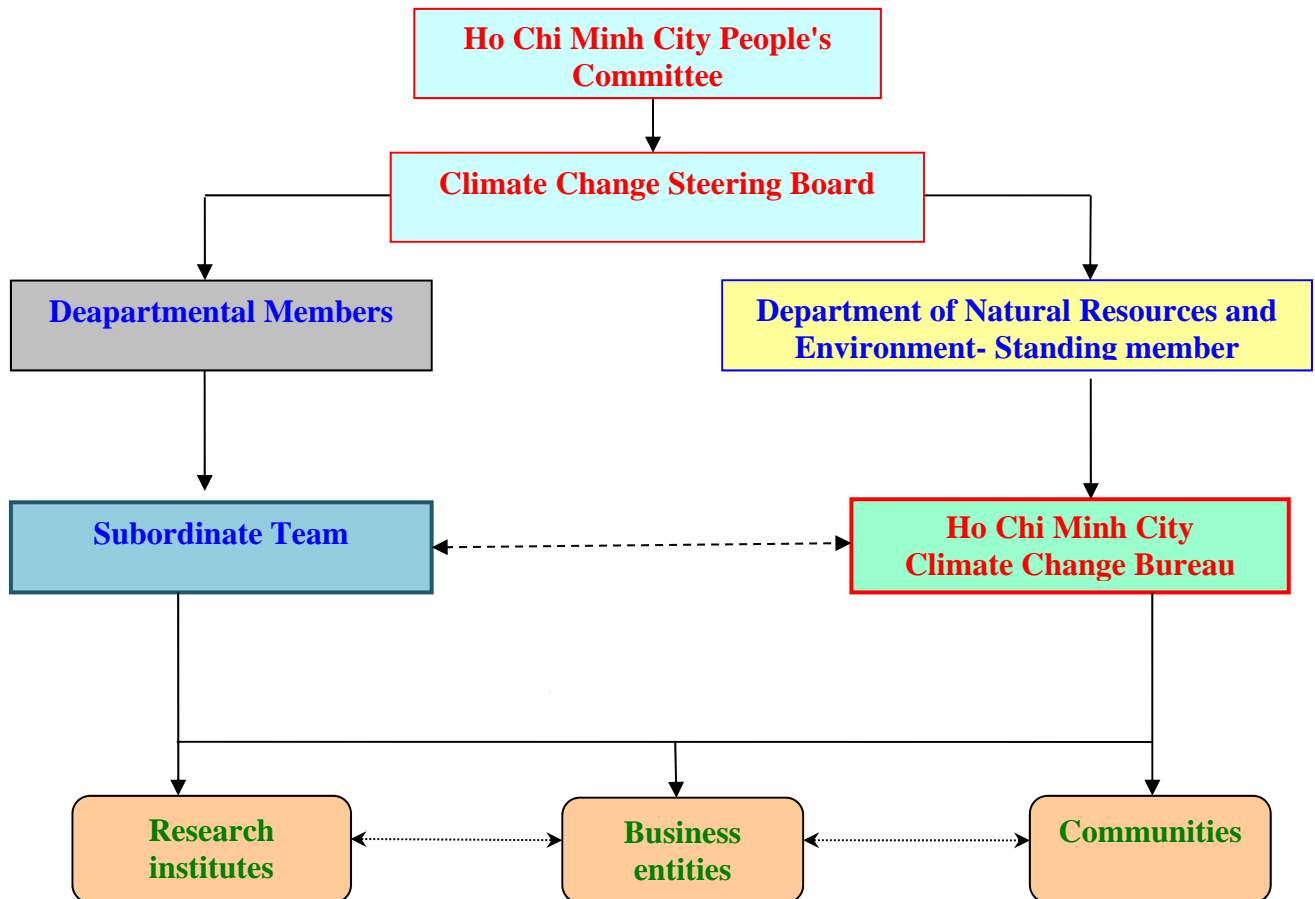


Figure 2. Administrative management organization of climate change in HCMC

The Climate Change Steering Board with the support of the Working Group has a task of advising and assisting the People’s Committee of HCMC in:

- (1) Organizing the implementation of guidelines and policies of the Communist Party and the Central Government in climate change response;
- (2) Organize the implementation of the national target programs and action plans of ministries in climate change response;
- (3) Research and develop the climate change action plan suitable with the conditions of HCM City;
- (4) Formulate policies to promote climate change mitigation, reducing GHG emission and sustainable development;

(5) Expanding and enhancing international cooperation to promote the transfer of technology, applied science and technique; taking advantages from the supports of technical and policy advices and financial sources from international organizations to help HCMC in increasing the capability of climate change adaptation and mitigation;

(6) Organizing the implementation of international cooperation programs and projects related to climate change response;

(7) Collect research information and solutions to cope with climate change in Vietnam and over the world and propose solutions for climate change response suitable with conditions in Ho Chi Minh City.

(8) Develop a plan for allocating capital from state budget, credit capital and mobilized capital from other lawful sources for implementation of programs, plans, projects relating to climate change response following the target and tasks of each period.

To create the favorable conditions and effectiveness in actions of the Steering Board, the Climate Change Bureau, which belongs to Department of Natural Resources and Environment, was established with the function of managing climate change response and international cooperation.

The Climate Change Bureau both assists the Department of Natural Resources and Environment, and assists the Steering Committee and coordinates the climate change network. At the same time, the Steering Committee has set up climate change working groups at various departments (2010) with 2-3 staff from each department. This staffs are the connection between the department and the climate change network to implement the climate change response tasks.

In addition, the Steering Board has established a climate change network by establishing climate working groups in departments and districts. The Steering Board has also linked with universities, research institutes, research centers and large enterprises to create a network with a team of experts in various fields and expertise to participate in the action of climate change response in the city.

2.3. PROGRAMS AND PROJECTS ON CLIMATE CHANGE RESPONSE

2.3.1. The National Target Program to respond to climate change in Ho Chi Minh City

In 2010, Ho Chi Minh City started to develop the Climate Change Action Plan in the area of HCMC until 2015 with financial support from MoNRE. The People's Committee of Ho Chi Minh City established this Action Plan on 15

May 2013. Accordingly, the objectives of the action plan to respond to climate change in the city until 2015 are: (1) Upgrading and improving the policies and mechanisms of managing, operating and guiding the implementation of Climate Change Action Plan in HCMC; (2) Strengthening the state management and linkages between departments and agencies in climate change response; (3) Assessing the magnitude and impact of climate change in HCMC and in each sector; (4) Increasing the public awareness in climate change response and (5) Identifying priority tasks and projects to adapt and mitigate climate change.

2.3.2. The Climate Change Action Plan in Ho Chi Minh City until 2015

3 groups of main tasks in the Climate Change Action Plan in Ho Chi Minh City until 2015 are identified including (1) Tasks of climate change adaptation, (2) Tasks of climate change mitigation and (3) Supporting tasks. After 2.5 years of implementing the Climate Change Action Plan in Ho Chi Minh City until 2015, Ho Chi Minh City has reached some initial achievements in climate change response, especially in raising awareness and propaganda programs and training programs in climate change response and international cooperation. The implementation of climate change adaptation/mitigation programs and projects in an annex of this action plan is still limited. Until the end of 2015, there are still a relatively small number of programs and projects that have not yet been allocated funds for implementation, specifically including some research programs, programs and projects in sector of health care, security and defense and some programs and projects in water resource management and agriculture. The main reasons of these difficulties in implementing programs and projects in the Climate Change Action Plan in Ho Chi Minh City until 2015 are determined as follows:

Firstly, the implementation period of the Climate Change Action Plan in Ho Chi Minh City until 2015 in only 2.5 years, which is a relatively short time as compared to one socio-economic development plan of provincial level.

Secondly, climate change is quite a new subject and needs an integration of different sectors and agencies so the application of response measures in each sector is still limited based on the fact that the legal provisions and guidelines for implementation at this period are still incomplete, especially in climate change mitigation.

Thirdly, capacity of the city staffs who work in the field of climate change response has been improved gradually in this period and the coordination between departments, agencies and stakeholders is still difficult due to lack of coordination mechanism.

Finally, the biggest obstacle in the implementation process of the Climate Change Action Plan in Ho Chi Minh City until 2015 is the budget allocated to implement the list of programs and projects. According to the Decision No.158/2008/QĐ-TTg dated 2 December 2008 of the Prime Minister on approval of the National Target Program to Respond to Climate Change, it is necessary to call for foreign financial supports to cover 50% of the total budget of the Program. The Climate Change Action Plan in Ho Chi Minh City until 2015 was developed with an ambitious list of programs and projects to be the premise for international cooperation in order to call for investment, which is similar to the National Target Program to respond to climate change. However, due to many unforeseen factors such as the economic crisis, the change of aid policy of partners and etc., the call for investment didn't achieved desired results. In addition, the city climate change response program has not received the priority in allocating national budget for climate change response as well as has not received funding from socialization due to lack of support from the business community. Furthermore, Thành phố Hồ Chí Minh City is still lack of specific mechanism to attract financial sources in private sector.

2.3.3. Program of “Ho Chi Minh City Moving Towards the Sea Adaptation to Climate Change” (cooperating with Rotterdam City, the Netherlands)

Under the framework of the Strategic Partnership Agreement between the Government of the Socialist Republic of Vietnam and the Government of the Netherlands, Ho Chi Minh City and Rotterdam City cooperated to develop and implement the Program of “Ho Chi Minh City Moving Towards the Sea Adaptation to Climate Change”. The objectives of this program are setting the orientation for the socio-economic development of Ho Chi Minh City towards the East Sea in a sustainable manner and adaptation to the impacts of climate change and developing the Climate Adaptation Strategy with specific recommendation for Ho Chi Minh City People's Committee in city spatial development and seaport development towards the sea.

Phase 1 of this program was being implemented from 2011 to 2013 with the participation of 6 departments including Department of Natural Resources and Environment, Department of Agriculture and Rural Development, Department of Zoning and Architecture, Department of Transport, Department of Construction and Steering Center for Flood Control together with a consultant team named Vietnam Climate Adaptation Partnership from the Netherlands. Results of Phase 1 are as follows:

- The Atlas of HCMC includes all relevant information, trends and background elements for city planning adapting to climate change;

- The Climate Adaptation Strategy for Ho Chi Minh City until 2100 describes 6 strategic directions which include technical interventions and additional measures to adapt to climate in HCMC. 6 direction strategies are suggested as follows:

- + Base development direction on soil and water conditions
- + Use a stepwise and multi scale approach for flood protection
- + Re-design the drainage system and use developments to create water storage
- + Combine flood protection measures with reduction of salt intrusion
- + Reduce subsidence by creating alternatives for groundwater use
- + Strengthen the blue-green network and ‘urban ventilation’ to reduce heat stress

- Action Plan for the implementation the Climate Adaptation Strategy for Ho Chi Minh City until 2100 in short, medium and long-term was developed based on institutional commitment, multi-stakeholder participation, guaranteed investment and specific implementation roadmap.

The Phase 2 of this program was being implemented from April 2014 to December 2015 with the participation of 9 departments and 2 districts. Results of Phase 2 includes a Guidance towards climate proof district master plans and one draft plan of climate adaptation ideas for District 4 as a prerequisite for the next cooperation phase. The contents of next phase of this program are being considered by the government of 2 cities.

2.3.4 Program of low-carbon city development (cooperating with Osaka City, Japan)

Since 2011, the Government of Japan has proposed the Joint Crediting Mechanism (JCM), a new mechanism to assist developing countries to achieve GHG emission reduction targets through the transfer of low carbon technologies. Through the agreement between 2 governments, the Ministry of Economy, Trade and Industry of Japan and the Ministry of Natural Resources and Environment of Vietnam signed a Memorandum of Understanding (MOU) on low-carbon growth in order to build an agreement between the two countries on JCM

After the International Conference on "Low Carbon Cities Development Program" held in Osaka on October 21, 2013 with the participation of the Chairman of the People's Committee of Ho Chi Minh City, Ho Chi Minh City and Osaka City jointly signed a MOU on Program of “Low-carbon city development” on October 22, 2013 with prioritized cooperation sector including integrated planning; energy efficiency; public transportation; sustainable water resource management (water supply and flooding control); integrated solid waste

treatment with energy recovery and industrial and domestic wastewater treatment on the ground that Osaka City supports Ho Chi Minh City in implementing projects follow JCM mechanism.

Following that, 2 cities has cooperated in developing some projects relating to waste treatment with energy recovery and trainings for capacity building for HCMC staff in low carbon development. Under the framework of this cooperation program, Osaka City also supported Ho Chi Minh City in developing the Climate Change Action Plan for 2017-2020 period with a vision to 2030. In this cooperation content, Osaka City is responsible for the outline of the project, GHG emission calculation and measures suggestion.

At the second Mayor's Dialogue between 2 cities on 6 November 2015, 2 cities presented cooperation results in 2011-2015 period and suggest cooperation content for 2016-2020 period. Accordingly, 2 cities will cooperate to improve capacity in implementing and managing the Climate Change Action Plan for 2017-2020 period and projects for low-carbon society in Ho Chi Minh City.

2.3.5 The SPI-NAMA project

The SPI-NAMA project was approved at the Decision No. 1911/QD-BTNMT of the Ministry of Natural Resources and Environment, dated July 29th, 2015, in which Ho Chi Minh City (HCMC) was selected as the model city to develop an MRV style necessary for planning, implementation and management of country-level mitigation actions (NAMAs) at the city level as part of the SPI-NAMA project which aims to:

- To take HCMC as a pilot to support the capacity building of local organizations, capacity of staff to be able to continuously identify emissions and reduce greenhouse gas emissions.
- To develop and propose MRV processes at the city and local level to be widely deployed in Vietnam.
- To develop and implement training materials for capacity building in other localities, and develop, implement and manage NAMAs in Vietnam.

SPI-NAMA project in HCMC has been implemented from 2015 to the end of 2017 and assigned by the City People's Committee to the Department of Natural Resources and Environment in collaboration with Department of Hydro-Meteorology and Climate Change, to implement the activities of the Project in accordance with the direction in the Official Letter No. 11080/VP-DTMT dated November 17th, 2015 of the City People's Committee on the implementation of Project to Support the Planning and Implementation of NAMAs in a MRV Manner (SPI-NAMA) in HCMC.

2.4. ASSESSMENT ON THE SYSTEM OF LEGAL DOCUMENTS ON CLIMATE CHANGE RESPONSE

2.4.1. List of important legal regulations

The Constitution of 2013 of the Socialist Republic of Vietnam has the principle of environmental protection as Article 43 states "Everyone has the right to live in a healthy environment and is obliged to protect about environment." In this latest constitution, issue of climate change response has been mentioned for the first time at Clause 1 Article 63 in Chapter III of the Socio-Economy, Culture, Education, Science, Technology and Environment as follows: "The Government adopts policies to protect environment; manage and sustainably, efficiently use natural resources; conserve nature, biodiversity; actively prepare and prevent natural disasters **and respond to climate change.**"

There is no specific law on climate change response in the Vietnamese legal document system so that Law on Environmental Protection 2014 is considered to have a central position in responding to climate change. With Chapter IV on climate change response, for the first time, climate change response has been legislated in close relation with environmental protection. In this chapter, the content of GHG emission management is stipulated at Clause 1 Article 41 as follows:

"1. The content of GHG emission management includes:

- a) Develop a national system of GHG inventory;
- b) Implement GHG mitigation actions suitable with the socio-economic conditions;
- c) Sustainable management of forest resources, conservation and enhancement of forest carbon stocks, protection and development of ecosystems;
- d) Monitor and inspect the compliance of with regulations on GHG inventory and GHG mitigation;
- e) Develop the internal carbon credit market and participate in worldwide carbon credit market;
- f) International cooperation in GHG mitigation."

The regulation on GHG emission management in Article 41 of the Environmental Protection Law 2014 is only of fundamental nature and principle, which has position as a legal basis for the development of specific programs, plans and projects for GHG mitigation in Vietnam. In relation to operational documents to implement GHG management and mitigation actions, these documents are listed in the chronological order as follows:

- In 2008, the Government of Vietnam approved the National Target Program to Respond to Climate Change (NTP-RCC) to assess the impacts of climate change and develop solutions to adapt to climate change and mitigate climate change by reducing GHG emissions.

- In 2011, climate change response has been placed in national strategic level with the approval of the National Strategy of Climate Change (issued at the Decision No.2139/QD-TTg dated 05/12/2011 of the Prime Minister). The National Strategy of Climate Change identified objectives for period of 2011-2015 and 2016-2050 and prioritization projects being implemented in the period of 2011-2015. The Strategy identifies climate change adaptation is a vital issue; climate change response must be linked to sustainable development, towards a low carbon economy, taking advantage of opportunities to improve national competitiveness and national position. The Strategy indicates that Vietnam should implement simultaneously both adaptation actions and mitigation actions; in which adaptation is central point. GHG mitigation contributes to protecting the global climate system is identified as one of key tasks in the Strategy and solutions to achieve this task focus on developing renewable energy and new energy sources; energy saving and energy use efficiency; reduce GHG emission in agriculture and waste management.

- In 2012, National Strategy of Green Growth was approved, which identifies the target of GHG mitigation and implementing measures; promulgating regulations on linkages to specific international carbon markets. In specific, for a period of 2010-2020 “reduce the GHG emission intensity from 8 to 10% as compared with 2010 level, reduce the energy consumption per GDP by about 1-1.5% per year.”

- Also in 2012, the National Climate Change Action Plan for a period of 2012-2020 was approved at the Decision No.1474/QD-TTg dated 05/10/2012 of the Prime Minister, in which 5 groups of key tasks need to be implemented from 2012 to 2020 have been identified including: (i) Strengthen the capacity of climate monitoring, early warning for natural disasters, ensure food and water security; actively respond to natural disaster, prevent flooding for major cities; reinforce river dykes, sea dykes and increase reservoir safety; (ii) Mitigate GHG emission, develop the economy toward low-carbon development; (iii) Strengthen the capacity of management and improve climate change mechanisms and policies; Mobilize the participation of economic sectors, scientific organizations, social and politic as well as professional organizations and non-governmental organizations in responding to climate change; build a well climate change resilient community; awareness raising and human resource development; (iv) Develop science and technology as the basis for policy formulation, impact

assessment, identification of adaptation and mitigation measures; (v) International cooperation, raising the position and role of Vietnam in international activities on climate change response; Mobilize resources and finance to cope with climate change.

- The Decision No.1775/QD-TTg dated 21/11/2012 of the Prime Minister on approval the Project on GHG emission management and management of carbon trading activities on the world market identifies a target of 2020 is reduce 8% of GHG emission in energy and transportation sector; 20% of GHG emission in agriculture; 5% of GHG emission in waste management; increase GHG absorption by 20% in land use, land use change, and forestry compared to BAU scenarios (Business-As-Usual).

- In 2015, the Prime Minister approves the Decision No.2359/QD-TTg on approval of the national system of GHG inventory. This Decision set up overall objectives including developing the national system of GHG inventory, creating a legal basis for work of GHG inventory in Vietnam, compliance with current regulations of Vietnam relating to climate change response, meet the requirements and obligations of a member participating the UNFCCC.

- In 2016, the Plan for Implementation of the Paris Agreement on climate change approved by the Prime Minister at the Decision No.2053/QD-TTg dated 28 October 2016 including groups of tasks as follows: (i) The task of mitigating GHG emissions for 2 periods 2016-2020 and 2021-2030; (ii) The task of climate change adaptation for 2 periods 2016-2020 and 2021-2030; (iii) The task to prepare the resources; (iv) The task of developing MRV system and (iv) The task of developing and improving policies and institutions. On 08/02/2017, the Prime Minister established the Official Letter No. 199/TT-QHQT to direct the implementation of results of COP22. In this official letter, a content relating to the provinces and cities under the central government is as follows: “To assign ministries and localities to develop specific plan to implement the tasks given at the Decision No.2053/QD-TTg dated 28/10/2016 of the Prime Minister on approval the Plan for Implementation of the Paris Agreement on climate change; actively integrate actions for climate change response into investment plans and socio-economic development plans, ...”

At a city level, the task of implementation of mitigation actions has been raised in the Action Plan for the implementation of the Action Program No.34-CTrHD/TU of the Communist’s Party Committee of HCM City and implementation of the Resolution No 08 / NQ-CP of the Government to implement the Resolution No. 24-NQ /TW of the 7th Conference of the Central Committee of Communist Party session XI on actively responding to climate change, strengthening resource management and environmental protection (at

the Decision No.2838/QD-UBND dated 11/6/2014) and the Climate Change Action Plan of Ho Chi Minh City for the period of 2017-2020, with a vision to 2030 (at the Decision No.1159/QD-UBND dated 17/3/2017). In particular, the task of developing a system of legal documents on GHG inventory and MRV procedure for mitigation action at city level is included in Appendix 1. A list of short-term programs and projects using the city's budget for the period 2017-2020 (*attached with the Decision No.1159/QD-UBND dated 17/3/2017 on approval of the Climate Change Action Plan of Ho Chi Minh City for the period of 2017-2020, with a vision to 2030*).

2.4.2. Short review

For over the past decade, Vietnam has been gradually improving the system of policies and regulations on responding to climate change (both adaptation and mitigation). The National Assembly of Vietnam has paid attention to building and promulgating policies and laws related to natural disaster prevention and mitigation and response to climate change. Climate change response has been constituted in the Constitution of 2013 of the Socialist Republic of Vietnam with the regulations on the responsibility of the Government to proactively prevent natural disasters and respond to climate change. Climate change response is also legally defined in Chapter IV of the Law on Environmental Protection in 2014. The content of GHG management is stipulated in Clause 1 of Article 41 of this Law.

However, as the Resolution No. 24-NQ /TW of the 7th Conference of the Central Committee of Communist Party session XI has identified: “climate change adaptation, active disaster prevention and preparedness is a focusing point”, the Government has issued relating regulations and policies, which focus on climate change adaptation and disaster prevention and preparedness. Although climate change mitigation has been mentioned in many legal documents such as steering documents to implement the UNFCCC and Kyoto Protocol, National Target Program for Responding to Climate Change, National Strategy of Climate Change, Green Growth National Strategy, the National Climate Change Action Plan for a period of 2012-2020, the Project on GHG emission management and management of carbon trading activities on the world market, etc. and recently the Plan for Implementation of the Paris Agreement on climate change has been approved by the Prime Minister in October 2016 but specific regulations and guidance relating to GHG inventory and MRV procedure at city level haven't been developed. This is a great impediment to the implementation of solutions and measures at above documents, especially the Plan for Implementation of the Paris Agreement on climate change.

As the leading socio-economic center in Vietnam, Ho Chi Minh City has established 2 action plans to implement climate change response. GHG inventory and developing legal documents on implementation of MRV procedure in the city area are two tasks listed in the Climate Change Action Plan of Ho Chi Minh City for the period of 2017-2020, with a vision to 2030. Recently, HCMC has established the Plan for implementation of National Green Growth Strategy in HCMC until 2020 at the Decision No.3544/QD-UBND dated 7 July 2017 of HCMC People's Committee. There are issues related to the reduction of GHG emissions in production, energy consumption and traffic in this Plan.

Thus, HCMC has promulgated clear directions and policy in GHG emissions reduction. In order to implement these directions and policy effectively, the city needs to develop and approve city-level legal framework to implement national target set in the Plan for implementation the Paris Agreement on climate change in general and implement mitigation actions in the area of HCMC in detail.

PART 3

POTENTIAL POLICY INSTRUMENTS TO IMPROVE ENGAGEMENT INTO THE IMPLEMENTATION PROCESS OF NAMAs

3.1. POTENTIAL POLICY INSTRUMENTS TO IMPROVE ENGAGEMENT INTO MEASUREMENT- REPORTING- VERIFICATION PROCESS

According to the Organization for Economic Co-operation and Development (OECD, 2015), a new approach for climate policies to achieve agreed targets from global to local levels has been formed around the following pillars as follows:

- **GHG pricing:** This is considered as one of the major pillar to promote low-carbon economies. Developing policies basing on market rules will bring in incentives to reduce GHGs when every emitting activity costs.

- **Regulations:** Where market-based mechanisms fail to overcome existing barriers or transaction costs, regulations are in need. This scope is the most usual for household sector and regulations can be in form of emission performance standards or energy efficiency encouragement.

- **Technology support:** This group refers to low-carbon technology promotion mostly popular in form of technology transfer for carbon offsetting.

Under the limit of resources and scale of this consultant service, a preliminary analysis of commonly used policy instruments has been conducted as the followings:

3.1.1. Market-based policy instruments

In market-based policy instruments, 3 carbon trading systems were analyzed including: (1) EU Emission Trading System (EU ETS) – the first major and biggest market in the world; (2) Tokyo Metropolitan Government’s Cap-and-Trade scheme – a role model for Asian cities; (3) China’s Emission Trading System – a programme designed basing on the lessons learnt from Western carbon markets to apply to such a special economy as China, which shares some similarities with Vietnam.

3.1.1.1 EU Emission Trading System

EU ETS is the first and longest lasting carbon market in the world with 31 national members (28 EU members plus Iceland, Liechtenstein and Norway), accounting for 45% of the GHG emission amount in Europe (European

Commission, 2014). The following information is summarized from the EU ETS Handbook of European Commission (EC).

Operation mechanism of EU ETS: EU ETS is developed to be implemented in four periods: the 1st period from 2005-2007; the 2nd period from 2008-2012; the 3rd period from 2013-2020; and the 4th period from 2021 onward. EU ETS is operated basing on “cap-and-trade” principle. EU determines emission caps, which are gradually decreased over time since the 3rd period, for the region. Within those caps, emitters are allocated with emission allowances for free or via auctioning, and they can also sell their unused allowances. In other words, “emission allowances” are a kind of currency in EU ETS and they have values since the total number of allowances is limited and decreased over time. Each allowance equals allows the holder to emit one ton CO_{2eq}. At the end of emission accounting, businesses have to prove that they possess adequate allowances equivalent to their emission amounts in that year.

Scope of EU ETS: From the 3rd period onward, EU ETS covers over 11,000 installations having high energy consumption level, including power production installations and incinerators whose input thermal capacity is over 20MW (excluding hazardous waste and municipal waste incinerators). EU ETS also includes aviation sector but only covers domestic flights within the European Economic Area (EEA) until 2016.

Emission cap and allowance: In the 1st and 2nd periods, the annual caps were even for the whole each period, but from the 3rd period onward, the cap will be decreased over time during the period with a linear ratio at 1.74% compared to the base year 2010.

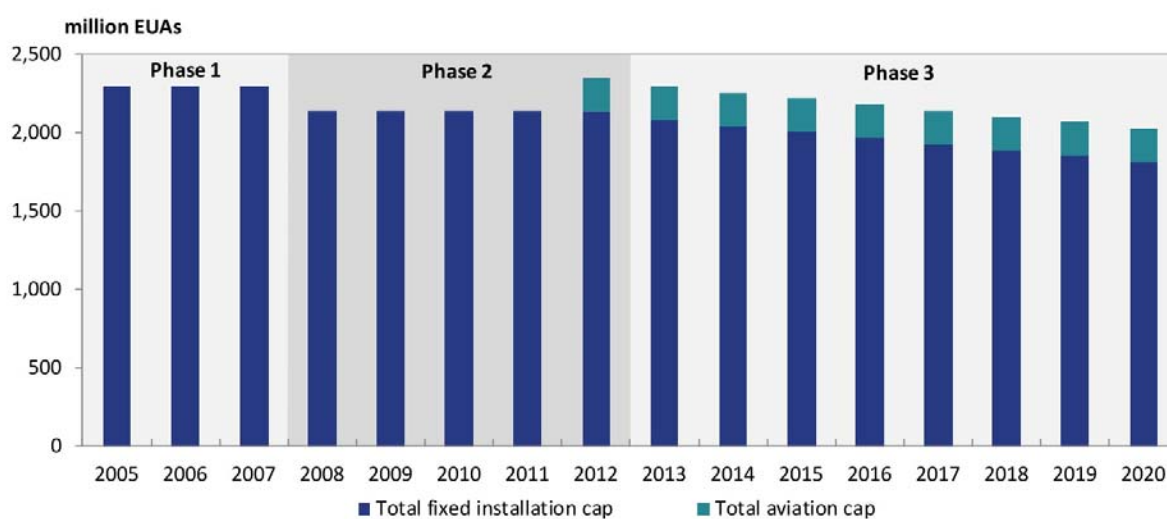


Figure 3. Emission caps in EU ETS over periods
(European Commission, 2012)

Equivalently to the change in emission cap setting, emission allowance allocation method in the 3rd period has also been changed. While in the 1st and 2nd periods, most of the allowances were allocated for free, the default allocation method in the 3rd period is auctioning which aligns with polluter-pay principle. However, to guarantee necessary needs for technology development during transitional period, particularly for new participants, in the 3rd period there is 43% of the allowances are allocated for free. Besides, EU is also concerned about the risks of carbon leakage situations in which businesses tend to relocate their emissions to other countries outside the scope of EU ETS, where strict environmental and pollution controlling regulations are inadequate or even absent, to save costs compared to implementing in-situ emission reduction measures. Such leakage will end up increasing their actual total emission amounts. Consequently, EU ETS establishes a list of sectors and sub-sectors with high risk of carbon leakage for free emission allowance allocation to avoid exporting emissions to other countries, as well as create incentives for them to develop their own roadmaps to apply low-carbon technology.

Compliance: EU ETS guarantees the compliance of participants via a strict procedure:

- Businesses shall monitor and report GHG emissions annually and surrender emission allowances equivalent to their emission amounts in that year. A certified verifying unit will check those reports.

- In case businesses fail to provide enough allowances, they are penalized with the following actions: must buy enough emission allowances to cover the short-fall amount, have their names public, and pay the fine for every exceeded ton CO_{2eq} (the fine rate in 2013 is €100/tCO_{2eq} and increased every year according to European CPI).

- A single Union Registry conducts emission allowances accounting and monitor allowance trading activities. The Union Registry is operated as a bank with emission allowances as currency. It allows any business to register an account to buy or sell emission allowances.

Carbon pricing: Via EU ETS, the price for every emission allowance is determined according to supply/demand similarly to other trading markets. The emission cap is fixed every year, equivalent to a fixed number of emission allowances. Additionally, the number of free allocated allowances is also decreased by year. Consequently, the supply is always lower than the demand, and this hence increases carbon price over time if businesses are slow or fail to develop low-carbon technology or mitigation measures to reduce their own GHG emissions.

Low-carbon technology promotion effects: EU ETS aims to promoting low-carbon technology via the following two approaches:

- Thank to the increasing carbon prices in parallel with the decline of free emission allowance allocation, businesses have to switch to low-carbon technology and implement mitigation measures to limit the purchase of emission allowances.

- Revenue from the sale of emission allowances is funded to NER300 Programme for co-financing large-scaled modal projects in two low-carbon sectors: (i) carbon capture and storage; (ii) advanced renewable energy technologies.

3.1.1.2 Tokyo Cap-and-Trade Programme

Unlike EU ETS and RGGI (Regional Greenhouse Gas Initiative) which aim directly to the initial sources of emissions, Tokyo cap-and-trade programme reaches to the “end-of-pipe” consumers - large-scale office and commercial buildings. This is considered to complement the puzzle of GHG emissions reduction efforts with both upstream and downstream approaches (Tokyo Metropolitan Government, 2010). The following briefing on this Programme is summarized from a document published by Tokyo Metropolitan Government (TMG) (Tokyo Metropolitan Government, 2010) and information posted by TMG on the website of C40 (Tokyo Metropolitan Government, 2011) in which Tokyo is a member.

Cap coverage:

- Sectors: industrial and commercial installations.
- Objects: installations with energy consumption levels at 1.500 kl (oil equivalent) per annum or more.

Emission cap: Emission caps of this Programme are determined by absolute values based on emission reduction targets of Tokyo City (25% reduction by 2020 compared to 2000 level).

Compliance period: Compliance period of this Programme is based on five year basis and emission reduction targets are calculated by the total emission amount in five years. The first compliance period is from the FY2010 to FY2014 (emission reduction target for large-scaled businesses is 6% in five years); the second period is from FY2015 to FY2019 (reduction target is 17%).

Emission allowance allocation method: Emission allowances are allocated by the following formula:

$$\text{Allowances} = \text{Base year emission} \times \text{Compliance factor} \times \text{Compliance period (5 years)}$$

“Base year emission”: the average of GHG emissions in three continuous years within the period from FY2002 to FY2007.

“Compliance factor”: In the first period, it is 6% for installations consuming energy from heating and cooling plants in districts and 8% for other installations. In the second period, installations evaluated as having outstanding progress in applying mitigation measures will be considered to reduce compliance factor by 1/2 or 2/3.

Emission allowance bank: This Programme includes establishing banking mechanism in which businesses can trade their unused emission allowances in the same fiscal, or deposit to the bank for later use in the next fiscal year. However, emission allowance bank does not allow loan service as normal financial banks.

Carbon offset mechanism (a solution to promoting GHG reduction for emitters outside the scope of Cap-and-Trade Programme): This is an extended mechanism of the Programme besides cap-and-trade mechanism to improve the flexibility for participants, allowing them to seek for additional opportunities to meet emission reduction targets beyond the scope of the Programme. Furthermore, offsetting mechanism is also helpful to expand the Programmer’s effect to emitters outside the Programmer’s scope. There are three carbon offset methods accepted by Tokyo Cap-and-Trade Programme:

(i) Buying GHG emission reductions from medium- and small-scaled businesses in Tokyo with the following conditions:

- reductions generated from energy-efficiency measures
- unlimited purchase

This mechanism would help to encourage medium- and small-scaled businesses (accounting for a large portion in the market) to strengthen their energy-efficiency measures so that they can get profit from selling emission reductions to the large-scaled businesses of Cap-and-Trade Programme.

(ii) Buying credits in form of Renewable Energy Certificates (another system in Japan to promote renewable energy production) with the following condition:

- Certificates granted for solar energy (heating and lighting), wind power, geothermal energy, hydropower (less than 1000kW), biomass energy (biomass ratio larger than 95% or more).

(iii) Reducing GHG emissions from outside Tokyo’s boundary:

- Coverage: large installations with base year emissions less than 150,000 tons.

- Large installations planning to participate in Cap-and-Trade Programme and having emission reduction levels lower than the cap requirement will be considered for carbon offset.
- However, businesses are allowed to buy maximum 1/3 of their base year emissions to guarantee promoting mitigation efforts within Tokyo's boundary.

Measurement and verification: TMG has published the guidance documents for implementation. Accordingly, participants shall report their verified GHG emissions to TMG per annum. Verification is conducted by a unit certified by TMG Governor.

Actions against violation: Installations fail to reduce their emissions under the cap shall receive the following obligations:

- Shall reduce further 1.3 times of the short-fall reduction amount.
- Pay the fine of 500,000 Yen.
- Violation shall be public.
- TMG Governor will purchase the short-fall credits but the violated business shall pay.

3.1.1.3 China's Emission Trading System

As the biggest carbon emitter in the world, China is making great efforts to develop carbon trading markets to set prices for domestic carbon credits (Han, Olsson, Hallding, & Lunsford, 2012). Han *et al.* (2012) mention that awarding of the close relationship between energy, climate change mitigation and economic growth, Chinese government has set ambitious policies for energy and climate change response in their 11th Five-year Plan (2006-2010) with many stringent control measures from central government to local authorities. Afterwards, following the success of the 11th Five-year Plan, along with the pressures from international communities requiring China to have commitment for concrete carbon reduction targets as well as energy security issues, Chinese government is heading to market-based instruments, including carbon trading mechanisms, to reduce energy consumption intensity and carbon emissions of its economy. In specifically, the target by 2015 is to establish domestic carbon trading system (as a component in the 12th Five-year Plan 2011-2015).

The following information on China's emission trading system (ETS) is summarized from a report of Swartz (2016) for the International Centre for Trade and Sustainable Development (ICTSD) - China's National Emissions Trading System: Implications for Carbon Markets and Trade. According to Swartz (2016), after involving in CDM under Kyoto Protocol, China has conducted the pilots for their domestic emission trading system (ETS)

commencing from October 2011 until 31 July 2015. The pilots involved five cities and two provinces (Beijing, Tianjin, Shanghai, Hubei, Chongqing, Guangdong and Shenzhen) who account for 26.7% of China's 2014 GDP. The pilots have resulted in 57 million tonnes of carbon traded. All seven pilots have been locally designed by a tripartite collaboration framework consisting of local Development and Reform Commission's (DRCs), local emissions trading exchanges, and prestigious academic experts. They have set different emissions reduction targets (intensity-based), emissions compliance thresholds, cap coverage's, and baseline years.

After the pilot period, on 19 June 2016, the National Development and Renovation Commission (NDRC) promulgated the circular to provide guidance for national ETS operation with the following main points (Swartz, 2016):

Scope: All businesses consuming more than 10,000 tons coal equivalent per annum in the sectors namely energy, industrial manufacture and aviation similarly to EU ETS.

Emission allowance: Emission reduction targets of Chinese ETS are identified in form of “carbon intensity” in the economy which is different from those in form of absolute GHG reduction amount in EU and Tokyo. In other words, while EU and Tokyo aim to reduce the amount of GHG emissions, China commits to reduce the ration of carbon emissions in economic growth rates. Such difference implies that Chinese ETS does not mean to reduce manufacturing growth rates. NDRC will set the total amount of emission allowances, including those preserved for market stabilisation and newly participating businesses or renovation fund.

Emission allowance allocation methods: Chinese ETS applies hybrid allocation mechanism – both free allocation and auctioning. Unlike EU ETS, major mechanism in Chinese ETS is free allocation in initial period to limit “carbon leakage” as the lesson learnt from the EU and moving gradually towards auctioning after 2020. However, as still in the early operation period, Chinese government is granting abundant free allowances (emission permits); making the liquidity of carbon credits very low and hence the carbon markets are not effectively operated. NDRC operates the national registry office. Revenue from emission allowance auctioning would be used for renovation fund.

Measurement – Reporting – Verification (MRV): MRV procedure is implemented to operate ETS effectively. NDRC nominates verifying units to implement MRV services, while the units within ETS's scope have to submit annual reports to provincial DRCs.

Carbon off-setting: Units within ETS's scope are allowed to conduct carbon off-setting for certified emission reductions (CERs) only with domestic Chinese CERs.

In overall, if placed in an overall climate change mitigation picture of a country or a local authority, MRV procedures would provide data flows to operate policy components including carbon trading systems. On the other hand, potential profits from ETS would create incentives for carbon emitters to implement MRV procedures so as to commercialize their GHG emissions reduction efforts. However, in this relationship, MRV procedures are the prerequisite for ETS operation. In other words, policy-makers would need to orient the overall roadmaps to develop climate change mitigation policy systems so that stakeholders are provided with various anticipated options and benefits, including potential profits generated from mitigation actions, that they may get when implementing MRV procedures.

Although ETS, in theory, is considered as the instrument that can create economic benefits for climate change mitigation via commercialising achieved efforts, current ETS models in the world have not yet been as fruitful in GHG emissions reduction as expected and have even been enduring global carbon market crisis since 2011 (Warnecke & Day, 2015). According to Warnecke and Day (2015), this decline does not only cause the steady drop of carbon prices but also has profound impacts on on-going CDM projects. For such a young market economy as Vietnam, developing a new form of market, i.e. carbon market, may both create new investment opportunities and bring along significant risks for the economy.

Besides, the procedure to establish a comprehensive and complete carbon trading market, including registry and database management systems, is very complicated and requires significant resources. With the existing capacity of Vietnam in general as well as Ho Chi Minh City, establishing a GHG emission trading system is not suitable at present time. Nonetheless, in long-term vision with the presence of GHG database, the orientation towards developing a GHG emission trading system for some major emitting sectors such as energy and industrial processes would be a meaningful supplementing component in climate change response policy system that would support big businesses in Vietnam to gain profits from making mitigation efforts and partly compensating technology innovation costs as well. However, this is only one of many policy alternatives for city governments to promote mitigation actions for some major emitters and they should not rely completely on this model.

3.1.2. Regulations

This group includes demand and control instruments, for instance, regulations on emission standards, energy consumption, etc. to reduce GHG emissions through modifying behaviors (or habits) and demands of energy consumers. In this group, 2 instruments were selected to evaluate including (1) Model of city carbon budget and (2) Integrated with mandatory administration instruments

3.1.2.1 *City carbon budgets*

Mitigation measures to reduce GHG emissions in transport sector and energy consumption in buildings are essential and have been implemented widely in many cities. However, Salon et al. (2010) argues that the discrepancies and competitive advantage lost between cities (in a country) may happen if those measures are not implemented equally in for all. Consequently, they suggest a policy framework namely “**city carbon budget**” to solve this puzzle by introducing requirements and incentive terms to promote mitigation actions at local level in a flexible manner.

The approach of the conceptual framework “city carbon budget” is that the central government would allocate “carbon budgets”, i.e. emission reduction targets (possibly for sectors), to local authorities. Accordingly, local authorities shall implement mitigation measures to ensure that their GHG emissions do not exceed the allocated budgets. Carbon budget allocation believed to guarantee the best equity possible is to set the same further reduction percentage for all local authorities but based on their different base year emissions per capita (Salon et al., 2010). On the one hand, such method accounts for the differences between local authorities in terms of scales and growth rates reflected via the amount of emissions per capita. On the other hand, the equity is ensured by setting the same further reduction percentage from base year emissions for all. It means that bigger cities with bigger emissions would still have to be responsible for higher reduction targets in absolute values.

The core requirement of “city carbon budget” model is comprehensive and highly accurate GHG inventory results. Nevertheless, developing a complete and reliable GHG inventory system is very difficult particularly for such developing states as Vietnam who has not had a synchronized and effective GHG database management system. Therefore, Salon et al. (2010) suggest to select certain major emitting sectors that are possible to obtain GHG inventory results with high accuracy to implement “city carbon budget” model instead of applying widely for all sectors.

The recommended “city carbon budget” model also concerns of using emission allowances for *depositing, loaning, and trading* (Salon et al., 2010) However, unlike other market-based instruments, “city carbon budget” model does not directly set prices for carbon emissions. The number of emission allowances equals to the amount of budget allocated for a local authority. If the local authority has not used up its budget, i.e. emitting less than the target, it can deposit the remaining budget into the “bank” for future use. Such deposit is limitless. On the contrary, in case the local authority emits more than the target, i.e. over-uses the budget, it can loan a part of future budget for the present use. However, the loan amount is limited to avoid unplayable accumulated “debts” because its carbon budget would be decreased gradually by years. In other words, the “city carbon budget” model differs from emission trading mechanism using monetary value in the way that its depositing and loaning mechanisms are not monetarily based but aim to balance emission levels at present and future times of the local authority itself. Besides, emission trading mechanism in “city carbon budget” is operated similarly to other emission trading systems analyzed above.

Regarding to *compliance guarantee* measures, Salon *et al.* (2010) insist that penalties are normally not highly effective but, on the contrary, may widen the distance and loosen the cooperative willingness between local authorities and central governments. In light of this thought, “city carbon budget” model is in favour of encouraging approach at first before seeking to penalty as an exhaustive option. Salon’s research team (2010) suggests to integrate infrastructure development funding schemes into “city carbon budget” model in the way to maintain or increase the funding amount according to the respective compliance levels of local authorities. This approach touches directly to the development demands of local authorities, so it is believed to produce higher compliance incentives. However, in case that some local authorities could manage a great part of their development financing by themselves and do not comply with their allocated GHG reduction targets/budgets, existing funding sources from the central government would be reconsidered to reduce significantly in the first year of non-compliance. If the non-compliance is maintained to the following years, penalties would be applied in form of funding cut or direct fines.

An example closing to “city carbon budget” concept is California Senate Bill 375 (SB 375) published in 2008. SB 375 requires regions in California to develop Sustainable Community Strategies in their transport planning which shall include GHG emissions reduction measures from transport sector with specific reduction targets. In other words, GHG emissions reduction targets are required to be integrated in local sectorial development plans by a higher government level who has the jurisdiction to allocate budgets for those lower

authorities. However, Salon *et al.* (2010) points out the weakness of SB 375 that it lays the GHG emissions reduction responsibility on sub-regional authorities who lack jurisdiction in land-use planning modification so that it would be difficult to establish long-termed and large-scaled transport development plans with high emissions reduction effects; besides, it also lacks requirements for implementation.

City carbon budget concept is especially promising in developing countries since it can improve the potential access to climate funding sources under the pressure of commitments to United Nations Framework Convention on Climate Change (UNFCCC) (Salon *et al.*, 2010).

Considerations on application potential in Vietnam and Ho Chi Minh City:

Although named “city carbon budget”, this policy framework is only operated effectively when placed within a multilevel governance system from central government to local authorities because each governance level would play a different role, possessing a different jurisdiction scope to implement different components of the framework. In addition, reliable database systems with the best detailed level possible are also a prerequisite to establish this policy framework. Particularly, GHG inventory database is crucial to form the foundation as well as monitoring instrument for policy operation performance, and estimating reduction target achievement potentials in the future as “city carbon budget” model also includes loaning future emission budgets to pay for the current emissions.

While ETS create incentives via direct economic profits for emitters, i.e. businesses, when implementing MRV procedures, “city carbon budget” concepts create incentives for local authorities via potential access to development funding sources. Consequently, this model may indirectly eclogue the engagement of businesses and communities at local level in mitigation actions and proving their achievements via MRV procedures. Furthermore, apart from the benefits, this model would also place a pressure on local authorities via emissions reduction targets to force them pro-actively implement internal stringent governance measures to achieve the missions. It means that “city carbon budget” model is a policy option that can link the responsibilities of public sector and private sector, connecting interwoven benefits in communities at different levels. This would partly be compatible with public-private-partnership orientation in Vietnam as well as Ho Chi Minh City.

In terms of institution, this model could possibly be integrated into existing administration systems for some major GHG emitting sectors such as energy, transport, and industrial processes. At present, the policy systems of

Vietnam in those sectors have also made certain steps towards climate change mitigation actions and GHG database development. Therefore, it would be feasible to conduct pilot projects with suitable agenda for some local authorities (aiming to biggest cities first), allocating GHG emissions reduction targets for some sectors together with low-carbon technology development funding packages. Nonetheless, similarly to ETS, “city carbon budget” model also requires huge efforts and resources to be established and effectively operated, especially with the availability of comprehensive platforms or systems for carbon database management, GHG inventories, and GHG emissions reduction potential forecasting. This means that GHG inventory systems need to be developed and operated effectively firstly to serve as the foundation for other policy components in the overall climate change response policy system.

3.1.2.2 Integrated with mandatory administration instruments

Where market-based instruments cannot function effectively, the presence of mandatory administration instruments is necessary (Spulber, 1989 cited in Shen et al., 2016), especially in short-term periods or in case of crisis management (Rosenthal and Kouzmin, 1997 cited in Shen et al., 2016). Mandatory management instruments include laws, regulations and standards. These instruments are particularly important in the field of energy efficiency, which is considered to be the most cost-effective way of reducing GHG emissions (Hood, 2011).

Regulations and standards to improve the efficiency of energy and resources use, environmentally-friendliness in buildings, construction and transport activities are globally ubiquitous, even in developing countries such as Vietnam. Vietnam itself has also promulgated relevant legal basis such as the Law of Energy Saving and Efficiency (Law numbered 50/2010/QH12 on 28/6/2010); the Circular on National Technical Standards for “Energy Efficient Use in Constructions” (Circular numbered 15/2013/TT-BXD on 26/9/2013 of the Ministry of Construction) etc. together with regulations on energy accountancies, reporting requirements, database management development. This basis would form the initial frame for MRV procedures in those sectors and provide compliance incentives for stakeholders.

Linking MRV concept with existing legal basis may be helpful to reduce burdens on extra duty generation and the demand of new administration mechanisms. It is also useful for systematizing data management procedures. Moreover, with the integration of MRV concept, existing legal systems could be proved to produce more direct and indirect benefits apart from their initial separate implications. This is one of the key advantages of climate change mitigation concept, i.e. co-benefit generation potential, that authorities at

different levels need to exploit further to enhance the executive effectiveness for their existing policy systems.

3.1.3. Mitigation technology supporting policies

This group includes programs and initiatives to promote technology investments that help reduce GHGs emissions, towards a low carbon economy. On the corporate side, besides profit motivation, another motive to attract engagement in MRV procedure is chance in accessing low carbon technology conversion. In general, technology support policies include public investment in basic research, various supportive measures to encourage private investment in research and development of applied technologies, public-private partnerships and the removal of financial barriers to develop low-carbon technologies and etc.

Researches using public investment have a key role in system of new technology development by providing new knowledge and pushing knowledge frontier. According to OECD (2014), although R&D projects which use public investment also account for 30% total amount of OECD R&D, universities and public research institutes in these countries implement more than 3/4 of total basic research. Another noteworthy point is the increase in the share of public R&D in developing countries from 10% to 30% of global R&D over 10 years. When emerging countries make an effort to switch to higher added-value economy with corresponding R&D efforts, it is recommended that this should happen in a way that supports rather than hinders the low-carbon transition. Early assessment of IEA (2013) indicated that global public investment in energy R&D should triple to match countries' aspirations for low-carbon technologies.

In addition, local government can choose among various tools for promoting R&D in private sector. On the supply side, government can provide direct supports such as grants, procurements or fiscal incentives such as R&D tax incentives. Indeed, more countries use tax incentives than in the past and 28 countries in OECD are applying this R&D tax incentives including Brazil, China and South Africa. R&D tax incentives are often shown to have some certain advantages over direct supports such as grants and procurements. R&D tax incentives have an important role as a market tool to reduce marginal cost of R&D activities and allow firms to identify which R&D projects to fund. However, this policy measure also have some constrains, which can be an impediment for small new companies that may need a few year to become profitable. Some countries such as Japan, United Kingdom, Australia, Canada and France released various subsidies to support in this circumstance such as immediate refund for expenditure on R&D personnel wages, strengthening support for the commercialisation of public research and start-up projects and

enhancing access to finance. To maintain and promote competition with innovative new entrant companies, the design of R&D tax incentives should be considered to avoid a bias. In most countries, over 50% R&D public funding goes to finance R&D for small and medium enterprises. However, in Japan, UK, US and Sweden, over 90% of this funding goes to larger firms (OECD, 2015).

Besides challenges relating to the identification of promising technologies, policymakers need to pay attention to the implementation of short and long-term policy objectives. On the supply side, support for basic research will remain an important role for radical innovations with potential long-term benefits. In other words, programs that foster co-operation between firms (both small and large) with research community are likely to be important in bridging the gap between basic and applied research.

Technology supporting policies for demand side such as public procurement, information dissemination, advanced market commitment and technology prizes can be important complement to supply-side measures above (OECD, 2011).

3.2. EVALUATION FOR THE APPLICABILITY OF EACH INSTRUMENT GROUP

The SWOT analysis model is a useful tool to analyze the angles of each policy's type and to provide an overview on the applicability of policy types within the context of HCMC

Table 3. SWOT analysis on the ability of applying 3 potential groups of policy tool in HCMC

	Price-based tools	Command and control regulations	Technology support policies
STRENGTHS	Provide economic incentives to encourage business participation	- City has a legal framework for energy efficiency, energy savings as well as reduction of environmental pollution	- Enterprises are aware of environmental protection and enhance the competitiveness of products - Enterprises in Ho Chi Minh City are very active in applying new technology to create momentum for development
WEAKNESSES	- Without proper operation, carbon markets may face the possibility of failure such as: the potential for devaluation of high carbon credits; Large emitters prefer purchasing emissions rather than attempting to reduce emissions themselves. - City budget must meet other priorities rather than investing in the construction and operation of carbon trading systems. - The current taxes and fees are overlapping and have partially integrated the meaning of “carbon tax”.	The overlap of legal documents is an obstacle to integrating and developing the MRV process and making it difficult for businesses to implement.	- Most of enterprises in the city are small and medium so the investment in technology change is limited. - Local budgets (especially in HCMC) are often very limited to spread for technology transfer programs. - The organizational structure and management of investment activities, as well as the complementary legal system in Vietnam, are not very flexible to meet the low carbon

	Therefore, if carbon tax is to be applied, then a number of other taxes and fees should be reviewed and corrected.		technology development trend.
OPPORTUNITIES	<ul style="list-style-type: none"> - The bilateral credit mechanisms are being promoted - Experience from carbon-credit trading systems in the world 	Ministries often prefer HCM City as a new pilot site	<ul style="list-style-type: none"> - Policies to support technology transfer by the Government of Vietnam is interested - The explosion of low carbon emission technology
THREATS	<ul style="list-style-type: none"> - All market-based systems require a comprehensive and reliable platform for GHG inventory and GHG database that takes a lot of time and resources to build. - The determination of additional carbon taxes is beyond local authority. - Vietnam's unique market economy will face the challenges of a new market model that is both similar but very different from the conventional financial market. 	Local regulations should be constitutional, legal and consistent with Vietnam's legal system	<ul style="list-style-type: none"> - Policies need to create fair competition among businesses. - Assessment and selection of local needs on low-carbon technologies should be appropriate for each locality as it is essential to avoid importing outdated or poorly utilized technology.

3.3. PROPOSAL ON POTENTIAL INSTRUMENTS TO ENCOURAGE ENGAGEMENT IN THE MRV PROCESS

Through a preliminary analysis on policy tools to encourage engagement in the implementation of the MRV process, including carbon pricing, legal tools and technical assistance in section 2 as well as preliminary evaluation on the role of local government and the ability to apply these policy instruments, it can be seen that three groups of policy instruments have complementary relationships that are closely related to each other. Depending on the target group and each stage, each tool group has its own advantages and disadvantages, and the combination of policy groups is necessary. Therefore, a number of policy tools that encourage the involvement of stakeholders, particularly the business community, in the MRV process are recommended as follows:

- GHG inventory management system and GHG database management should be developed and operated as the foundation for climate change mitigation policy instruments.

- Develop regulations on mitigating the implementation of GHG emission reduction activities and the unified MRV process from central to local levels together with specific implementation guidelines.

- Develop GHG emission reduction targets for key energy enterprises and/or public enterprises in the city. The GHG emission reduction can be calculated according to the percentage of energy consumed by the enterprises to save, mainly to reduce the energy from fossil fuels and having a specific reduction schedule consistent with the plan on GHG emission reduction target of the Central government. In case the enterprises can use renewable energy, there may be no need to reduce energy consumption, and without renewable energy, energy efficiency should be improved. State enterprises should play a pioneering role in the implementation process of MRV to quantify emission reductions to contribute to the propagation and raising awareness in the business community.

- Gradually develop a voluntary carbon trading market suitable to the socio-economic conditions of HCMC in each stage of development. In the immediate future, the city government should support enterprises to access international funding to implement activities supported NAMAs. Once the voluntary carbon-trading market of the country or the city is formed, it will support the implementation of both voluntary NAMAs and supported NAMAs with appropriate MRV process.

- Implement policy measures to encourage small and medium enterprises involving in implementing mitigation measures and MRV procedures such as bellows:

+ Support for energy audits by city budget or through public-private partnerships for enterprises that register for the MRV process. The result of energy audit will be a basis for finding and applying appropriate solutions to reduce energy consumption and increase energy efficiency;

+ Tax exemption for income arising from efficient use of energy and energy saving;

+ Tax exemption for goods and equipment that consume less energy;

+ Import duty exemption on renewable energy equipment;

+ Prioritize in accessing bank loans and supporting funds such as Environment Protection Fund, Science and Technology Development Fund at a preferential interest rate to invest in (or replace) equipment with energy efficiency or renewable energy;

+ Prioritize in accessing international supporting financial sources such as funds in financial mechanism of UNFCCC, bilateral funds such as Carbon Capture Fund, Asian Clean Energy Fund, Nordic Climate Fund and etc., multi-lateral funds, market-based financial mechanism and domestic financial sources. Local government will actively contact and search for these international financial resources.

- Study on adding indicator of GHGs emission reduction by using new technology in issuing Vietnam Green Label of VEA.

- Organize training, education events to for agencies, organizations, businesses, communities and individuals in the implementation of emission mitigation and appropriate MRV procedure.

3.4. CONCLUSION

Efforts on GHGs emission reduction of HCMC to contribute into national commitment of GHGs emission reduction need a transformative agenda in which supporting policies suitable with the current condition of the city play an essential role.

The instruments analysed above share one common prerequisite requirement as fundamental basis for the implementation of GHGs inventory and

NAMAs for HCMC. Therein, MRV processes play an important role to ensure smooth data flow, strengthening GHG data management and sharing among stakeholders so that mitigation efforts can be tracked and improved effectively. On the other hand, the engagement of stakeholders, especially business community (the objects directly carry out MRV process), can be a vital factor for the success of the efforts of mitigating the climate change of the city.

After revising important potential policy groups which can encourage the engagement of stakeholders into MRV process, it can be seen that policy actions can be mutually reinforcing, can work against each other or can be redundant depending on how they are designed and implemented. In addition, timing issue seems to be an obstacle to realise the stakeholders' proactive engagement in MRV processes from the beginning since the benefits generated from supporting instruments normally come in later stages. Therefore, policy-makers need to identify target group to establish appropriate policy instruments to achieve the highest effectiveness in the context of limited budget.

PART 4
ANALYSIS OF POTENTIAL REDUCTION OF HCMC
IN THE NEXT PERIOD

4.1. STATE ASSESSMENT AND CITY'S VISION DEVELOPMENT

Population and households

As shown in Table 4, the registered population in HCMC is projected to increase 1.9% per year during 2013-2025 and 1.7% per year during 2025-2030, reaching 10 million people in 2025 and nearly 10.87 million people in 2030 (only registered population, exclude the non-registered population). This projection is consistent with the target total population mentioned in HCMC master plan. Besides, HCMC master plan has no target for total number of households, thus this research assumes that the household size in 2025 is 5.0 persons per household and reduces to 4.0 persons per household in 2030 (calculated household size in 2013 based on reported population and number of households is 6.2 persons per household). Therefore, the total number of households in HCMC is projected to increase 1.96 times in 2025 and 2.13 times in 2030 compared to 2013, reaching 2.50 and 2.72 million households in 2025 and 2030, respectively.

Macro economy

In HCMC master plan, the targets of GDP growth rate in 2011-2015 period is 10.0%-10.5%, in 2016-2020 period is 9.5%-10.0%, and in 2021-2025 period is 8.5%-9.0%. Based on these targets, this research estimates that the GDP of HCMC in 2025 will increase 2.91 times compared to 2013 (average annual growth is 9.3%), from 764,560 billion Dongs in 2013 to 2,227,495 billion Dongs in 2025. Since there is no target for post 2025 in the master plan, we assume that the growth rate for 2026-2030 is the same as 2021-2025 periods. Thus, the GDP of HCMC in 2030 will increase 4.41 times compared to 2013 (average annual growth is 8.7%), reaching 3,373,415 billion Dongs.

Table 4. Projection of main socio-economic indicators

	Unit	2013	2025	2030	2025 /2013	2030 /2013	CAGR	
							2013-2025	2025-2030
Population	persons	7,939,752	10,000,000	10,869,565	1.26	1.37	1.9%	1.7%
No. of households	household	1,277,338	2,500,000	2,717,391	1.96	2.13	5.8%	1.7%
GDP per capita	mil. Dongs	96	223	310	2.31	3.22	7.2%	6.9%
GDP	bil. Dongs	764,560	2,227,495	3,373,415	2.91	4.41	9.3%	8.7%
Agriculture		7,769	13,952	17,976	1.80	2.31	5.0%	5.2%
Industry		302,257	814,952	1,206,243	2.70	3.99	8.6%	8.2%
Commercial		454,534	1,398,591	2,149,195	3.08	4.73	9.8%	9.0%
Outputs	bil. Dongs	1,891,385	5,382,009	8,096,193	2.85	4.28	9.1%	8.5%
Agriculture		15,064	27,054	34,857	1.80	2.31	5.0%	5.2%
Industry		1,098,972	2,963,072	4,385,763	2.70	3.99	8.6%	8.2%
Commercial		777,348	2,391,883	3,675,573	3.08	4.73	9.8%	9.0%
Final consumption	bil. Dongs	400,533	1,168,617	1,795,117	2.92	4.48	9.3%	9.0%
Gross fixed capital formation	bil. Dongs	223,014	615,088	915,693	2.76	4.11	8.8%	8.3%
Export	bil. Dongs	723,138	2,009,995	3,009,204	2.78	4.16	8.9%	8.4%
Import	bil. Dongs	582,125	1,566,204	2,346,600	2.69	4.03	8.6%	8.4%
Passenger transport demand	mil.per.km	75,357	118,861	138,204	1.58	1.83	3.9%	3.1%
Freight transport demand	mil.ton.km	57,434	154,154	227,903	2.68	3.97	8.6%	8.1%

Note: CAGR stands for Calculated Annual Growth Rate

As the biggest city in Vietnam, the GDP per capita of HCMC in 2013 is around 96 million Dongs (more than twice of national average), and it is assumed to increase 7.2% per year by 2025, becomes more than 2.31 times larger than 2013, reaching 223 million Dongs in 2025 due to the rapid GDP growth. In the 2025-2030 period, the annual growth rate of GDP per capita is 6.9% and reach 310 million Dongs in 2030 (3.22 times larger than 2013).

The final consumption in 2025 increases 2.92 times compared to 2013 (average growth is 9.3% per year), from 400,533 billion Dongs in 2013 to 1,168,617 billion Dongs in 2025. Moreover, in 2030, the final consumption increases 4.48 times compared to 2013, reaching 1,795,117 billion Dongs (with the average annual growth in 2025-2030 period is 9.0%). In which main consumption by households is for industrial commodities and services while the government consumption is mainly for science, technology, and other services.

Economic outputs

As shown in Table 4, compared to 2013, the total output increases 2.85 times in 2025 (average growth is 9.1% per year) and 4.28 times in 2030; from 1,891,385 billion Dongs in 2013 to 5,382,009 billion Dongs in 2025 and 8,096,193 billion Dongs in 2030. In which, the industrial sector still dominates with 58.1% in 2013 (1,098,972 billion Dongs), 55.1% in 2025 (2,963,072 billion Dongs) and 54.2% in 2030 (4,385,763 billion Dongs). However, due to the higher growth rate compared to other sectors, the share of commercial sector increases from 41.1% in 2013 (777,348 billion Dongs) to 44.4% in 2025 (2,391,883 billion Dongs) and reaches 45.4% in 2030 (3,675,573 billion Dongs). Agriculture still keeps a small share of less than 0.8% of the total output, from 15,064 billion Dongs in 2013 to 27,054 billion Dongs in 2025 and 34,857 billion Dongs in 2030. The average growth rates of output for agricultural sector, industrial sector, and commercial sector are assumed to be the same as the average GDP growth rates in these sectors respectively since HCMC master plan has no specific target for the output.

Particularly, in the industrial sector, the food and tobacco, construction, machinery, chemical and petrochemical, rubber and plastic are main sectors contributing to 17.7% (523,127 billion Dongs), 14.5% (431,119 billion Dongs), 11.8% (338,061 billion Dongs), 9.1% (270,990 billion Dongs), and 7.7% (228,398 billion Dongs) of industrial output in 2025, respectively (Figure). In 2030, we assume that these contribution proportions are the same as in 2025, thus the main contributors to total industrial outputs are food and tobacco (774,301 billion Dongs), construction (638,116 billion Dongs), machinery

(515,395 billion Dongs), chemical and petrochemical (401,104 billion Dongs), and rubber and plastic (338,061 billion Dongs).

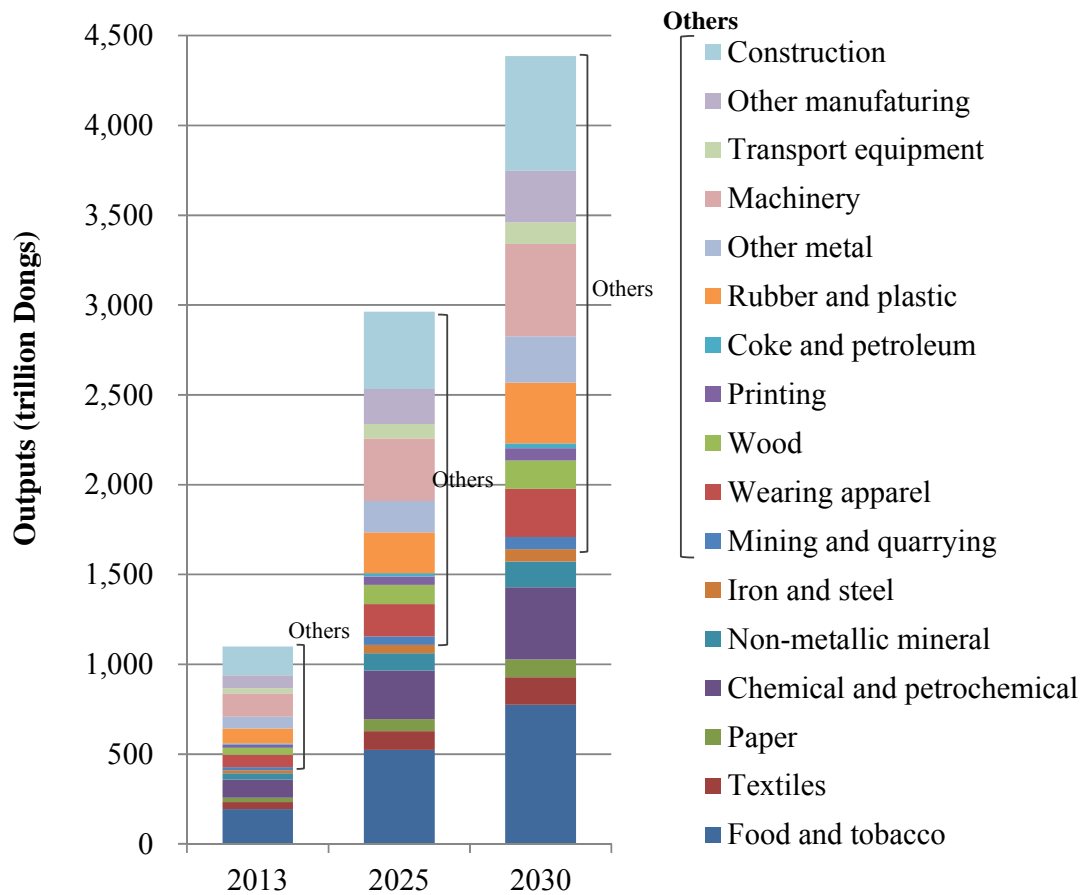


Figure 4. Outputs by industrial-sub sectors

Waste generation

As shown in Table 5, with the population in 2013 is 7,939,752 persons, the total municipal solid waste (MSW) generation in 2013 of HCMC is around 2,446 thousand tonnes (cited from solid waste report of Center for Environmental Technology and Management - ETM), thus the calculated waste generation per capita is 308 kg/(person.year) (or 0.84 kg/(person.day)). In 2025, with the population increases 1.26 times and the total daily MSW generation is 15,577 tons/day (projected in the Solid Waste Treatment plan by 2020 with vision to 2030 for HCMC, 2012), the total municipal solid waste generation is assumed to be 2.32 times larger than in 2013, reaching 5,686 thousand tonnes and the calculated waste generation per capita 1.56 kg/(person.day). In 2030, the population increases 1.37 times compared to 2013, leading to the increase of total municipal solid waste generation to 7,608 thousand tonnes or 1.92 kg/(person.day).

As described in the ETM's solid waste report, in 2013 the main solid waste management option is disposal in landfill with 80.2%, followed by composting with 11.2%, incineration with 6.6% and the remaining part is recycling (2.0%). However, in 2025 and 2030, following the solid waste management plan of HCMC mentioned in the ETM's solid waste report, we assume that 10.0% of the municipal solid waste will be recycled, 30.0% is for incineration, 40.0% is for composting and the disposal is reduced to 20.0% (as shown in Table 5).

Table 5. Projection of MSW generation and management options

	Unit	2013	2025		2030		2025		2030	
			BaU	CCAP	BaU	BaU/2013	CCAP/BaU	BaU/2013		
MSW generation										
Population	thous. persons	7,940	10,000	10,000	10,870		1.26		1.00	1.37
Waste per capita	kg/person/day	0.84	1.56	1.32	1.92		1.85		0.85	2.27
Total MSW	thous. tons	2,446	5,686	4,833	7,608		2.32		0.85	3.11
MSW management option										
Disposal	%	80.2%	80.2%	20.0%	80.2%					
Composting	%	11.2%	11.2%	40.0%	11.2%					
Incineration	%	6.6%	6.6%	30.0%	6.6%					
Recycling	%	2.0%	2.0%	10.0%	2.0%					

Source: ETM's report (2014) and Solid Waste Treatment plan by 2020 with vision to 2030 for HCMC (2012)

Transportation

Due to the increasing population and industrial activities, the transport demand in 2025 and 2030 also increases rapidly with average annual growth of 3.5%, which is 1.44 to 1.83 times larger than 2013 in case of passenger transport. Meanwhile, the average annual growth of freight transport demand is 8.4%, which is 2.68 to 3.97 times increase compared to 2013 (Table 6).

As shown in Table 6, in 2025 the number of passenger traffic increases from 75,357 mil.persons.km in 2013 to 118,861 mil.persons.km in 2025BaU and reach 120,256 mil.persons.km in 2025CCAP. There is a rapid increase of demand of car (including taxi) to 3.15 times, even motorbike still dominates the share. Considering the modal share by trip, the share of public transport (bus, train and MRT) increases from 6.5% in 2013 to 27.1% in 2025BaU and reaches 33.4% in 2025CCAP due to the contribution of BRT and MRT system. Following the targets in urban transport development plan for HCMC, in 2030 the share of public transport (bus, train, MRT) increases to 31.6% in 2030BaU; in which the number of passenger traffic increases to 138,204 mil.persons.km.

In the freight transport, the total volume of freight traffic increases from 57,434 mil.ton.km in 2013 to 154,154 mil.ton.km in 2025 and 227,903 mil.ton.km in 2030, mainly by car (truck) and waterway. We assume that there is no difference in the volume of freight traffic between BaU and CCAP scenarios.

Since we have no information about the plan for freight transport, we assume that the shares of freight transport modes in 2025 and 2030 are the same as in 2013, in which waterway contributes to 82.7%, followed by car (truck) with 16.9% contribution, and a very small part is by train.

Table 6. Projection of transport volume

	2013	2025		2030	2025		2030
		BaU	CCAP	BaU	BaU/2013	CCAP/BaU	BaU/2013
Number of passengers traffic (mil.per.km)	75,357	118,861	120,256	138,204	1.58	1.01	1.83
Walk	338	946	946	514	2.80	1.00	1.52
Bicycle	1,424	1,992	1,992	2,166	1.40	1.00	1.52
Motorbike	59,546	58,323	51,753	52,370	0.98	0.89	0.88
Car	7,227	22,731	22,731	36,598	3.15	1.00	5.06
Bus	4,673	27,877	33,187	36,073	5.97	1.19	7.72
Train	256	359	359	390	1.40	1.00	1.52
MRT	0	3,982	6,637	7,215		1.67	
Aviation	1,893	2,649	2,649	2,879	1.40	1.00	1.52
Volume of freight traffic (mil.ton.km)	57,434	154,154	154,154	227,903	2.68	1.00	3.97
Car	9,711	26,065	26,065	38,534	2.68	1.00	3.97
Train	220	589	589	871	2.68	1.00	3.97
Waterway	47,503	127,500	127,500	188,497	2.68	1.00	3.97

Energy consumption and power generation

Final energy consumption

As shown in Table 7, the energy intensity (energy consumption/GDP) reduces from 9.1 toe/bil. Dongs in 2013 to 8.2 toe/bil. Dongs in 2025BaU (0.90 times compared to 2013) and 7.4 toe/bil. Dongs in 2025CCAP (0.90 times compared to 2025BaU) due to the lower increasing rate of energy consumption compared to the rapid growth of GDP. Moreover, in 2030 the energy intensity reduces to 7.7 toe/bil. Dongs in 2030BaU (0.84 times compared to 2013). This reduction follows “more than 20% reduction of energy intensity” mentioned in the Decision 2631/QD-TTg (“Master Plan for Socio-economic Development of HCMC”) (or 1.0% to 1.5% reduction per year as mentioned in the Decision 1393/QD-TTg for “National Green Growth Strategy”).

In BaU scenarios, the total energy consumption increases 2.56 times in 2025 and 3.73 times in 2030 compared to 2013; increases from 6,972 ktoe in 2013 to 17,859 ktoe in 2025 and 25,973 ktoe in 2030. In which industry is still the main energy consumer with 56.2% in 2013 and increases to 62.8% (in 2025) – 65.6% (in 2030) (2.86 times increase in 2025 and 4.34 times increase in 2030 compared to 2013), followed by commercial sector (10.9% in 2025 and 12.1% in 2030). Commercial sector has the highest speed of energy consumption with 3.47 times increase in 2025 and 5.60 times increase in 2030 compared to 2013. Moreover, passenger transport, residential sector, and freight transport have the share around 18.0% (in 2025) – 8.1% (in 2030), 11.3% (in 2025) – 7.4% (in 2030), and 6.6% (in 2025) – 6.7% (in 2030), respectively. In 2025CCAP, the total final energy consumption reduces to 15,566 ktoe (0.87 times compared to 2025BaU) (Table 7).

In term of energy consumption mix, there is a switch from coal and oil consumption to natural gas consumption, together with the reduction of coal and oil consumption from 68.2% in 2013, 65.9% in 2025BaU, and 66.0% in 2030BaU to 45.6% in 2025CCAP. Compared to BaU scenario, there is a half reduction in coal and oil consumption and the natural gas consumption increases 10.85 times in 2025CCAP. However, coal and oil are still the main energy sources, especially for industrial activities. Biomass also contributes to a small share of total final consumption (8.1% in 2013, 9.0% in 2025BaU, 5.1% in 2025CCAP and 9.3% in 2030BaU), mainly for some industrial activities and some residential and commercial purposes.

It is estimated that the electricity consumption will increase 2.70 times in 2025BaU and 3.84 times in 2030BaU compared to 2013; from 17,651 GWh (1,518 ktoe) in 2013 to 47,726 GWh (4,103 ktoe) in 2025BaU and 40,452 GWh (3,478 ktoe) in 2025CCAP, and reach 67,702 GWh (5,821 ktoe) in 2030BaU, contributing to more than 22.4% of the total final energy consumption in each scenario.

Table 7. Projection of final energy consumption

	2013		2025				2030							
			BaU		CCAP		BaU		BaU/2013		CCAP/BaU		BaU/2013	
	ktoe	%	ktoe	%	ktoe	%	ktoe	%						
Total	6,972	100.0	17,859	100.0	15,566	100.0	25,973	100.0	2.56	0.87	3.73			
By sector														
Agriculture	8	0.1	15	0.1	14	0.1	19	0.1	1.91	0.95	2.52			
Industry	3,921	56.2	11,223	62.8	10,364	66.6	17,031	65.6	2.86	0.92	4.34			
Commercial	561	8.0	1,945	10.9	1,489	9.6	3,142	12.1	3.47	0.77	5.60			
Residential	786	11.3	1,693	9.5	1,271	8.2	1,915	7.4	2.15	0.75	2.44			
Passenger transport	1,256	18.0	1,800	10.1	1,604	10.3	2,116	8.1	1.43	0.89	1.69			
Freight transport	441	6.3	1,183	6.6	823	5.3	1,749	6.7	2.68	0.70	3.97			
By energy type														
Coal	1,916	27.5	5,483	30.7	2,442	15.7	8,320	32.0	2.86	0.45	4.34			
Oil	2,837	40.7	6,283	35.2	4,659	29.9	8,829	34.0	2.21	0.74	3.11			
Gas	135	1.9	387	2.2	4,199	27.0	587	2.3	2.86	10.85	4.34			
Solar	0	0.0	0	0.0	0	0.0	0	0.0						
Biomass	566	8.1	1,604	9.0	787	5.1	2,415	9.3	2.83	0.49	4.27			
Electricity	1,518	21.8	4,103	23.0	3,478	22.3	5,821	22.4	2.70	0.85	3.84			
Energy intensity (toe/bil. Dongs)	9.1		8.2		7.4		7.7		0.90	0.90	0.84			

Grid power generation

The power supply in HCMC is mainly from the national grid. Thus, we follow the structure of energy mix in power generation as decided in the PDP7 (Decision 1208/QD-TTg, 2011), and BaU and CCAP scenarios have the same assumption for power generation mix. In which the contribution of nuclear is 2.1% and 10.5%, respectively, in year 2025 and 2030. Moreover, wind and biomass make up the share of 3.1% and 1.5% in 2025; and increase to 4.7% and 1.6% in 2030, respectively.

However, coal-fired thermal power still dominates the mix with 48.4% in 2025 and 58.6% in 2030, followed by natural gas (24.7% in 2025 and 15.0% in 2030) and hydro power (20.2% in 2025 and 9.7% in 2030) (as shown in Table 8).

Table 8. Power generation mix (following the PDP7)

	2013	2025		2030
		BaU	CCAP	BaU
Coal	21.1%	48.4%	48.4%	58.6%
Oil	4.8%	0.0%	0.0%	0.0%
Natural gas	43.9%	24.7%	24.7%	15.0%
Hydro	30.1%	20.2%	20.2%	9.7%
Nuclear	0.0%	2.1%	2.1%	10.5%
Wind	0.1%	3.1%	3.1%	4.7%
Biomass	0.1%	1.5%	1.5%	1.6%

GHG emissions

In this research, we estimate the GHG emissions and classify the emission sources into two types: energy-related activities and non-energy-related activities. The energy-related activities include the activities which directly consume the energy and emit GHGs by the consumption. In the energy-related activities, industry, construction, transport, commercial and residential are included. Meanwhile, the non-energy-related activities includes the activities which emit GHGs not related to energy consumption, such as in agriculture and waste sectors.

As shown in Table 9, the total GHG emissions increases 2.64 times in 2025 and 3.91 times in 2030; from 30,012 ktCO₂eq in 2013 to 79,103 ktCO₂eq in 2025BaU and 117,232 ktCO₂eq in 2030BaU. In which, the share of energy-related GHG emissions increases from 93.6% in 2013 to 96.5% in 2025BaU and 96.3% in 2030BaU. The remaining share is from non-energy-related GHG emissions.

In 2025CCAP, the total GHG emissions is 63,209 ktCO₂eq (0.83 times compared to 2025BaU), in which 96.6% is from energy-related GHG emissions and 3.9% is from non-energy-related GHG emissions, and CO₂ absorption contributes to reduce 0.5% total reduction.

Similar to energy intensity shown in Table 7, the emission intensity (per GDP) also reduces from 39.1 tCO₂eq/bil. Dongs in 2013 to 35.5 tCO₂eq/bil. Dongs in 2025BaU and 26.9 tCO₂eq/bil. Dongs in 2025CCAP due to the rapid GDP growth compared to the increasing speed of GHG emissions. In 2030BaU, the emission intensity is 34.8 tCO₂eq/bil. Dongs. Meanwhile, the emission per capita increases from 3.8 tCO₂eq in 2013 to 7.9 tCO₂eq in 2025BaU (2.10 times compared to 2013), 10.8 tCO₂eq in 2030BaU (2.86 times compared to 2013) and reduces to 6.0 tCO₂eq in 2025CCAP.

Table 9. Projection of GHG emissions from energy and non-energy related activities

	2013		2025				2030		2025		2030
	ktCO ₂ eq	%	BaU ktCO ₂ eq	%	CCAP ktCO ₂ eq	%	BaU ktCO ₂ eq	%	BaU /2013	CCAP /BaU	BaU /2013
GHG emissions	ktCO ₂ eq	%	ktCO ₂ eq	%	ktCO ₂ eq	%	ktCO ₂ eq	%			
Energy-related GHG emissions	28,094	93.6	76,316	96.5	63,209	96.6	112,851	96.3	2.72	0.83	4.02
Agricultural energy-related	26	0.1	50	0.1	45	0.1	66	0.1	1.94	0.91	2.59
Industry	15,001	50.0	44,314	56.0	38,263	58.5	68,407	58.4	2.95	0.86	4.56
Commercial	2,988	10.0	11,127	14.1	8,565	13.1	18,663	15.9	3.72	0.77	6.25
Residential	5,074	16.9	11,937	15.1	8,904	13.6	14,139	12.1	2.35	0.75	2.79
Transport	5,006	16.7	8,889	11.2	7,431	11.4	11,574	9.9	1.78	0.84	2.31
Non-energy related GHG emissions	1,918	6.4	2,787	3.5	2,576	3.9	4,381	3.7	1.45	0.92	2.28
Agricultural non-energy related	635	2.1	540	0.7	400	0.6	406	0.3	0.85	0.74	0.64
Solid waste management	1,283	4.3	2,247	2.8	2,177	3.3	3,975	3.4	1.75	0.97	3.10
CO₂ absorption	0	0.0	0	0.0	-334	-0.5	0	0.0			
Total GHG emissions	30,012	100.0	79,103	100.0	65,451	100.0	117,232	100.0	2.64	0.83	3.91
GHG emissions per GDP (tCO₂eq/bil.Dongs)	39.1		35.5		26.9		34.8		0.91	0.76	0.89
GHG emissions per capita (tCO₂eq/person)	3.8		7.9		6.0		10.8		2.10	0.76	2.86

GHG emissions from energy-related activities

As shown in Table 9, the GHG emissions from energy-related activities increases 2.72 times in 2025 and 4.02 times in 2030. The emission amount increases from 28,094 ktCO₂eq in 2013 to 76,316 ktCO₂eq in 2025BaU and 63,209 ktCO₂eq in 2025CCAP (0.83 times compared to 2025BaU), and reaches 112,851 ktCO₂eq in 2030BaU. In which the biggest GHG emitter is still industry with 2.95 times increase in 2025BaU and 4.56 times increase in 2030BaU, contributing to total GHG emissions about 53.4% in 2013, 58.1% in 2025BaU, 60.5% in 2025CCAP, and 60.6% in 2030BaU.

In 2025BaU, residential and commercial sectors contribute to 15.6% (2.35 times larger than 2013) and 14.6% (3.72 times compared to 2013) of total energy-related GHG emissions, respectively. Meanwhile, emission from transport increases 1.78 times compared to 2013 (11.6% of the total energy-related GHG emissions). In 2025CCAP, the emission shares of residential and commercial sectors reduce to 14.1% and 13.6%, respectively; while the share of emissions from transport increases to 11.8%. Agriculture contributes to a very small part (0.1% of total GHG emissions) due to its consumption of energy, as classified in “Agriculture, Forestry and Fishery” commodity.

GHG emissions from non-energy-related activities

Table 9 shows the total GHG emissions from non-energy-related activities, including emissions from Agriculture and Waste sectors with the total emissions increase 1.45 times in 2025BaU and 2.28 times in 2030BaU; from 1,918 ktCO₂eq in 2013 to 2,787 ktCO₂eq in 2025BaU and 4,381 ktCO₂eq in 2030BaU; and reduces to 2,576 ktCO₂eq in 2025CCAP (0.92 compared to 2025BaU).

4.2. GHG EMISSIONS REDUCTION POTENTIAL AND THEIR ANALYSIS

4.2.1. Top-down analysis of GHG emissions reduction potential

Figure 5 shows the GHG emissions projection and the emission reduction potential of Ho Chi Minh City in 2025 and 2030.

In 2025CCAP, the total GHG emissions reduction of HCMC is 13,448 ktCO₂eq. In which, industry has the highest emission reduction potential (6,051 ktCO₂eq), followed by residential and commercial (3,033 ktCO₂eq and 2,562 ktCO₂eq respectively). Transport has 1,458 ktCO₂eq emission reduction potential

while agriculture has the lowest potential at 11 ktCO₂eq. Besides that, the GHG emissions reduction from grid power is 3,259 ktCO₂eq.

In 2030CCAP, the total GHG emissions reduction of HCMC is 24,590 ktCO₂eq. In which, industry has the highest emission reduction potential (10,154 ktCO₂eq), followed by commercial and residential (6,484 ktCO₂eq and 4,404 ktCO₂eq respectively). Transport has 2,500 ktCO₂eq emission reduction potential while agriculture has the lowest potential at 22 ktCO₂eq. Besides that, the GHG emissions reduction from grid power is 7,696 ktCO₂eq.

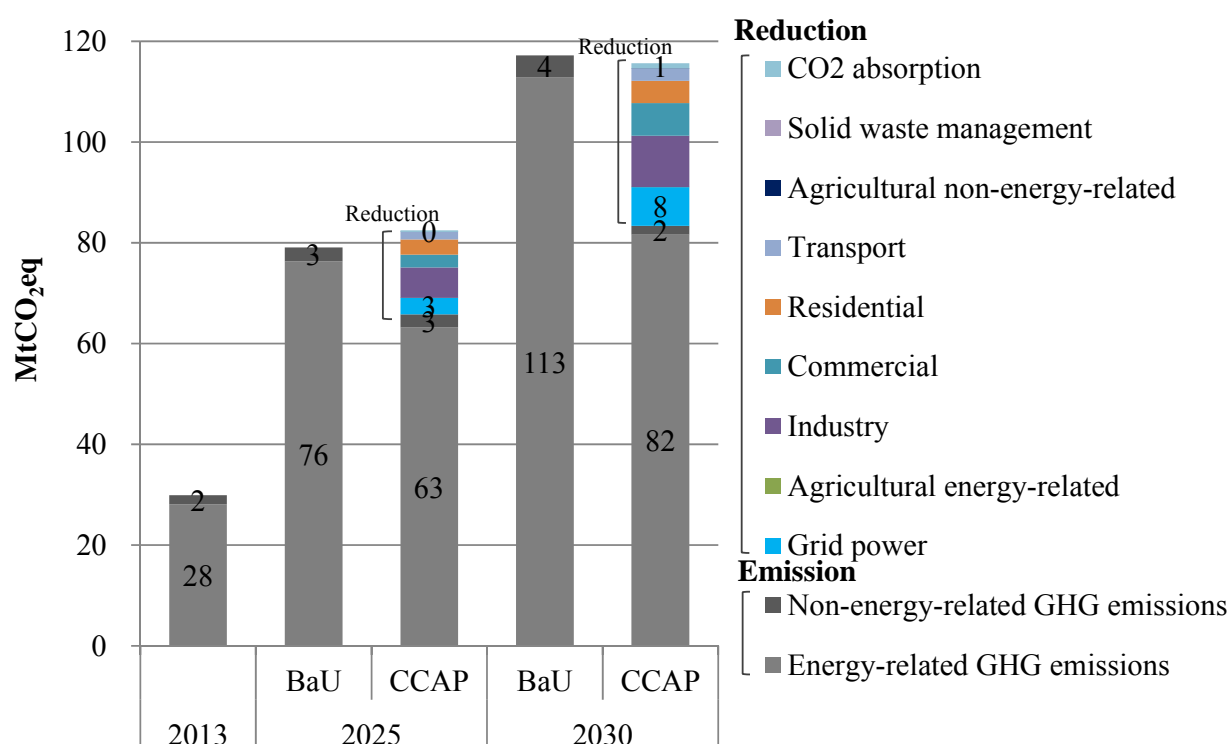


Figure 5. GHG emissions and reduction

4.2.2. Bottom-up analysis of GHG emissions reduction potential

Based on the assumed technology and ratio for each project, we estimate the GHG emissions reduction potential for each project (based on project list provided by CCB) and divided into 2 groups: internal (without international supports) and external (with international supports) (as shown in Table 10). Moreover, we also propose some projects to increase the GHG emissions reduction potential for HCMC (detail is described in next section). It is important to notice that, in this

report we only estimate the bottom-up emission reduction potential for 2025 (based on the mitigation projects for this year) but not for 2030.

Table 10. GHG emissions and project-based reduction in HCMC in 2025

		Amount		Share	
		(ktCO₂eq)		(%)	
1. GHG emissions in 2025BaU		79,103.0		100.0	
2. Total GHG emissions reduction potential in 2025CCAP by bottom-up approach		13,651.9		17.2	
2a. Reduction by projects		Effort		Share	
		Internal	External	by sector	
Sector			Total by sector	Share by sector	
	<i>Land-use planning</i>	<i>333.7</i>	<i>0.3</i>	333.9	0.4
	<i>Energy</i>	<i>4,066.7</i>	<i>2,351.1</i>	6,402.8	8.1
	<i>Transportation</i>	<i>454.7</i>	<i>814.8</i>	1,269.5	1.6
	<i>Industry</i>	<i>1,004.7</i>	<i>0.0</i>	1,004.7	1.3
	<i>Water management</i>	<i>21.3</i>	<i>24.0</i>	45.3	0.06
	<i>Solid waste management</i>	<i>1,150.7</i>	<i>0.0</i>	1,150.7	1.5
	<i>Construction</i>	<i>90.9</i>	<i>68.6</i>	159.5	0.2
	<i>Healthcare</i>	<i>0.0</i>	<i>0.0</i>	0.0	0.0
	<i>Agriculture</i>	<i>0.0</i>	<i>11.1</i>	11.1	0.01
	<i>Tourism</i>	<i>0.0</i>	<i>0.0</i>	0.0	0.0
Total by effort		7,122.68	3,269.90	10,392.7	13.1
Share by effort (%)		9.0	4.1	13.1	
2b. Reduction from grid power				3,259.3	4.1

According to Table 10, HCMC can reduce 9.0% total GHG emissions in 2025 based on the projects that HCMC can implement based on its own budget (group “internal”). With 4.1% reduction potential is from grid power, if considering

this project into “internal” group, then HCMC can increase the reduction target to 13.1%. Moreover, projects in “external” group (including some proposed projects) can contribute to reduce 4.1% total emissions.

In conclusion, by implementing all projects (“internal”, “external”) and GHG emissions reduction from grid power, in 2025CCAP HCMC can reduce 17.2% total GHG emissions in 2025BaU (between the 10-20% national reduction target as declared in the Green Growth strategy and within 8-25% mentioned in the Vietnam’s INDC submitted to UNFCCC).

4.2.3. Assessment of mitigation potential by projects

This session describes the GHG emissions reduction of each project in 10 sectors. In each sector, the GHG emissions reduction potential is calculated for mitigation projects mentioned in the HCMC Climate Change Action Plan (CCAP), as well as some proposed projects in order to maximize the reduction potential of the whole HCMC.

In each section, each project starts with the project code and name (given in the CCAP’s project list), and only projects with quantitative GHG emissions reduction potential are listed. Some projects which are proposed by AIM team will have the code starting with “Proposed-#”.

Detail of the calculation is explained in the detail report.

Sector I: Land-use planning (total reduction: 333.9 ktCO₂eq)

These are some projects:

- **I-3: Afforestation and greening (parks, roads, pedestrian spaces, riparian and coastal areas) (internal):** Assume that 10,000,000 trees will be planted in 2025 this project will contribute to reduce 333.67 ktCO₂eq.

- **Proposed-1: Build wind channels (green corridors) (external):** Assume that the ratio of commercial buildings in wind channels in 2025 is 1%, this project will contribute to reduce 0.3 ktCO₂eq.

Sector II: Energy (including energy-related industry) (total reduction: 9,677.1 ktCO₂eq)

- **II-1: Energy efficiency technology applied to buildings (internal):** Assume that the energy-saving rate by BEMS is 11.2% and the diffusion rate of BEMS in 2025 is 15%, this project will contribute to reduce 133.0 ktCO₂eq.

- II-2: ESCO (Energy Saving Company) Project (external):

+ **For commercial buildings:** Assume that diffusion rate of ESCO is 26% and the energy-saving rate by ESCO is 14%, this project will contribute to reduce 389.6 ktCO₂eq.

+ **For industry:** Assume that diffusion rate of ESCO is 23% and the energy-saving rate by ESCO is 13%, this project will contribute to reduce 1,465.7 ktCO₂eq.

- II-3: High Efficiency Lighting (Internal):

+ **For public lighting:** Assume that the number of public light replaced by 2025 is 200,000 units, this project will contribute to reduce 4.9 ktCO₂eq.

+ **For commercial buildings:** Assume that the number of LED and CFL lighting in commercial buildings in 2025 is 15,000 thous. units, this project will contribute to reduce 750.0 ktCO₂eq.

+ **For residential buildings:** Assume that the number of lightings per household is 5 unit and the diffusion rate of high efficiency lighting in residential in 2025 is 80%, this project will contribute to reduce 500.0 ktCO₂eq.

- II-4: High Efficiency Air Conditioners (such as Air Conditioners with Inverter Controllers) (internal):

+ **For commercial buildings:** Assume that the diffusion rate of high efficiency air conditioners in commercial in 2025 is 25%, this project will contribute to reduce 63.5 ktCO₂eq.

+ **For residential buildings:** Assume that the diffusion rate of high efficiency air conditioners in residential in 2025 is 25%, this project will contribute to reduce 178.7 ktCO₂eq.

- II-5: Energy Efficiency Improvement Facilities to be installed at Small/Medium Enterprises (such as Compressors, and Motors) (internal): Assume that the number of installed high efficiency furnace is 450 units, this project will contribute to reduce 612.8 ktCO₂eq.

- II-6: Introduction of Photovoltaic Power Generation (internal):

+ **For commercial buildings:** Assume that the installed capacity in 2025 is 10 MW and the coefficient of system output is 73%, this project will contribute to reduce 7.8 ktCO₂eq.

+ **For residential buildings:** Assume that the installed capacity in 2025 is 8 MW and the coefficient of system output is 73%, this project will contribute to reduce 6.4 ktCO₂eq.

- II-7: Introduction of Solar Water Heater (internal):

+ **For commercial buildings:** Assume that the number of solar water heater in commercial buildings in 2025 is 1 mil. units, this project will contribute to reduce 402.0 ktCO₂eq.

+ **For residential buildings:** Assume that the diffusion rate of solar water heater is 20%, this project will contribute to reduce 619.5 ktCO₂eq.

- II-8: Installation of Energy Saving Glasses (external):

+ **For commercial buildings:** Assume that the diffusion rate of energy saving glasses is 5% and the energy-saving rate by energy saving glasses is 24%, this project will contribute to reduce 128.4 ktCO₂eq.

+ **For residential buildings:** Assume that the diffusion rate of energy saving glasses is 5% and the energy-saving rate by energy saving glasses is 24%, this project will contribute to reduce 136.5 ktCO₂eq.

- **II-9: Regional Energy Supply System (external):** Assume that the diffusion rate of regional energy supply system is 10%, this project will contribute to reduce 487.5 ktCO₂eq.

- **II-10: Introduction of Small-scale Hydropower Generation (at water distribution stations, canals) (external):** Assume that the generated power by small-scale hydropower generation in 2025 is 4,000 MWh, this project will contribute to reduce 2.8 ktCO₂eq.

- **II-11: Introduction of Wind Power Generation (external):** Assume that the installed units in 2025 is 10, this project will contribute to reduce 20.5 ktCO₂eq.

- **Proposed-2: Promotion of energy-efficient appliances in households (internal):** Assume that the diffusion rate of energy-efficient appliances in residential in 2025 is 20%, this project will contribute to reduce 508.2 ktCO₂eq.

- **Proposed-3: Reduction from grid power (internal):** Assume that the efficiency in coal-fired power plant will be improved from 35% to 40% and the transmission loss will be improved from 10% to 5%, this project will contribute to reduce 3,259.3 ktCO₂eq.

Sector III: Transportation (total reduction: 1,269.5 ktCO₂eq)

- **III-2: Promotion of Eco-Driving with Digital Tachographs (internal):** Assume that the diffusion rate of eco-driving with digital tachographs is 20%, this project will contribute to reduce 37.2 ktCO₂eq.

- **III-3: Construction of Subway (internal):** Assume that the rate of modal shift from motorbike to subway compared with BaU is 2%, this project will contribute to reduce 52.0 ktCO₂eq

- **III-7: Wide-range traffic control (internal):** Assume that the number of integrated control traffic lights in 2025 is 1,500 units, this project will contribute to reduce 30.0 ktCO₂eq.

- **III-10: Expansion of Frequencies and Routes of Bus Transportation (internal):** Assume that the rate of modal shift from motorbike to bus compared with BaU is 3%, this project will contribute to reduce 102.9 ktCO₂eq.

- **III-12: Development of Bus Rapid Transit (BRT) (external):** Assume that the rate of modal shift from motorbike to bus compared with Current case is 3%, this project will contribute to reduce 102.9 ktCO₂eq.

- **III-13: Shift to CNG bus (external):** Assume that the diffusion rate of CNG bus is 30%, this project will contribute to reduce 25.3 ktCO₂eq.

- **III-14: Introduction of Electric Motorbikes and Bicycles (internal):** Assume that the diffusion rate of electric motorbike in 2025 is 7%, this project will contribute to reduce 129.7 ktCO₂eq.

- **Proposed-4: Promotion of energy-efficient vehicles (external)**

+ **For passenger cars:** Assume that the diffusion rate of energy-efficient vehicles in 2025 is 30%, this project will contribute to reduce 187.4 ktCO₂eq.

+ **For motorbikes:** Assume that the diffusion rate of energy-efficient vehicles in 2025 is 30%, this project will contribute to reduce 328.4 ktCO₂eq.

+ **For freight trucks:** Assume that the diffusion rate of energy-efficient vehicles in 2025 is 30%, this project will contribute to reduce 273.7 ktCO₂eq.

Sector IV: Industry (total reduction: 1,004.7 ktCO₂eq)

- **IV-1: Improvement of Kiln Operation Techniques/Technologies (internal):** Assume that the number of installed waste heat recovery units in 2025 is 1,500 units, this project will contribute to reduce 1,004.7 ktCO₂eq.

Sector V: Water management (total reduction: 45.3 ktCO₂eq)

- V-1: Regulation ponds (internal):

+ **For commercial buildings:** Assume that the area of regulation pond is 800 ha, this project will contribute to reduce 2.1 ktCO₂eq.

+ **For residential buildings:** Assume that the area of regulation pond is 800 ha, this project will contribute to reduce 2.1 ktCO₂eq.

- **V-6: Introduction of Rainfall Water Storage Facility (internal):** Assume that the water catchment area is 40,000 m², this project will contribute to reduce 0.0164 ktCO₂eq.

- **V-8: Recycling of Rain Water (with Water Purification Equipment) Countermeasures for water storage and flood (internal):** Assume that the water catchment area per unit is 100 m² and the number of rain water storage facilities installed in 2025 is 150 area, this project will contribute to reduce 0.006 ktCO₂eq.

- **V-10: Promotion and Distribution of Water-Saving Equipment (internal):** Assume that the diffusion rate of water-saving shower is 15% and the reduction rate of water usage by water-saving shower is 17%, this project will contribute to reduce 17.1 ktCO₂eq.

- **Proposed-5: Improvement of Leakage from Clean Water Pipe Network (external):** Assume that the water leakage rate reduces from 35% (current level) to 28% (by this project), this project will contribute to reduce 18.8 ktCO₂eq.

- **Proposed-6: Introduction of Water Distribution Management to Improve Water Supply System (external):** Assume that the reduction rate by introducing water distribution management is 3%, this project will contribute to reduce 5.2 ktCO₂eq.

Sector VI: Solid waste management (total reduction: 1,150.7 ktCO₂eq)

- **VI-2: Biogas-based Power Generation (internal):** Assume that 60% of CH₄ from composting is recovered and transferred to biogas, this project will contribute to reduce 85.7 ktCO₂eq.

- **VI-3: Electricity Generation from Solid Waste Incineration (internal):** Assume that 60% of CH₄ from composting is recovered and transferred to biogas, this project will contribute to reduce 181.0 ktCO₂eq.

- **Proposed-7: Reduction of waste generation (internal):** Assume that the reduction rate of generated waste is 10%, this project will contribute to reduce 178.1 ktCO₂eq.

- **Proposed-8: Change of management options (internal):** Assume that the solid waste management is changed (reduce disposal from 80.2% to 20%, increase composting from 11.2% to 40%, increase incineration from 6.6% to 30%, and increase recycling from 2% to 10%), this project will contribute to reduce 40.3 ktCO₂eq.

- **Proposed-9: CH₄ recovery from landfill and transferred to biogas (internal):** Assume that 60% of CH₄ from composting is recovered and transferred to biogas, this project will contribute to reduce 665.6 ktCO₂eq.

Sector VII: Construction (total reduction: 159.5 ktCO₂eq)

- **VII-1 Introduction of Incentive to Environmentally Sound Buildings (internal):** Assume that the diffusion rate of environmentally sound buildings in 2025 is 15%, this project will contribute to reduce 19.0 ktCO₂eq.

- **VII-5: Introduction of Energy Efficient Constructing Machine (internal):** Assume that the diffusion rate of energy efficient constructing machines in 2025 is 20% and the reduction rate of energy consumption by energy efficient constructing machines is 10%, this project will contribute to reduce 71.9 ktCO₂eq.

- **Proposed-10: Introduction of Energy Efficient Building Materials (external):** Assume that the reduction rate of energy consumption in well insulated houses is 48%, this project will contribute to reduce 68.6 ktCO₂eq.

Sector VIII: Health care

No project from this sector is estimated for the GHG emissions reduction.

Sector IX: Agriculture (total reduction: 11.1 ktCO₂eq)

No project in CCAP from this sector is estimated for the GHG emissions reduction. Below is the reduction potential estimated for some proposed projects.

4.3. CONCLUSION

Within limited resources of the consultancy service, a quantitative analysis of GHG emissions reduction actions in Ho Chi Minh City was conducted to provide a basis for the development of policy framework in HCMC in near future. As the

analysis based on some information that are not fully fit with HCMC, some limitations need to be improved as follows:

- One of the key inputs in this study is the energy balance table. However, as HCMC does not have its own energy balance table so we need to downscale the energy balance table of Vietnam and adjust with other energy information to estimate energy balance table for HCMC in 2013. This estimation may not fully describe the real situation of Ho Chi Minh City and the distinctive features of HCMC compared to the whole country.

- Furthermore, we only have the inter-sectoral balance sheet for HCMC in 2007. Therefore, other macroeconomic information such as GDP, final consumption demand, etc. were used to estimate the inter-sectoral balance sheet for HCMC in 2013.

- In the Statistical Year Book of HCMC, transportation data are not classified detailedly, particularly, data on walking, biking, buses, trains, etc. Therefore, integration with other information to estimate transportation needs for each type of vehicle is urgent

- Proposed actions have not been prioritized (based on feasibility of implementation, financial issues, etc.) and the nature of the mitigation measures in each action is still a lot of assumptiveness. Therefore, proposed actions are still generic so opinions of experts and relevant agencies are needed so that more appropriate and practical actions can be proposed.

- The analysis also does not include GHG emissions and GHG emission reduction in some areas such as land use change and water management and there is no concrete roadmap for emission reduction actions.

PART 5
PROPOSAL OF THE LEGAL FRAMEWORK FOR GHG INVENTORY
AND IMPLEMENTATION OF MITIGATION ACTIONS
SUITABLE WITH THE CONDITIONS OF HO CHI MINH CITY

5.1. BASIS FOR POLICY DEVELOPMENT

5.1.1. International agreements

Viet Nam has made great efforts to cope with climate change in general and climate change mitigation in particular not only through national policies and specific actions that have been being implemented in recent past but also through international commitments that Vietnam has signed and approved. The Government of Vietnam has signed many international conventions on global response to climate change, specifically as follows: (1) Signed the United Nations Framework Convention on Climate Change in 1992 and ratified it in 1994; (2) Signed Kyoto Protocol in 1998 and ratified Kyoto Protocol in 2002 and (3) signed and ratified Paris Agreement on climate change in 2016.

Amongst these international agreements, Paris Agreement on Climate Change adopted at the COP21 is the first global legal document that obliges all Parties to commit into GHG reduction by establishing the Intended Nationally Determined Contributions (a.k.a INDC). Therefore, from one country which was not bound to reduce GHG (Non-Annex I of UNFCCC), Vietnam must fulfill the duty of contributing in GHG emission reduction which set out in the INDC of Vietnam to take advantage of the opportunity to develop a low carbon economy.

5.1.2. Legal basis

5.1.2.1. Important legal basis

As being reviewed in Section 4 of Part II of this report, Vietnam has been gradually improving the system of policies and regulations on responding to climate change (both adaptation and mitigation). Some highlights of important legal documents are summarized as follows:

- Issue of climate change response is stated in at *Clause 1 Article 63 in Chapter III of The Constitution of 2013* of the Socialist Republic of Vietnam;

- *Law on Environmental Protection 2014* has 1 separate chapter for climate change response (Chapter IV). The content of GHG emission management is stipulated at Clause 1 Article 41;

- *The National Target Program to Respond to Climate Change (NTP-RCC)* was established in 2008;

- *The National Strategy of Climate Change* was established in 2011 identifies that “climate change response must be linked to sustainable development, towards a low carbon economy”;

- *The National Strategy of Green Growth* was approved in 2012, which defines targets of GHG emission reduction and solutions for implementation;

- *The National Climate Change Action Plan for a period of 2012-2020* was approved at the Decision No.1474/QD-TTg dated 05/10/2012 of the Prime Minister. “Mitigate GHG emission, develop the economy toward low-carbon development” is identified as 1 of 5 main groups of tasks of this action plan;

- *Project on GHG emission management and management of carbon trading activities on the world market* established in 2012 has identified detailed target of GHG emission reduction in 2020 for each sector;

- *The national system of GHG inventory* was approved at the Decision No.2359/QD-TTg dated 22/12/2015 of the Prime Minister to provide a legal and technical basis for the implementation of national GHG inventory. However, the implementation of GHG inventory at local level needs to be adjusted to suit the actual conditions of each locality;

- In 2016, *the Plan for Implementation of the Paris Agreement on climate change* was approved by the Prime Minister at the Decision No.2053/QD-TTg dated 28 October 2016 to specify Vietnam’s commitments with the international community in climate change response and fulfill obligations of Vietnam in Paris Agreement, which identifies 5 task groups with 2 specific implementation periods (2016-2020 and 2021-2030).

At a city level, the task of implementation of mitigation actions has been raised in legal documents as follows: (1) *The Action Plan for the implementation of the Action Program No.34-CTrHD/TU of the Communist’s Party Committee of HCM City and implementation of the Resolution No 08 / NQ-CP of the Government to implement the Resolution No. 24-NQ /TW of the 7th Conference of the Central Committee of Communist Party session XI on actively responding to climate change,*

strengthening resource management and environmental protection (at the Decision No.2838/QD-UBND dated 11/6/2014); (2) *The Climate Change Action Plan of Ho Chi Minh City for the period of 2017-2020, with a vision to 2030* (at the Decision No.1159/QD-UBND dated 17/3/2017) and (3) *The Plan for implementation of National Green Growth Strategy in HCMC until 2020* (at the Decision No.3544/QD-UBND dated 07 July 2017 of HCMC People's Committee).

5.1.3. Assessment of potential GHG reduction in the area of HCMC

In recent years, a number of studies have been carried out to initially implement GHG inventory and assess the potential of GHG emissions reduction in the city. Recent researches on GHG emission and the potential of GHG emissions reduction in HCMC include:

Research project on "Assessing the current situation and forecasting GHG emissions in Ho Chi Minh City and proposing mitigation measures"

In 2012, research team led by Associate Prof. Le Thanh Hai studied a research on GHG inventory in HCMC in 2011 at 4 sectors including Energy (including transportation), Waste Management, Agriculture and IPPU. Result of GHG inventory in HCMC in 2011 for these 4 sectors is 11,722,632 ton CO_{2eq}/yr including:

- GHG emission in energy sector was calculated at 9,280,463 ton CO_{2eq}/yr (accounting for 79.17%) including the use of combustion fuels in transportation, industry, thermal power plants and others. GHG emission from grid electricity consumption wasn't included in this result;

- GHG emission in IPPU sector was calculated at 161,842 ton CO_{2eq}/yr (accounting for 1.38%) including activities using raw materials and products that emit GHG from non-metallic mineral industry, electro-electronic industry and industry which use refrigerants;

- GHG emission in Agriculture sector was calculated at 951,912 ton CO_{2eq}/yr (accounting for 8.12%) including emissions from livestock, aquaculture and crop production;

- GHG emission in Waste Management sector was calculated at 1,328,415 ton CO_{2eq}/yr (accounting for 11.33%) including emissions from solid waste treatment technologies (landfill, burning, compost) and waste water treatment (domestic and industrial waste water treatment and household waste water treatment and others).

Research team also forecast that GHG emission in HCMC in 2020 will be at 19,620,815 ton CO_{2eq}/yr (in 04 above sectors), in which energy still accounts for the most amount of GHG emission at 75.42%, the second most emission source is waste management with 20.23%, the remaining 4.35% contributed from agriculture and IPPU.

In the scope of this research, 2 group of mitigation measures were proposed as follows:

- Group of planning and management measures: propose policies to support and encourage enterprises and production facilities to use environmentally friendly forms of energy in a saving and efficient way;

- Group of technology measures: encourage enterprises and production facilities operating in the city area to use renewable energy and especially propose the direction of innovation in technology production and processing for industries in the area of Ho Chi Minh City.

The task of GHG inventory in 2013 in HCMC.

In the framework of the Climate Change Action Plan of HCMC until 2015, Ho Chi Minh City Climate Change Bureau sign a contract with Sai Gon University to implement the task of GHG inventory in 2013 in the area of HCMC at energy (including power use in HCMC), waste management and agriculture. After collecting data and calculating in 2015 and 2016, the total amount of GHG emission in HCMC in 2013 was calculated at 34,707,035,8ton CO_{2eq}/yr including:

Table 11. Results of GHG Inventory of GHG Inventory Task

No	Sector	Emission (ton CO _{2eq})	Percentage (%)
1	Energy	29,076,502.9	83.7%
2	Agriculture (crop cultivation, livestock and aquaculture)	1,076,054.32	3.1%
3	Waste	4,554,478.6	13.1%
	TOTAL	34,707,035.8	100%

Research team of Sai Gon University calculated an amount of indirect emission from power consumption into energy sector. According to this calculation, GHG emission in energy sector is higher clearly than the result of research team of Associate Prof. Le Thanh Hai. In addition, result of GHG emission in Waste

Management of this research is higher than this in research of research team of Associate Prof. Le Thanh Hai for 2011.

Research of a research team of Asian-Pacific Integrated Model - AIM, Japan

In the framework of cooperation between HCMC and Osaka City to implement a Low-Carbon City Program, a research team of Asian-Pacific Integrated Model used AIM to estimate an amount of GHG emission in 2013 in HCMC and forecast GHG emission as well as develop scenarios for GHG reduction in 2020. Result of GHG inventory in HCMC in 2013 using the AIM shows that total amount of GHG emission in HCMC in 2013 was estimated at around 30 million tons CO_{2eq}, in which GHG emission from activities using energy is estimated at 28 million tons CO_{2eq}, emission from agriculture is estimated at 0.635 million tons CO_{2eq} and emission from waste management is 1.283 million tons CO_{2eq}. Result of total GHG emission of AIM research team have no significant difference compared with this of the research team of Saigon University as above. Result of total GHG emission of the research team of Sai Gon University is higher as they included the emission from waste water and sludge treatment process into the total of GHG emission. AIM research team also estimated the GHG emission in HCMC in 2020 following the BAU scenario at around 52.5 million tons CO_{2eq}, in which emission from activities using energy will account for nearly 50 million tons CO_{2eq} (accounting for 95.2%).

In addition to GHG inventory in 2013, AIM research team also estimated the potential GHG reduction in HCMC when the city implements mitigation actions listed in the Climate Change Action Plans, the strategies and potential projects. Accordingly, if Ho Chi Minh City can implement mitigation projects in its draft Action Plan for period of 2017-2020 (draft of 25 September 2015), the city can reduce 9.4% of total GHG emission following the BAU scenario. If we consider a potential mitigation from Vietnam power grid (can reduce 6.1% total GHG emission in 2020) and some potential mitigation actions suggested by AIM research team, HCMC can reduce around 17% of total GHG emission in 2020 as compared with BAU scenario.

Ho Chi Minh City component of SPI-NAMA Project

In the framework of SPI-NAMA financed by JICA, the short-term consultant team of JICA has collected data to implement GHG inventory in HCMC for base year 2013 based on GPC Guideline. The short-term consultant team estimated GHG emission in HCMC in all 5 sectors including energy, transportation, waste, IPPU

and AFOLUC in 3 different scope. Accordingly, indirect emission from power use from the national grid is calculated in Scope 2. Results of GHG inventory in HCMC in 2013 are as follows:

Table 12. Results of GHG Inventory in the area of HCMC in 2013 in SPI-NAMA Project.

Sector	Scope 1 (tons CO_{2eq})	Scope 2 (tons CO_{2eq})	Scope 3 (tons CO_{2eq})
Stationery energy	3,952,505	13,229,684	656,192
Transportation	14,693,310	0	2,701,073
Waste	2,291,607	0	0
IPPU	1,940,512	0	0
AFOLUC	423,362	0	0
Total	23,301,295	13,229,684	3,357,265

Total GHG emission in HCMC in 2013 is estimated at 39.89 million tons CO_{2eq}. This number is a little bit higher than result of Sai Gon University research team as the short-term consultant team of JICA collected more sufficient data and also estimated IPPU sector. The division of scope in GHG inventory can help HCMC understand clearly on the overall situation of GHG emission in HCMC and avoid duplication in calculation of GHG emission between HCMC and other provinces.

In general, there are some initial researches on assessment of situation of GHG emission and forecast the GHG emission in the area of HCMC. Although there is a difference in the scope of research as well as the base year for GHG inventory, these researches can be considered as useful references for HCMC to implement GHG inventory as well as MRV process for mitigation actions in near future. In addition, through these initial researches, the city can assess the situation of essential data management for GHG inventory as well as the potential of GHG reduction when potential programs and projects are implemented in HCMC, which helps policymakers can direct the implementation of mitigation actions in accordance with HCMC conditions in the future.

5.2. ASSESSMENT OF THE NECESSITY IN DEVELOPING THE POLICY FRAMEWORK

After reviewing legal basis from international agreements to central and local legal documents, it can be seen that Vietnam is trying to reduce GHG emission as BAU, contributing to efforts of international community and the most recent effort is the Plan for Implementation of the Paris Agreement on climate change approved by the Prime Minister at the Decision No.2053/QĐ-TTg dated 28 October 2016. However, although the content of greenhouse gas inventories and the implementation of mitigation actions in locality are mentioned in Annex 1 of the Plan, there is still lack of specific regulations and guidance from MoNRE to implement these works in locality. In near future, regulations on implementing climate change mitigation measures at provincial level will be published by MoNRE to contribute to the country's commitment to reduce GHG emissions. It can be said that HCM City as a special city will be a pioneer in the implementation of this task.

Recently, both the Climate Change Action Plan of Ho Chi Minh City for the period of 2017-2020, with a vision to 2030 and the implementation plan of the Action Program No.34-CTrHD/TU of the Communist's Party Committee of HCM City haven't set quantitative target in the reduction of GHG emission. Quantitative targets for GHG emission reduction in the city as well as in each sector will be the concretization of the city's efforts in implementing GHG mitigation measures in important above plans. GHG Inventory can help the city to set up a quantitative target of GHG reduction for next periods as well as to assess the total emission of GHG in the city according to the timeline consistent with national GHG inventory. In the Plan of Implementation the National Green Growth Strategy of Ho Chi Minh City until 2020, there is an annual indicator "Reducing GHG emission intensity compared to 2016". Therefore, in order to quantify this indicator, it is necessary to have regulations and guidance on GHG inventory to be able to carry out GHG inventory in Ho Chi Minh City for the base year 2016.

While GHG inventory gives us an overview of current status of GHG emission in the area of HCMC, MRV procedure can track a specific amount of GHG reduction from each program, project or policy. A guidance of MRV procedure can assist companies and organizations which implement mitigation actions in demonstrating their efforts by a specific amount of GHG reduction

verified by functional agencies. Implementation of MRV procedure is not urgent as GHG inventory but it links to benefits as follows:

- Firstly, MRV procedure can assist companies and organizations which implement mitigation actions to prove a quantitative contribution of these companies and organization in GHG reduction;

- Secondly, MRV procedure can encourage companies and organizations which haven't implemented mitigation actions to participate in this work. Besides this, implementation mitigation actions with MRV procedure can help these companies and organizations access international supporting financial sources;

- Thirdly, Ho Chi Minh City can track an amount of GHG reduction from programs and projects in each sector and based on this, HCM City can develop appropriate support policies to encourage businesses and community to participate in implementing locally appropriate mitigation actions.

Thus, MRV process is considered as a useful tool to encourage participants to implement mitigation actions suitable with city conditions. Procedure of GHG inventory and MRV procedure can be considered as the prerequisites for the successful implementation of mitigation actions in Ho Chi Minh City, towards a low carbon society and contribute to the achievement of the national commitment.

Based on the above assessment, it can be seen that the development of the Policy Framework for GHG inventory and MRV procedure for NAMAs is necessary. This policy framework is developed based on results of the study on GHG inventory and MRV procedure in HCM City which conducted by the short-term JICA team of SPI-NAMA project and a preliminary assessment of potential tools that encourage stakeholders to participate in the process of implementing NAMAs.

5.3. OBJECTIVES OF THE POLICY FRAMEWORK

Overall Objectives

Establish the initial legal basis for implementing measures of GHG reduction, to achieve the order of the Prime Minister at the Decision No.2053/QĐ-TTg dated 28 October 2016 on approval of the Plan for Implementation of the Paris Agreement on Climate Change.

Specific Objectives

Develop a roadmap to provide regulations and guidelines for the implementation of two important contents as follows:

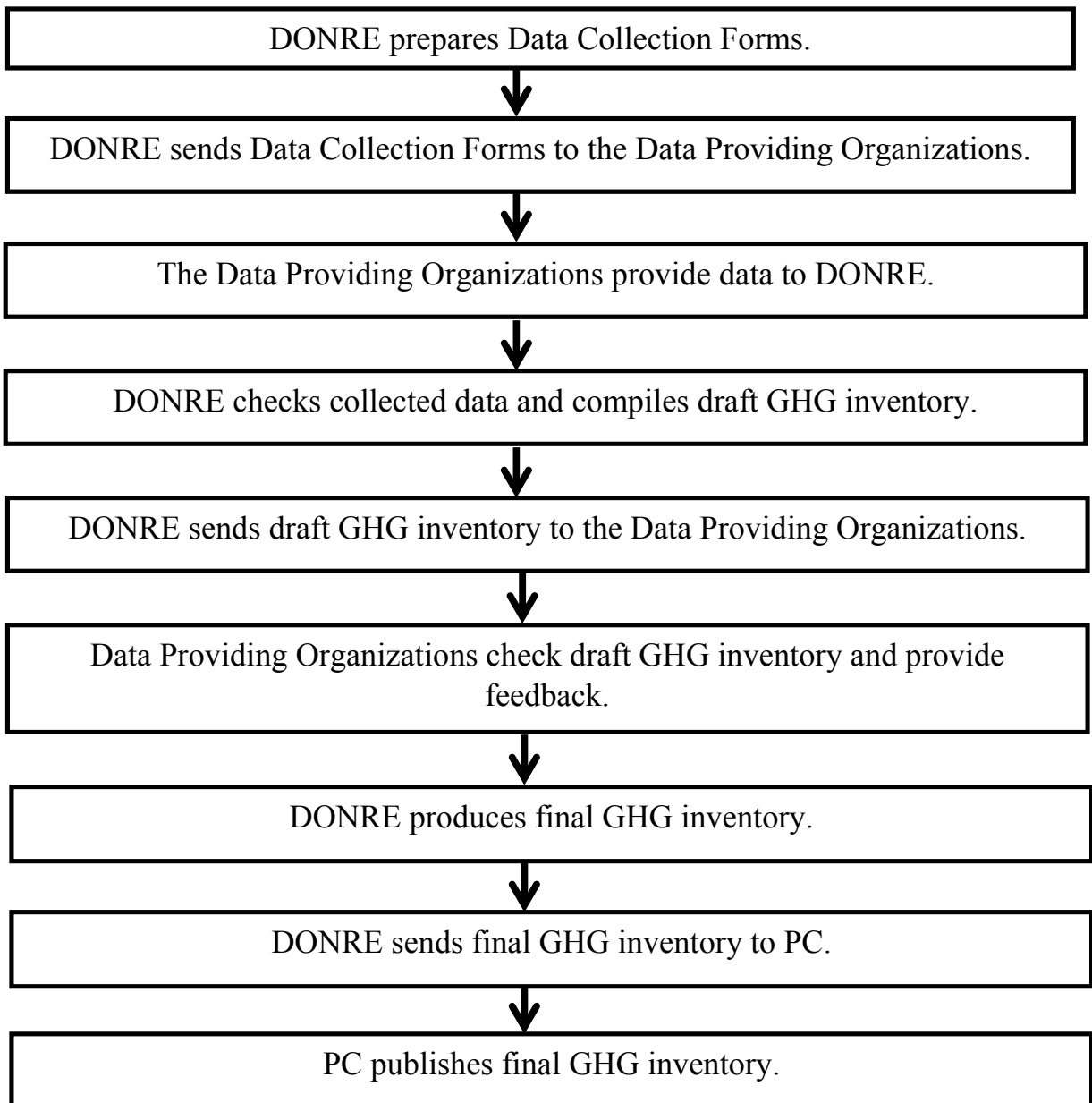
(1) Inventory of GHG emissions in Ho Chi Minh City in important sectors every 2 years;

(2) Encourage actions to reduce GHG emissions in Ho Chi Minh City and the participation of stakeholders in implementing of MRV procedure for these mitigation actions.

5.4. THE MANAGEMENT STRUCTURE OF GHG INVENTORY AND MITIGATION ACTIONS

5.4.1. Procedure of GHG inventory

Procedure of GHG inventory in Ho Chi Minh City has been developed by the short-term consultant team of JICA and is presented in the GHG Inventory Preparation Manual for city level within the framework of the SPI-NAMA Project. Accordingly, the GHG inventory is proposed to be implemented in even years and in bi-annual period corresponding to the national inventory. The Department of Natural Resources and Environment is responsible for GHG inventory following the proposed procedure as follows:



Besides a procedure to implement GHG inventory, GHG Inventory Preparation Manual for city level is also suggested an organizing institutional structure for GHG inventory in city area in Figure 6:

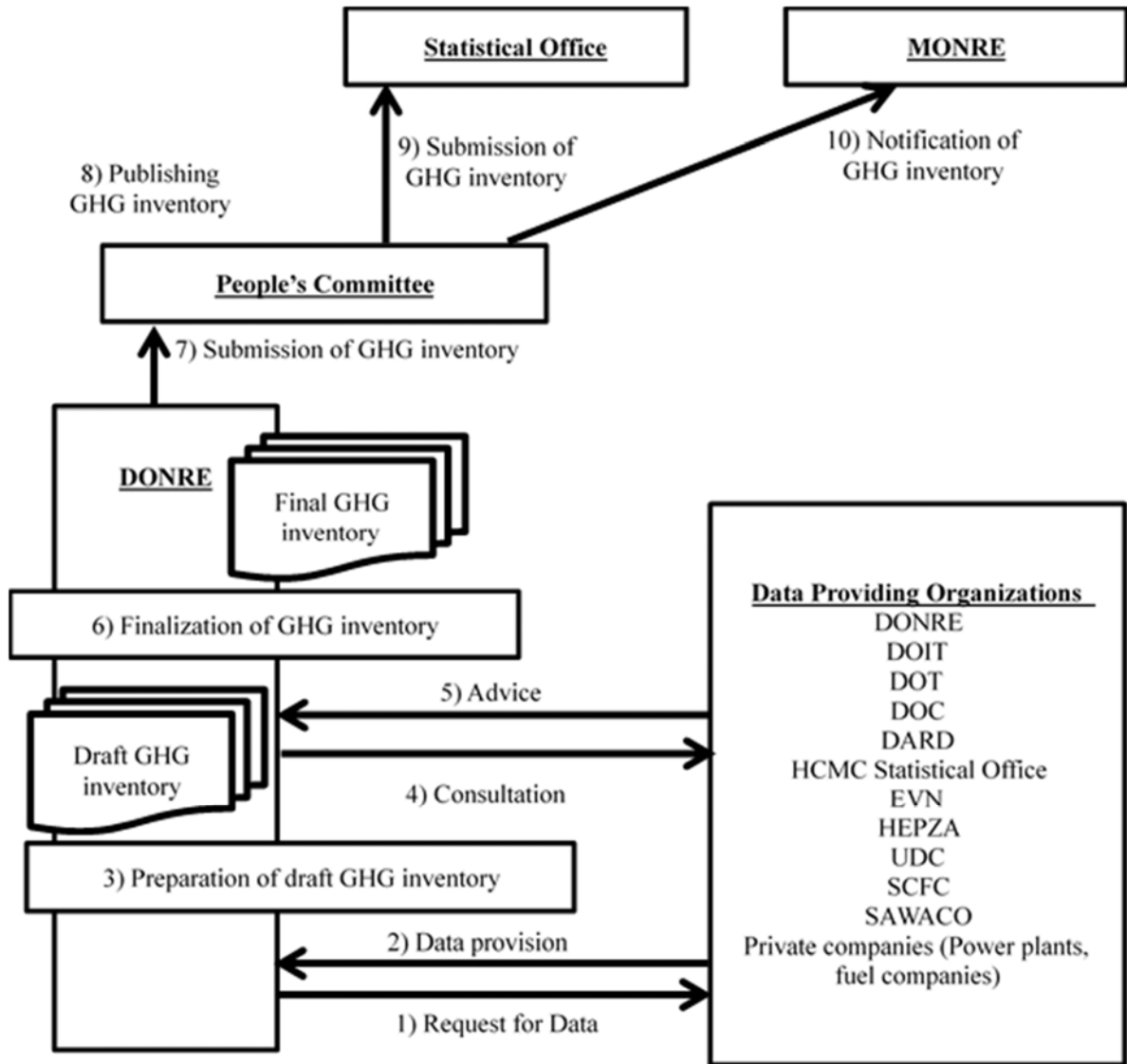
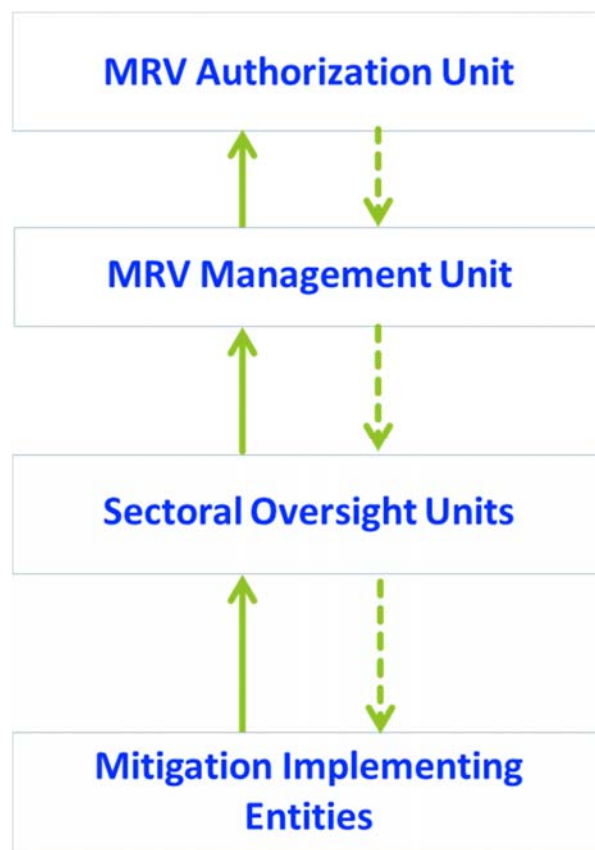


Figure 6. The structural organization of GHG inventory in HCM City

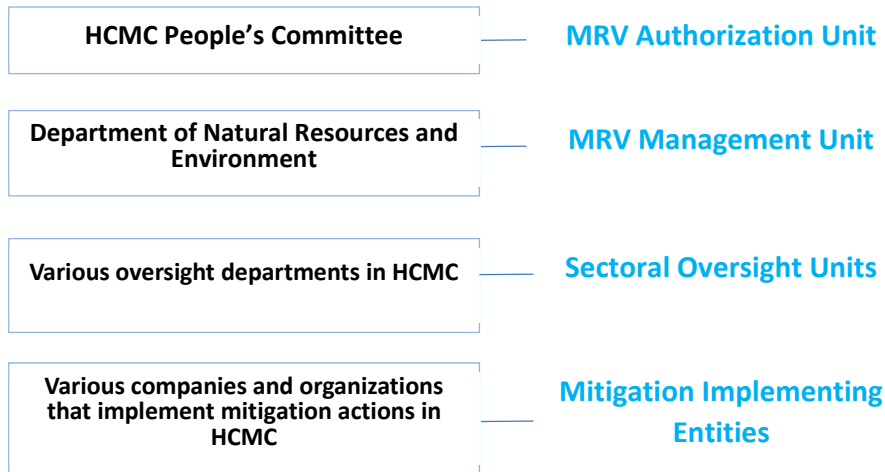
5.4.2. The MRV procedure for the implementation of mitigation actions

Similar to GHG inventory procedure, MRV procedure for mitigation actions which are suitable for the conditions of HCMC has been developed by the short-term consultant team of JICA and is presented in the Operational Manual for MRV within the framework of SPI-NAMA Project.

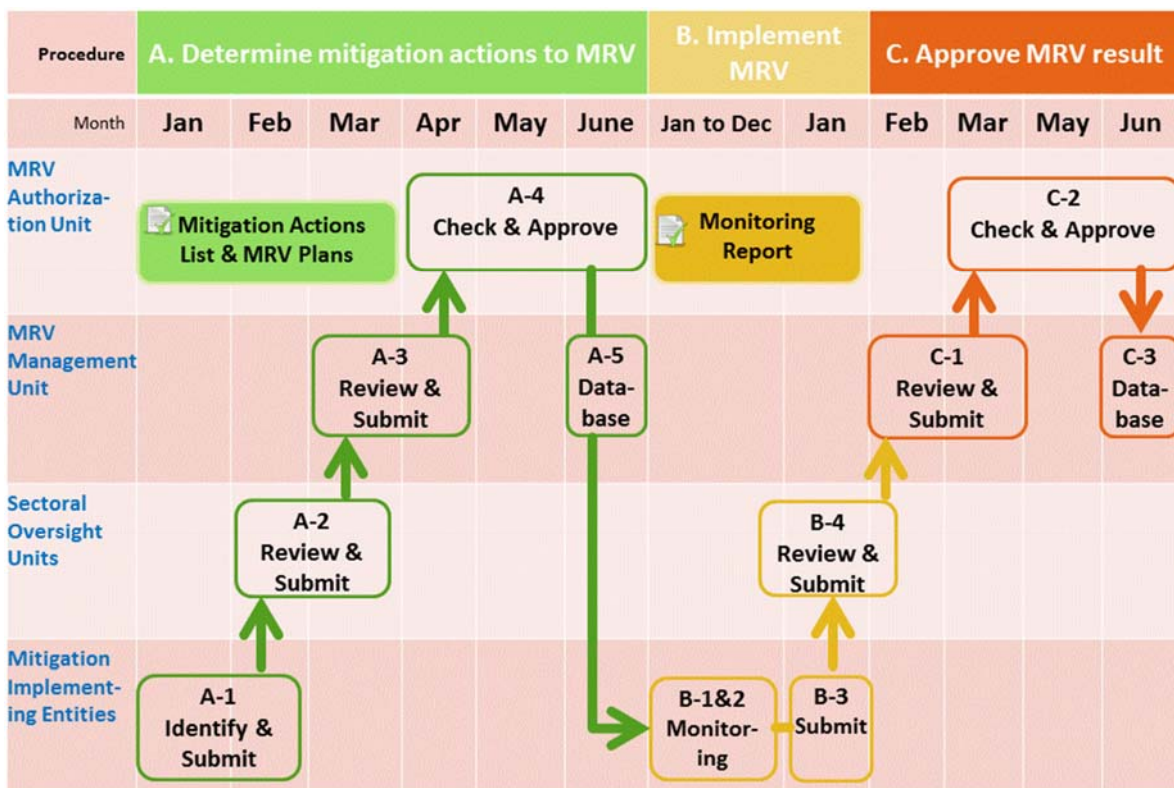
In principle, the consultant team has suggested 4 major units in the MRV process including: *MRV Authorization Unit*, *MRV Management Unit*, *Sectoral Oversight Unit*, and *Mitigation Implementing Entity* (a.k.a Implementing Unit). Depending on the current institutional structure and available resources, a city can either assign existing organizations, departments or divisions in the city's administration to these MRV units or create new entities or units that specifically deal with MRV-related activities. The relationship between these units is defined as follows:



In Ho Chi Minh City, the involving agencies of MRV procedure is defined as follows:



MRV procedure for mitigation actions suitable with the conditions of HCMC including specific steps, which is suggested in the Manual as follows:



5.5. PROPOSAL OF IMPLEMENTATION MECHANISMS

5.5.1. Operating mechanisms

Proposals relating to the completion of legal documents from the central government to the local government level as follows:

- Proposal to the Ministry of Natural Resources and Environment:
 - + Promulgate regulations and guidelines on GHG inventory and MRV implementation procedures for NAMAs;
 - + Promulgate regulations and guidelines on participation in bilateral credit mechanisms as well as multilateral funds which have partnership with Vietnam;
 - + Collaborate with Ministry of Science and Technology to issue a list of low carbon technologies as a scientific basis for evaluating MRV implementation plans proposed by the implementing agencies.
- Proposal to the HCMC People's Committee

Until 2020:

- + Issue and disseminate the GHG Inventory Preparation Manual and Operational Manual for MRV on city level climate change mitigation actions (results of Component 2 of SPI-NAMA Project);
 - + Assign DoNRE to coordinate with relevant departments and units to carry out GHG inventory in the city in even years corresponding to the national GHG inventory;
 - + Assign DoNRE to coordinate with relevant departments and units to pilot the MRV process for some appropriate mitigation actions in the period 2018-2020. The results of these pilot projects will be a basis of promulgating appropriate regulations for the next period 2020-2030;
 - + Assign DoNRE to coordinate with relevant departments and units to conduct periodic training for stakeholders implementing the MRV process in each specific period;
 - + Assign Department of Industry and Trade to coordinate with relevant departments and units for making reports on the current status of energy use in intensive energy-consuming enterprises, industrial zones and export processing zones; analyzing these results to create a basis for promulgating appropriate policies in energy sector;

- + Assign Department of Finance to allocate funds for GHG inventory, pilot implementation of the MRV process, and training and communication programs related to this content.

After 2020:

- + Assign DoNRE to coordinate with relevant departments and units to inspect the implementation of emission mitigation activities applying MRV process in the city area;

- + Assign DoNRE to coordinate with relevant departments and units to initially study on developing a carbon trading market for HCMC in accordance with national regulations and conditions of the city;

- + Assign the Department of Industry and Trade to coordinate with relevant departments and units to support the energy audit for the enterprises in non-mandatory group which actively register for mitigation actions. Enterprises and units registering for participating mitigation actions or actions of energy saving and efficiency will be trained and instructed how to implement (for ex, energy audit), as a basis for finding and applying appropriate solutions to reduce cost of energy consumption and increase energy efficiency.

- + Assign the Department of Finance to allocate funds for activities to support enterprises in non-mandatory groups which actively register for implementing mitigation actions.

5.5.2. Financial mechanisms

Proposals on financial support for enterprises participating in MRV procedure for mitigation actions suitable with conditions of HCMC, especially financial mechanisms to encourage the business community to participate in this procedure.

- Proposal to the Ministry of Natural Resources and Environment:

- + Collaborate with the Ministry of Finance and relevant ministries to study and issue CO2 tax policies and establish an appropriate roadmap to implement these policies;

- + Allocate international financial resources to support the implementation of mitigation actions in each sector.

- Proposals to Ministry of Finance

- Promulgate policies to encourage businesses to implement mitigation actions related to energy efficiency using the MRV process as follows:

- + Exemption from income tax on income derived from efficient use and energy efficiency;
- + Tax exemptions for energy-efficient goods and equipment;
- + Import tax exemption for renewable energy equipment;
- + Prioritize to access bank loans, supporting funds such as Environment Protection Fund, Science and Technology Development Fund at a preferential interest rate to invest (or replace) energy-efficient equipment and equipment using renewable energy
 - Proposal to the HCMC People's Committee
 - + Assign Department of Planning and Investment to coordinate with relevant departments and units in considering to put businesses which implement mitigation actions applying MRV procedure into enterprises supporting programs of the city;
 - + Assign Department of Science and Technology to coordinate with relevant departments and units support innovative start-up businesses in the implementation of mitigation actions (technological innovation, energy saving, renewable energy, etc.);
 - + Encourage businesses in non-mandatory group to actively implement suitable mitigation actions and MRV procedure following the form of socialization;
 - + Actively seek the assistance of international finance from bilateral funds, multilateral funds, the sister cities or other international partners in responding to climate change to support non-mandatory group in the implementation of mitigation actions applying MRV procedure.

5.5.3. Propagation mechanism

Proposals relating to advocacy, awareness raise, and accountability of government agencies, businesses and the community on the implementation of GHG mitigation actions and the MRV procedure for these mitigation actions, specifically as follows:

- Proposal to the HCMC People's Committee
 - + Assign DoNRE to coordinate with Department of Industry and Trade and Vietnam Chamber of Commerce and Industry to organizing propaganda campaigns for business community in the implementation of mitigation actions and applying MRV procedure;
 - + Assign DoNRE to continue implementing a propaganda plan on the implementation of MRV procedure for mitigation actions suitable with conditions of HCMC within the Project on GHG emission management and management of

carbon trading activities on the world market at the Decision No.1775/QD-TTg dated 21/11/2012 of the Prime Minister;

- + Assign DoNRE to study on adding priority criteria of implementation of mitigation actions to the plan of organizing an annual plan of Ho Chi Minh City Environment Award.

- Propose Ministry of Natural Resources and Environment to support the implementation of local propaganda programs by providing financial sources.

5.5.4. Other incentive mechanisms

Proposals relating to capacity building, strengthening the connection between the stakeholders in the GHG inventory process and MRV procedure for mitigation actions suitable with conditions of HCMC, as follows:

- Recommend DoNRE to integrate contents of GHG inventory and MRV procedure for mitigation actions suitable with conditions of HCMC into plans of capacity building of DoNRE;

- Recommend HCMC PC to assign DoNRE to consider in establishing a network of enterprises which implement mitigation actions to share information and experience in implementing mitigation actions as well as domestic and international accessible financial sources;

- Recommend DoNRE to study in developing an information database relating to the implementation of mitigation action and MRV procedure in HCMC and also carbon trading markets so enterprises and agencies can refer as needed.

5.6. PROPOSED IMPLEMENTATION ROADMAP

Roadmap for implementation of GHG Inventory and mitigation actions suitable with the conditions of HCMC applied the MRV procedure is suggested as follows:

Table 13. Proposed implementation roadmap until 2020

	GHG Inventory		MRV Procedure	
<i>Time</i>	<i>Content</i>	<i>Responsible Units</i>	<i>Content</i>	<i>Responsible Units</i>
2018	GHG inventory in HCMC in 2016	DoNRE	Select pilot mitigation projects applying the MRV process	Major units in MRV procedure
	Formulate and approve the plan to develop regulation on GHG inventory in HCMC	DoNRE	Formulate and approve the plan to develop regulation on MRV process implementation in HCMC	DoNRE
2019	Assessment of 2016 GHG inventory results to adjust the process and methodology	DoNRE	Implement selected pilot mitigation projects applying the MRV process	Implementing Units
	Develop regulation on GHG inventory in HCMC	DoNRE, Department of Justice	Develop regulation on MRV process implementation in HCMC	DoNRE, Department of Justice
2020	GHG inventory in HCMC in 2018	DoNRE	Continue to implement pilot mitigation projects applying the MRV process	Major units in MRV procedure
	Promulgation and dissemination of regulation on GHG inventory in HCMC	HCMC PC	Promulgation and dissemination of regulation on MRV process implementation in HCMC	HCMC PC
2020-2030	Implementation of GHG inventory bi-annual in accordance with the issued regulation	DoNRE	Implementation of mitigation actions using MRV procedure in accordance with the issued regulation	Major units in MRV procedure

CONCLUSIONS

CONCLUSION

Within allowable resources of the consultancy services, some important conclusions are drawn as follows:

- As a major center of economy, culture, education, science and technology in Vietnam, Ho Chi Minh City is an urban with a high level of GHG emission from activities in energy consumption, transportation, agriculture, waste treatment, IPPU and land use changes. Therefore, HCMC also has a large potential to reduce GHG emissions (up to 17% of total GHG emissions as compare to the BAU), contributing to the implementation of Vietnam's commitments in the Nationally Determined Contribution.

- Ho Chi Minh City has set up an organizational structure to respond to climate change and issued three important documents that are closely related to the implementation of appropriate mitigation actions including the Action Plan for the implementation of the Action Program No.34-CTrHD/TU of the Communist's Party Committee of HCM City and implementation of the Resolution No 08 / NQ-CP of the Government to implement the Resolution No. 24-NQ /TW of the 7th Conference of the Central Committee of Communist Party session XI on actively responding to climate change, strengthening resource management and environmental protection; The Climate Change Action Plan of Ho Chi Minh City for the period of 2017-2020, with a vision to 2030 and The Plan for implementation of National Green Growth Strategy in HCMC until 2020. It can be said that the city has initially set up important foundation for the implementation of appropriate mitigation actions.

- Efforts to reduce GHG emission in HCMC to contribute to the country's commitment of GHG emission reduction needs a roadmap of implementation; in which, support policies suitable to city conditions play an essential role in climate change mitigation. Groups of supporting policy instruments to encourage stakeholders to participate in the implementation procedure of appropriate mitigation actions are identified including group of market-based policy instruments, group of regulation instruments and group of technology support instruments. The assessment of these groups of supporting instruments keeps a role as an initial basis for policy-makers to continue researching in appropriately use for each target group so the implementation procedure of appropriate mitigation actions will be effective.

- In the general picture of GHG emissions reduction, GHG inventory can show an overview of GHG emission in the city area while MRV procedure can help the city to track the specific GHG emission reduction for each program, project or policy. A guidance of MRV procedure can assist companies and organizations which implement mitigation actions in demonstrating their efforts by a specific amount of GHG reduction verified by functional agencies. Implementation of MRV procedure for mitigation actions in HCMC is considered necessary with the following benefits:

+ Firstly, MRV procedure can assist companies and organizations which implement mitigation actions to prove a quantitative contribution of these companies and organization in GHG reduction;

+ Secondly, MRV procedure can encourage companies and organizations which haven't implemented mitigation actions to participate in this work. Besides this, implementation mitigation actions with MRV procedure can help these companies and organizations access international supporting financial sources;

+ Thirdly, Ho Chi Minh City can track an amount of GHG reduction from programs and projects in each sector and based on this, HCM City can develop appropriate support policies to encourage businesses and community to participate in implementing locally appropriate mitigation actions.

- Groups of specific implementation mechanisms are proposed including: (1) Operating mechanisms, (2) Financial mechanisms, (3) Propagation mechanisms and (4) Other incentive mechanisms. The role of the competent government agencies and forms of encouragement and support are specially identified.

- A roadmap for the implementation of the framework is also proposed for the period up to 2020.

PROPOSAL

In Part 5, there are many proposals in different groups of supporting implementation mechanisms for policy-makers to study and consider in appropriately use for the city conditions. In this content, the authors focus on important recommendations to be implemented in the near future:

- The HCMC People's Committee considers to approve 2 manuals of the Ho Chi Minh City component of SPI-NAMA (GHG Inventory Manual and Manual for implementation of MRV procedure) as technical documents so relevant departments

and agencies can study before mitigation actions can be implemented in the city area;

- The Department of Natural Resources and Environment asks for the approval of the HCMC PC in piloting some chosen mitigation actions applying MRV procedure to gradually adjust proposed MRV procedure in the Manual for implementation of MRV procedure;

- The Department of Natural Resources and Environment cooperate with the Department of Justice and relevant agencies to propose the HCMC PC to issue legal documents in GHG inventory and encouraging stakeholders to participate the implementation of appropriate mitigation actions with MRV procedure in the city area before 2020, creating legal framework for implementation of mitigation actions for the period 2021-2030;

- The HCMC People's Committee strengthens and expands the cooperation with strategic partners such as Osaka City, C40, etc. to seek initial supporting financial sources for MRV implementing units.

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